Stand in the Place Where You Work: Digital Implications of the Use of the Physical Elements of a Library During Browsing

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ABSTRACT

Information seeking is cognitively intense work, and browsing is particularly so. In complex environments, users will often support their work by using their bodies or artefacts around them to support the task at hand. When we move processes that have traditionally been performed in physical environments online, we need to consider any elements of cognition distribution, and how they might be supported in the new system. In this paper we discuss one form of external cognition during browsing: that of placemarking or context retention. We use data from an observational study to form detailed descriptions of five behaviours that constitute placemarking in some way and point to avenues for understanding how we might support these behaviours in a digital environment.

CCS CONCEPTS

• **Human-centered computing~Empirical studies in interaction design** • Human-centered computing~Interaction design theory, concepts and paradigms; • Information systems~Task models

KEYWORDS

Information seeking, browsing cognition, design

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1 Introduction

Information seeking is widely acknowledged to be a cognitively demanding task [26; 39]. Searching, browsing and triage all impose cognitive costs, whether this is in understanding an information system, identifying appropriate query terms and engaging with a query interface, making decisions about what information to use, or facing and rapidly evaluating the large number of options examined while browsing.

There is a history in HCI of examining how those engaged in complex tasks externalize elements of cognition, this has been applied in emergency services and air traffic control, for example [4; 10]. This approach has been applied in only a limited way to information seeking, though, and never to the task of browsing.

We know that information seekers are aware of the cognitive work of information seeking. Too many options when only a small number of items are needed is experienced as information overload [3]; highly complex interfaces can paralyse information seekers into abandoning their information seeking process [12], and we know users make conscious trade-offs between serendipitous discoveries and an original information task [38].

Information interfaces have evolved to support some cognitive tasks; long search boxes, for example, encourage information seekers to enter more words, thus generating more specific results [22]. Tabbed web browsing reduces the number of windows information seekers have to manage, thus reducing the cognitive burden of merely arranging them [15]. Those triaging information are shown to spend as much time arranging documents as they are reading them [1].

There is a widely acknowledged gap in digital information systems when it comes to browsing for information (as opposed to browsing the web) though [26]. While browsing is a widely acknowledged component of human information behaviour [9; 11; 19; 26; 29], it is poorly supported online [5; 17; 33], and well known to be under-theorised [2; 5; 26]. While thus far browsing has been well supported in an offline context, with the move of all types of information—music, videos and books—online we can no longer ignore the need to support browsing online, too.

The most theoretical definition of browsing behaviour to date was given by Bates in 2007: she describes browsing as glimpsing a large and interesting scene, then examining objects of interest one after the other [2]. Given this definition, the library shelves are readily described as a 'near perfect' browsing engine [18]. In this paper, though, we argue that the shelves are more than a

large and interesting scene: their physical nature specifically supports readers in externalizing some cognitive tasks in a form of distributed cognition. We draw on observations of library browsing to describe five ways in which this occurs, and point to deficits in current online browsing systems, drawing design recommendations from these deficits.

2 Method

There is a long history in information interaction of using interactions in physical space with physical information to drive the design of online systems (e.g. [7; 21; 31]; this is one such study. This paper reports on a subset of data from a broader study of browsing, other findings are presented in [28]. That paper reports browsing behaviours generally, without looking to their cognitive underpinnings or motivations. This paper reports descriptively a wide set of behaviours that make up browsing without addressing underpinning motivations or information needs. In contrast, this paper addresses a small subset of those behaviours specifically based on their role as cognitive support for managing information complexity.si

The study from which this data was drawn is an observational study conducted in two libraries. The first library is the university library of a small research-active Australian university, the second is a large public reference library. 32 readers were approached as they began their book seeking process at the library shelves and asked if they minded being observed while they were choosing their books; 31 agreed. Of the 31 17 were in the public library, 16 were in the university library. The gender split was even, and all participants were over the age of 18 as required by the ethical approval attached to the study. This data is supplemented by a small series of triangulation interviews taken only at the university library as readers borrowed books. 14 readers were interviewed for this study, and asked about the process they used for selecting books, whether they had searched, how many books they had examined, and whether they had found everything they sought.

During observations participants were followed until they had made their selections, and then interviewed briefly about what kind of information they had been seeking, whether they had searched the catalogue before approaching the shelves, whether they had found what they were looking for. During observations, participants were questioned about any elements of their activities that were unclear to the observer. This observation and interview approach is common in studies of information seeking behaviours, particularly in physical spaces; see for example [6; 21; 24].

Data was gathered in the form of handwritten notes describing physical interactions with the shelves, and tallies of the number of stacks, shelves and books with which readers interacted. Interviews were recorded using handwritten notes. Immediately after each observation the episode was recorded as a story akin to Makri's serendipity stories [23]. It was these stories that formed the basis for data analysis.

In the original study data was analysed by two researchers using a grounded theory approach to classify a wide range of features and behaviours. Only the behaviours were re-analysed for this paper; we looked specifically for behaviours that externalized cognition in a way that would allow readers to 'know where they were up to' or resume a browsing activity where they left off, if it had been interrupted. All behaviors were re-analysed through a lens of managing cognitively complex tasks, and we identified five specific behaviors that could be viewed as supporting cognition using the physical environment.

3 Behaviours Supporting Cognition

We identified five behaviours that were clearly being used to retain or support orientation in space or cognitive context. For inclusion in this list, a behaviour needed to have met two criteria: including a physical interaction with books or shelves; and for that physical action to have been used to support the cognitive work of browsing (which, as identified in the introduction, is high [26]). These behaviours are placemarking; running fingers along the shelves; flipping books along the shelves; photographing books or shelves; and triaging books at the shelves. Each of these behaviours—and their cognitive implications—is explored below.

3.1 Placemarking

Placemarking is the use of a hand or an object to hold one's place in the shelves while an item is examined in more detail. This behaviour was first identified in 1992, but it was not described in detail until 2017 [20; 27], and remains entirely unsupported in major book information seeking interfaces [27].

There were two ways in which placemarking behaviour varied: the object that was used to mark a place, and the task that was undertaken while the place was marked. Objects used to mark a place ranged from—at its most basic—a finger placed on the shelves right up to a book placed strategically in a gap in the shelves. Other examples were pens and scraps of paper.

The other variation in placemarking was the activity undertaken while the place was marked. These could be as simple as the reader pausing a scanning task to examine a book spine more closely (perhaps tilting their head to read the title), right up to taking a book of the shelf and flicking through its contents to determine its suitability for meeting an information need. The conclusion of a placemarking activity is either the selection of an item, or a return to scanning.

Clearly, placemarking in all these cases is being used to support memory and pause the cognitive task of scanning the shelves to chase down a plausible 'information scent' [32]. Placemarking ultimately gives readers the confidence to change tasks, knowing that if their investigation of an alternative is unfruitful, they can return to where they were

The most pronounced example of this behaviour we observed was the young man browsing books on music history, who, when he found a candidate volume placed a finger in the gap left by the book as he removed it from the shelves then half turned away from the shelves as he examined the book. His arm was extended straight at an awkward angle to his body, and when he

determined the book did not meet his need, he turned back to the shelves and replaced it, restarting scanning and saying 'I didn't want to lose where I was up to'.

3.2 Running Fingers Along Shelves

When examining only the observations of readers who browsed books as part of their information seeking (as opposed to those who simply sought one book and left), running fingers along the shelves was surprisingly common. 5 out of 22 readers observed to browse engaged in this behaviour; it was more common in the university library. Of the 5, 3 also engaged in placemarking, so their fingers were left in place while items were examined.

Cognitively, running a finger along a line of text while reading is known to help a reader keep their eye on a single line of text, and remind them where they are up to in a text [13]. We suspect there are similar cognitive underpinnings in this behaviour as seen at library shelves: shelves with diverse spines can be visually distracting, and using a finger to support focus on horizontal browsing (which means the reader is examining items most closely related to each other [35]) avoids this distraction. A classic example of this practice in our observations was the reader at the research library who was very clear about being in a hurry and somewhat frustrated; using his finger allowed him to examine books more quickly than he was before he began this practice.

3.3 Flipping Books Along the Shelves

This behaviour is flicking books along a shelf like CDs in a rack, and happened in 4 of 31 observations, predominantly in the university library. The shelves in the research library are particularly tightly packed; being a mandated deposit library they must maximise the use of shelf length. This behaviour had two purposes—like flicking CDs along a rack, it allowed readers to get a better view of the cover of the books, however it also served as a visual cue to 'where they were up to'.

The visual angle of this behaviour is not to be discounted, both CD covers [6] and book covers [34] are demonstrably useful in making selections. We argue, though, that the secondary visual result—showing readers where they are 'up to'—allowing them to retain their place—is also an element of this behaviour.

3.4 Triaging Books at the Shelves

Out of all 45 readers we observed and spoke to, only one moved away from the shelves to make decisions about which books they would take, and that person examined (and ultimately selected) a single book. This finding is not new, it was also noted in an earlier study on how readers choose books in the physical library [14], however the cognitive underpinnings for it have not been made explicit in the literature.

We know that information seekers are conscious of some of the trade-offs they make when deciding what to investigate. When they encounter information serendipitously during another information task, for example, there is a clear tension between following the serendipitous lead and pursuing the original information task [38]. We know that navigating away from search results to examine a single result imposes a cognitive cost [8]—it seems likely that this is also true during physical browsing. By remaining within the shelves while they triage books readers retain visual access to alternative materials if the things they have chosen do not meet their needs. This finding is particularly interesting in the context of literature on triage of other types of materials: during journal article triage, for example, arranging materials takes as much time as reading them [1]. Readers in the library shelves cannot rearrange the entire set of candidate books, so they are making a choice to forego arranging items to retain a wide set of alternatives.

One way that the cognitive cost of selecting and choosing among alternatives is managed during online search is the use of tabs in a web browser—this allows information seekers to 'bookmark' something to follow up without interrupting their information seeking process [15]. This approach though still means that target objects are examined outside the context of the original set of items, and so cannot be quickly visually compared.

Given how many readers triaged at the shelves, despite in some cases being uncomfortable and (for example) sitting on the floor, it is clearly important to retain a visual sense of alternatives. We argue that this is a cognitive support, both in helping readers remember what their choices are, and in reducing the cognitive cost of examining a single item.

3.5 Photographing Shelves and Items

This behaviour was relatively uncommon, seen in only two readers during observations, and identified during one interview. It was explicitly described as cognitive support: observed readers said they were photographing books to remember them for later.

This form of cognitive support is one that persists between visits—the photographs are explicitly intended to be an aide memoire for a future visit to the library. Like other forms of externalising cognition during information seeking—opening tabs, for example [15]—it is possible that readers will never return to these things they have saved for later; even so the saving has allowed them to proceed with their information task even after an information encounter that could have disrupted it.

One participant in the follow up interviews demonstrated that this is not merely a deferral strategy. They mentioned that most of the books they had borrowed that day were books they had photographed on a previous visit. They had explicitly photographed them to remember them for later—they had more books than they could carry on the first visit in question.

Photography, then, is acting in two cognitive capacities—as a memory aid, but also as a means to capture information so that a principal task can be resumed.

3.5 Summary

The five behaviours described in this section—placemarking, running fingers along the shelves, flipping books along the shelves, triaging at the shelves, and photographing books—are all ways of externalising the high cognitive load imposed by

browsing. They do this in a variety of ways, by supporting memory, supporting (re)orientation in a large information space, reducing visual distraction, supporting decision making, and reducing the cognitive cost of choosing not to follow up right now. Supporting browsing successfully online will mean supporting this type of behaviour, but what might that look like? We address this in the next section.

4 Design Implications

Wilson notes that information seeking is so complex that it may be difficult to exactly specify systems to support it; instead we should make recommendations based on what we know about behaviour [39]. This paper takes that approach.

Many systems have recently emerged that attempt to support browsing online (e.g. [18; 36]). These have recently been analysed against a much broader set of criteria than those presented here to determine their likelihood of supporting browsing behaviour, and the challenges around orientation and managing cognitive load have demonstrably been the least-addressed [27]. In that analysis, placemarking and mark as read (to show readers where they had been) were not addressed by any of the systems analysed. Overview (for orientation) and visible alternatives (equivalent to triaging at the shelves) were each addressed by a single system (out of 6 examined).

Clearly these cognitive support activities are undersupported, even in systems such as BookFish [30], The Blended Bookshelf [18], and the Bohemian Bookshelf [36] that are specifically designed to support browsing and serendipity. The absence of this cognitive support in major browsing systems, though, particularly in view of the finding that browsing relies on a large collection [28], is a major gap in the design of browsing systems.

One key element of supporting cognition during online browsing is support for orientation: many of the behaviours described here allow readers to return to where they were, and re-orient themselves in space. Given that we know it is easy to get lost in digital space—particularly two dimensional space [16]—supporting orientation during a browsing task is important. It is possible that traditional approaches to orientation on the web—such as overview and breadcrumbs—may be of value here.

For browsing to be successful—according to Bates' definition [2], it inherently must present visually complex information and choices. Supporting information seekers in managing this complexity by narrowing their focus—as they do when they run their fingers along the shelves—is a key element of online browsing. Zooming or fish-eye views could support this

It is further important to support browsers by allowing them to retain a sense of what is available when the examine an item, whether this examination is of the spine of a book or a more in-depth assessment. This allows browsers to take more risks [38]—they can pursue a risky information seeking strategy without the same sense of loss as when the alternatives disappear [37]. New web browser overlay capabilities have potential in this space.

Supporting information seekers in saving information for later use is also likely to support online browsing. The reason this is important is twofold—it allows information seekers to move on when they scent something interesting but risky [25; 38], but also they may actually return to the items they identify if their memory of the space is supported. Tabbed browsing can be useful while searching, potentially it can be useful for browsing as well. Between-sessions saving likely to fall into the domain of personal information management, but technical compatibility with e.g. Google Keep is likely to be useful.

Finally, online support for these actions must be simple and lightweight. In the physical world, placemarking is as simple as leaving a finger on a shelf while reading a title. To demand a reader takes a complex series of steps to support the cognitively demanding tasks of examining items, orienting themselves in space, and retaining their information seeking context will inevitably interrupt the flow of their information seeking, possibly derailing it [25; 38].

5 Conclusions and future work

Th contribution of this paper is to show physical strategies—such as placemarking, running a finger along the shelves, and triaging at the shelves—that readers use while browsing for books. These strategies are used to reduce the large cognitive burden imposed by browsing by externalising some of the cognition. They help readers retain a sense of place, remember what they were doing, and manage the cognitive cost of making choices about their information seeking.

These behaviours are near-universally poorly supported in online information seeking systems. Given that online browsing is far from a plausible reality, despite the dramatic recent shift to online information, it is possible that better understanding and supporting these behaviours may be the key to unlocking digital browsing. How, exactly online systems might support this externalizing of cognitive load while browsing remains a question for future work.

Which behaviours—and cognitive challenges—should be addressed first also remains an open question. The study reported on here was not specifically designed to address the cognitive challenge of browsing, nor the strategies browsers used to ameliorate them. Further study of these behaviours could address issues of prevalence of each type of behaviour, and potentially identify further behaviours of this type. Study in other environments could give rise to design ideas and would demonstrate how transferrable these strategies are between information domains. The study presented in this paper is merely a preliminary examination of these issues; understanding them fully remains future work.

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