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Discovering the Unfindable: The Tension Between Findability and Discoverability in a Bookshop Designed for Serendipity

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Abstract. Serendipity is a key aspect of user experience, particularly in the context of information acquisition - where it is known as *information encountering*. Unexpectedly encountering interesting or useful information can spark new insights while surprising and delighting. However, digital environments have been designed primarily for goal-directed seeking over loosely-directed exploration, searching over discovering. In this paper we examine a novel physical environment - a bookshop designed primarily for serendipity - for cues as to how information encountering might be helped or hindered by digital design. Naturalistic observations and interviews revealed it was almost impossible for participants to find specific books or topics other than by accident. But all unexpectedly encountered interesting books, highlighting a tension between findability and discoverability. While some of the bookshop's design features enabled information encountering, others inhibited it. However, encountering was resilient, as it occurred despite participants finding it hard to understand the purpose of even those features that did enable it. Findings suggest the need to consider how transparent or opaque the purpose of design features should be and to balance structure and lack of it when designing digital environments for findability and discoverability.

Keywords: Information Encountering, Serendipity, Findability, Discoverability

1 Introduction

We can learn about designing digital information environments, such as search engines, digital libraries and e-commerce sites, by examining information behavior in *physical* places. Major models of information seeking, on which many digital information interfaces are founded, were all based in examining user behavior (see, for example, [1-3]). There are also several more direct examples of using physical behavior in information environments to generate design guidelines; these include music information seeking [4, 5], browsing physical libraries [6-8], and reading [9]. We follow this tradition of examining physical environments to inform digital design by investigating a novel type

of information environment: a bookshop specifically designed to facilitate serendipity with features that include 'continuous' shelving, ambiguous section names, author-curated sections, recommendations, seating, and topically diverse display tables.

Digital and physical information environments are primarily optimized for findability over discoverability [10]. Even physical libraries, long heralded as discovery environments [11, 12], are predominantly designed for finding items; discovery via browsing is a secondary consideration [10]. This focus dramatically limits opportunities for (serendipitous) information encountering [13]. Information encountering is an important information experience; it can spark insight [11, 14], enhance knowledge [15] and propel users in new and exciting directions [11, 16], surprising and delighting [17]

Given the importance of information encountering as a form of Human Information Interaction, understanding how to support it online is highly topical in an age where information is increasingly digital; previous work in this area is limited. The work presented in this paper takes advantage of the rarity of an environment designed to facilitate information encountering to understand how it affects both serendipity and directed seeking. Our study is exploratory in nature, using observations and interviews to understand the information seeking and encountering experiences of 9 people, during both goal-directed seeking and loosely-directed exploring tasks.

Firstly, we introduce the concepts of serendipity and information encountering and review prior research. Next, we describe the physical bookshop's serendipity-related design features and how each might facilitate information encountering and explain our data collection and analysis approaches and limitations. Then, we present and discuss our findings first on the features of the bookshop, then on the overall design. Finally, we describe design implications for digital information environments.

2 Related Work

In this section, we first introduce the concepts of serendipity and information encountering, then discuss the influence of the design of physical space on information encountering. Next, we discuss how physical space affects how users find information, turning finally to discuss the literature on information encountering in bookshops.

2.1 Serendipity and Information Encountering

Serendipity is where unexpected circumstances and insight result in a valuable, unanticipated outcome [14]. In the past decade or so, it has become of increasing interest to HCI researchers (e.g. [13, 14, 46]), who are beginning to address the important, but difficult challenge of how best to design for it. HCI researchers have, however, noted a 'serendipity design paradox' - that 'hard-wiring' serendipity into algorithm design may lose some of its inherent 'unexpectedness,' potentially 'destroying' the experience [21]. This suggests the need to preserve user agency in making insightful connections. It is less contentious, however, that designing to facilitate serendipity, whether through AI, human insight, or a blend of the two, is worthwhile [13, 17, 20, 25, 46, 47].

Serendipity in the context of information acquisition is known as *information encountering* [18, 22]. It usually occurs as an embedded activity during information seeking [18]. It involves unexpectedly finding information considered useful or interesting [19]. This can be when looking for something specific (goal-directed seeking) or when not looking for anything in particular (loosely-directed exploration) [20]. While information-seeking is active, encountering is passive; it is characterized by the encounterer's low expectation of and involvement in finding the information [18, 19]. The process involves noticing a stimulus in the environment, stopping any active seeking task underway, examining the encountered information, then capturing or sharing it, before returning to the active task (if applicable).

Information encountering is an important form of Human-Information Interaction. It enhances user experience by 'surprising and delighting' [14] and facilitates processes such as creativity and ideation [21]. It is important in both physical and digital information environments; consider the examples of unexpectedly finding an interesting or useful: book in the library when browsing nearby shelves, or Webpage when searching for information on another (partly or seemingly unrelated) topic. However, no prior research has investigated information encountering in a physical environment specifically designed to facilitate it. This can inform digital information environment design.

2.2 Impact of Physical Environments on Information Encountering

Some research has found environmental factors can influence information encountering [19, 22]. However, very little research has examined how information environments might be designed to facilitate it.

Starting with a set of 'serendipity dimensions' identified from physical libraries [23], McCay-Peet et al. developed a measure of the propensity of digital information environments to facilitate serendipity [24, 25], comprising four factors (which may also apply to physical environments). These include the degree to which the environment is *trigger-rich* (contains a variety of information, ideas and resources that are interesting or useful), *highlights triggers* (brings interesting or useful information, ideas or resources to attention), *enables connections* (makes relationships between information, ideas or resources apparent) and *leads to the unexpected* (provides opportunities for unexpected interactions with information/ideas/resources) [25]. A theoretical framework [26], partly based on this earlier work, proposes ten 'sub-affordances' for serendipity in physical and digital information environments: *diversity* (heterogeneity of content); *cross-contacts* (collision of dissimilar resources); *incompleteness* (inconsistent features that offer users the potential to make their own meaning); *accessibility* (physical topology of the space and its impact on access)*; multi-reachability* (ability to access the same place from many routes); *explorability* (how much of an invitation the environment offers for browsing and exploration); *slowability* (how well the environment invites users to slow down and look closer); *exposure* (how content is displayed trigger interest); *contrasts* (allowing items to stand out from the crowd) and *pointers* (ways the environment highlights content in specific ways, such as curation/recommendation).

Looking to research on physical environments, one observational study was partly conducted in a specialist bookshop, where most books (e.g. History and Fiction) were

organized unconventionally by country [27], It did not, however, examine the impact of the bookshop's organization on reader behavior. Similarly, interviews with staff in a large bookshop [28] identified a design feature (table displays with books on diverse topics and with their covers showing) as potentially facilitating encountering. However, observations did not focus on use of the tables. This echoes the literature on libraries; regular visitors scout display tables and return trollies for interesting books [29, 30]. Libraries, with their rich classification schemes and information-dense environments, are generally seen as being supportive of encountering [7, 31]. Librarians are aware of this and have attempted to improve discovery by rearranging the shelves. One study rearranged fiction from alphabetical to by genre and found that while the change did not increase borrowing, it did increase browsing-based exploration [32].

Physical environments do not always support encountering, though; in libraries, an abundance of books can overwhelm [33] and top and bottom shelves are used less than those in the middle [31, 34]. Exploration can be hampered in very quiet environments as people feel self-conscious about moving items around [33]. Other environmental factors affect willingness to pause (i.e. slowability [26]); exploration is limited anywhere there is possibility of 'butt-brush' (people will even move away from items of interest to avoid being brushed from behind) [35]. Finally, particularly when there are heavy space constraints, physical books often only appear in a single location and this can inhibit discoveries that might otherwise be made through multi-reachability [21]. Findings from physical environments often cannot be directly transferred to digital ones [7]. But understanding the relative importance of physical design features for supporting encountering can indirectly inform digital design. This is the focus of this work.

2.3 Impact of Physical Environments on Goal-Directed Information-*Seeking*

In contrast to passive information encountering, there is the issue of active information-*seeking*. While there is much literature on wayfinding, including in libraries, work on how physical environments help or hinder finding known or highly describable items is limited. There is evidence library users get lost in the shelves and that a range of physical design features, including organization scheme and book visibility, inhibit goal-directed seeking [25]. Equally, target books may not be in stock [27], or may be missing or out [8]. Digital environments support highly goal-directed information-seeking well, provided good search functionality is available. The question, then, is whether it is possible to adequately support both goal-directed information seeking and exploration-driven information encountering in a single digital environment and, if so, how?

2.4 Bookshops as Information Environments

Information encountering in libraries has been widely discussed [36, 37], and occasionally observed [7, 33]. However, no studies have focused on observing encountering in bookshops. The few prior studies of information behavior in bookshops demonstrate very little evidence of encountering (or exploration in general). But this is perhaps because of their focus - on enquiries made by customers [27], collaborative interactions with books [38], children's book selection process for recreational reading [39] and

general reading practices [28]. Although one study had a think-aloud element [39], all were primarily based on anonymous observations, which limits capture of rationale for choosing books. This rationale can include perceptions of unexpectedness.

In the bookshop customer enquiry study, most adults were found to 'grab-and-go,' demonstrating highly goal-directed rather than exploratory behavior [27]. This does not, however, speak to the behavior of those who did not talk to staff (who may have explored and potentially discovered more). While older children also engaged in goal-directed seeking for a specific book, author or topic, younger (pre-school and elementary) children did not have clear information needs and relied on "serendipitous encounters with a book that matches a preference" [39]. No further detail was, however, provided on the nature of these encounters. Many readers who visited bookshops in groups also had unclear needs [38]. While no information encounters were reported, it was concluded that digital information environments should support "both task-oriented and 'serendipitous' information-searching behaviors" [28]. Limited existing evidence of encountering in bookshops highlights the need for dedicated examination.

3 Bookshop Design

Libreria is a small independent bookshop in a trendy part of London's East End. It was chosen, as its website (Libreria.io) notes, because books are curated to 'maximize serendipity' and "every aspect of Libreria is designed to help you discover new books and ideas."

Libreria has two types of design features aimed at supporting serendipity: *physical* features and *informational* features. We describe each of these in turn.

3.1 Physical Design Features

Libreria is situated in an area peppered with other 'explorable' environments (e.g. vintage clothing stores and specialist music shops). The shop itself is long and narrow, and the sales counter is near the entrance (see Fig. 1). All elements of the store are visible from the entrance, which may help promote *explorability* [26]. There are several elements specifically designed to invite exploration, though - we describe these now.

Fig. 1. Bookshop layout showing continuous shelving

The Appearance of Continuous Shelving Libreria uses the linear, narrow layout of the shop - emphasized by a large mirror strategically placed opposite the entrance - to make the shelves seem 'infinite'. This infinity shelving is a nod to the inspiration of the shop's design: the infinite shelves in the library of Babel. The shelves in Libreria are divided horizontally into sections, but the shelf dividers are shallow and transparent to avoid visual disruption of the space (see Fig. 2). This is deliberate, to reinforce the impression of continuous shelving and downplay the semantic structure of the store. This design may *enable connections* and lead to the *unexpected discovery* of books in adjacent, different sections [25]. It could promote cross-contacts, *explorability* and *slowability* [26], by forcing close examination.

Fig. 2. 'Ways of Seeing' section marked by shallow, transparent acrylic sign

The Presence of Seating. Taking time to reflect is a known element of serendipity [21]. This *slowability* [26] is encouraged in Libreria by the presence of seating, not just the conventional kind regularly seen in bookshops, but also seating physically built into the shelves. The bookshop curator noted that seating is 'part of the bookshop tradition'; it encourages readers to try before they buy.

Exposing the Covers of (Some) Books. Most books are displayed on shelves with only spines showing, but some have their covers exposed - particularly those that are visually striking (see Fig. 2). Covers are widely used by savvy readers to make book selections [28, 40], so this information is important. Libreria makes more extensive use of this design feature than most bookshops. This may *highlight triggers* [25] by making covers immediately visible It could promote exposure by displaying covers in a way ready to trigger readers' visual sense, in contrast to those with only spines displayed. [26].

3.2 Informational Design Features

In addition to Libreria's physical design features, there are several informational design features specifically for supporting serendipity. These are introduced below.

Broad, Ambiguous Organization Scheme and Section Labelling. The books in Libreria are classified by broad, unconventional themes such as 'Bad Feminism', 'Home and Hearth' and 'Enchantment for the Disenchanted', rather than by traditional subjects

or genres. Each theme includes books on multiple subjects, e.g. 'Utopia' includes books on history, architecture and philosophy. The curator explained the thematic layout was *"to enhance chance finding…on different subject matters. It's about spurring ideas."*

Adjacent books are linked semantically; 'Home and Hearth,' for example, displayed 'The Vegetarian' and 'Aliens and Anorexia' next to each other - a possible example of *cross linking* [26] and *enabling connections* [25]. However, there were *"no hard and fast rules"* for curating content or linking books: *"too many guidelines would be restrictive. Diversity and playfulness engender a more creative approach."* (Curator).

The variety of themes and topical variance of books classified within themes could promote *diversity* and facilitate *cross-contacts* [23], through proximal placement of books that are simultaneously conceptually similar *and* dissimilar. This could *lead to the unexpected* [25], by broadening readers' interests.

The scheme's ambiguity demonstrates *incompleteness*, with imperfect 'cracks' that could *enable connections [25]* and spur new ideas. It may promote *slowability*, by forcing readers to "slow down, look closer and examine" [26] the shelves. The quirky section labels may act to *highlight triggers* [25], bringing books to the reader's attention.

Topically Diverse Table Displays. All tables contained piles of books, of the same title. None were intended to be topically-related to each other, or to those on nearby shelves. Books on tables were also shelved elsewhere. Juxtaposition of adjacent books on different topics may *enable connections* and *lead to the unexpected* , promoting *diversity*, *cross-contacts* and *multi-reachability* (by enabling books to be found by multiple routes, on the shelf or table) [26]. Covers were easily scannable, as tabletops were at waist height (see Figure 1). This may create *exposure* and *contrasts* with books on the shelves [23], highlighting the covers as *visual triggers* [25].

Author Curated Sections. There were two author-curated sections, denoted by signs including the curator's name and background. A small section was curated by South London gallery owner Hannah Barry, containing books related to her artistic influences. A larger section on African literature was curated by African poet Belinda Zhawi. Author curation might provide *accessibility* to specially-selected books [26]. Curated sections could act as *pointers* [26] by *highlighting* specific books as potential *triggers* [25].

Fig. 3. Recommendation cards, clipped to the covers of books, obscuring them

Recommendation Cards. Some books had recommendation cards with the recommender's name, occupation and recommendation reasons clipped to their covers (see

Fig. 3). A ‘Second Home members recommend…’ sign was placed nearby, explaining Second Home is a ‘creative accelerator, workspace and cultural venue’ (Libreria was incubated by Second Home). These cards can *highlight triggers* and *enable connections* [25]. They might provide *exposure* by *contrasting* with books without clipped-on cards [23]. Recommendations can also be considered a specific type of *pointer* [3].

4 Method

Here, we outline our data collection and analysis approach and discuss limitations.

4.1 Data Collection

We conducted naturalistic observations and interviews with 9 participants (6 female, 3 male), all aged 22-30 and recruited through personal contacts. All were regular bookshop visitors (>6 times per year). Naturalistic observations are a common approach in this type of formative study of Human Information Interaction (see for example [7, 31, 39]). Similarly, exploratory studies of this nature are suited to small participant numbers, and frequently seen in the Human Information Interaction literature (see for example [8], which observed 9 information seekers, [7], which observed 8, and [9], which - despite being seminal work - used video observations of only 3 readers).

Participants were met before the study in a location near the bookshop. They were not told ahead of time which bookshop they would be visiting, to avoid them researching Libreria. None had previously visited the bookshop. Observations took place inside Libreria, during regular opening hours. However, to ensure a quiet task environment (and avoid disrupting business), we conducted the study at less busy times (e.g. beginning of the day). Observations comprised two tasks: a *goal-directed* seeking task, and a *loosely-directed* exploration task. To avoid task effect influence, we alternated which task was first. After each session, interviews were conducted in a nearby coffee shop.

We adapted guidance from previous research to minimize bias with task structure and briefing procedure [20, 41]. Participants were told they would spend 30 minutes in Libreria divided between two tasks, and asked to think aloud during both tasks. The instructions for the goal-directed seeking task were: *“Find a specific book you might want to read, or books written by an author or on a topic of interest. It* doesn’t *matter if you find what you’re looking for or not. Just do what you’d normally do in a bookshop when you have a goal.”* The loosely-directed task instructions were: *“Explore the bookshop freely, without looking for anything in particular.”* Participants were reminded before both tasks to ‘be as natural as possible.’ The self-directed nature of the tasks further supports naturalistic behavior. Intervention was limited to probing questions, such as ‘what are you doing and why?’ Due to the anticipated likelihood of either rapid resolution or rapid frustration during the goal-directed task, this task was limited to 8 minutes, leaving 22 minutes for the exploration task. After the observation, we interviewed participants to elicit their opinions on how well the environment supported them in their two active seeking tasks and in passive information encountering during

them, and to verify their encounters. To avoid biasing their behavior, the study's information encountering focus was only revealed in the post-task interview.

To understand motivations for the bookshop's design, we also interviewed a curator - who was involved in the initial 'serendipity-inspired' stock selection and organization. The observations and interviews were audio recorded (we deemed video recording too intrusive). Rather than taking notes, the researcher made a photographic record of interactions with individual books, capturing both the book and the interaction. These photos were taken with permission from bookshop management and participants.

4.2 Data Analysis

We used inductive and deductive Thematic Analysis [42] to analyze our data. The inductive part of the analysis identified themes in the data, e.g. 'difficulty understanding section labels.' The deductive part looked for evidence for encountering and the impact of specific design features on goal-directed seeking, loosely-directed exploration and information encountering.

As with all qualitative analysis, caution is needed when interpreting prevalence of observations; *"more instances do not necessarily mean a theme itself is more crucial"* [42]. This is particularly true for studies of serendipity - which is 'regular but rare' [12], thus relatively few examples can be expected during observation. As such, we avoid quantifying observations, instead using relative, qualitative descriptions of prevalence.

4.3 Limitations

The user tasks were naturalistic, but not completely natural. Both goal-directed seeking and loosely-directed exploration are commonplace in bookstores, and indeed it is likely that shoppers switch between tasks while shopping. Whether goal-directed seeking is a task that people would normally attempt in a bookshop designed for serendipity, though, is an open question. Similarly, whether our participants' persistence in the face of observed difficulty would hold in their everyday life, or whether they would simply ask bookshop staff for help remains unclear. Nonetheless, both the goal-directed task and the persistence in the face of difficulty actually serve the purpose of our study: to identify which design elements support goal-directed seeking, which support exploration, and which simply hinder users in either type of information acquisition task.

The time-constraints imposed may have influenced how participants undertook the tasks; if unconstrained, they may have spent less or more time (potentially impacting encountering frequency), or made more extensive use of certain design features.

Finally, the relative rarity of information encounters and the small number of participants mean this study is necessarily exploratory. We cannot guarantee, for example, that the features most frequently found useful are the most important in supporting serendipity. However, our findings provide concrete evidence that design elements can affect both goal-directed seeking and loosely-directed exploration, sometimes in ways that counteract each other.

5 Findings

Each feature of the bookshop affected goal-directed seeking and loosely-directed exploration in one way or another. In this section we address each design feature identified above, describing their impact on both these types of information task.

5.1 Physical Design Features

The physical elements of Libreria's design, while somewhat dependent on the actual features of the shop building, had various implications for goal-directed seeking, loosely-directed exploration and information encountering (which was found to occur both during goal-directed seeking and loosely-directed exploration).

The Appearance of Continuous Shelving. This was one of the most striking design features, yet ultimately facilitated neither goal-directed seeking nor exploration. There was potential to unexpectedly find interesting books, including where one section ends and another begins, based on juxtaposition or novel adjacencies. However, no participant experienced this. Instead, the uneven spacing of bays and low visibility of the shallow section dividers made browsing the 'never-ending' shelves daunting for many. For example, P8 stated *"it makes me feel overwhelmed because there's no clear separation between categories. I can't tell where a category starts and where it ends."* This overwhelm is not uncommon in information seeking; information overload demonstrably limits users' cognitive capacity for finding information [43]. It further inhibits exploration and serendipity, which requires mental capacity for reflection [21].

P8 did suggest that continuous shelving *could* potentially facilitate encountering, as it encourages horizontal browsing along the shelf, across sections. She stated *"my eye is moving along with the shelf, even if the category changes. It's natural to keep looking at the shelf to see what else is on there."* So the intention of this intervention was noted by at least one participant as plausible, despite the lack of observations to support it.

The shallow, unobtrusive section dividers that are a necessary component of the illusion of continuous shelving actively inhibited directed seeking. Not one participant noticed the dividers right away, confirming that this feature worked as intended. However, even after spotting section dividers, seeing others was hard. P8 provides a classic example, noticing the labels only partway through her task and exclaiming *"there are labels! There are labels! Wow! I swear though, I don't see labels on other shelves."* The initial failure to notice labels also meant participants failed to understand the horizontal sectioning of the shelves *"there were a couple of books where I thought 'it makes sense these books are together.' But above them would be books that had nothing to do with them. There's not much connection."* They had to attempt to build mental models of the bookshop from the ground up, often unsuccessfully. P1, for example stated incorrectly *"I guess for the classics they're organized by author and for the history section it's by theme".* These findings echo those in physical libraries, where users find it hard to understand even conventional organization schemes such as Dewey [7, 44].

Seating. It is perhaps clear seating will not help with goal-directed seeking, which often leads to grab-and-go experiences [27]. However, seating could reasonably be expected to lead to encounters. We observed a single encounter that could be attributed to seating, and in particular Libreria's specific seating style. P4 sat on a wooden chair near 'Home and Hearth', where he noticed and examined an abandoned book on a nearby table.

While we might have expected to see more than just one encounter related to seating, our study design may have worked against this particular design element. Time to sit was limited during our study, and sitting and reading while being observed may feel 'creepy' to participants [45]. Our participants' comments confirmed our sense seating was underrepresented as a feature of support for exploration. Participants noted that seating may facilitate encountering by inviting them to *"stay…longer"* (P4) and examine books *"with no pressure"* (P2).

Book Cover Exposure. Several encounters were triggered by book cover exposure, on the shelves (P1, P3, P7, P8, P9) and on the tables (P4, P6). Exposure attracted readers' attention. For example, referring to a children's book, P7 stated *"I noticed this book because it was placed here on the shelf. All the other books nearby were darker, deeper colors. This light blue cover really caught my eye."* P7 reflected on the reasons for cover exposure, commenting *"I guess the owner intentionally wanted to let shoppers see this book."*

Some participants ignored the display tables in the center of the shop (more on this in Section 5.2), but for some the face-up covers facilitated encountering. Most participants, however, noticed and examined at least one table and, as with the shelves, exposed covers attracted their attention. For example, P6 picked up a book with striking cover art ('The Book of Joan' by Yuknavitch) from the center table. She stated *"people say don't judge a book by its cover, but I quite like the design."* This supports findings that covers play a key role in deciding whether to examine a book in detail [18, 31].

There were no examples of book cover exposure supporting goal-directed seeking, despite previous intimations that this could be the case. Previous work in bookshops have noted that queries about books sometimes include cover details, for example [27].

5.2 Informational Design Features

The information elements of Libreria could potentially be replicated in any space, or even online. In this section we report how they helped and hindered goal-directed seeking, loosely-directed exploration and information encountering.

Broad, Ambiguous Organization Scheme. This feature impacted both goal-directed seeking and loosely-directed exploration, as noted by the vast majority of participants.

The categories in Libreria were described by participants as too ambiguous to support goal-directed seeking. When P8 noticed 'Home and Hearth', she said *"such a weird label name! I wouldn't consider finding a book here."* She also highlighted they could have multiple meanings and therefore have many possible books 'correctly' classified within them. She stated *"the labels were vague. For example, with 'Identity,' what*

type of identity is it about? Racial identity? Gender identity? Surely lots of books in a bookshop can be classified under 'Identity'."

Most participants also considered the labels too difficult to relate to individual books, which negatively impacted their goal-directed seeking. For example, P4 noticed the 'Wanderlust' sign and took out books from that section, stating *"oh, I like travelling."* He then noticed a book on 'London Craft Beer' in the same section and asked himself *"does it belong to Wanderlust?"*

In contrast to goal-directed seeking, the ambiguity of the organization scheme and associated section labels greatly encouraged exploration, and often encountering as a result. For example, P8 encountered a non-fiction book 'Assata: An Autobiography' after stating she usually prefers fiction. She commented *"it almost forces me to discover books I would not have considered otherwise. Because you have to browse by broad theme rather than by category."* Books were often placed next to each other in ways participants did not expect, and which facilitated discovery. P8 described these novel adjacencies as *"placing familiar things next to unfamiliar things, so you can discover something new"* and P3 said the sections *"repackage[d] the books and give them different meanings."* Novel adjacencies feature in the Bohemian Bookshelf [46], whose interactive visualizations of a library collection were designed for serendipity.

Some participants explicitly stated the broad organization scheme could lead to encounters that expanded their interests and burst their filter bubbles [47]. P4 stated *"in a normal bookstore often you already know what you're looking for and just go straight for it. And you end up reading stuff like what you've already read. This one makes you browse more."* He commented *"you may have to look through the entire store to find a specific book. But while you're looking you might find other books you like. It's like you can't filter anyway, even if you wanted to."* Topic diversity was regarded positively, as a means of potential discovery; referring to the 'Africana' shelf, P8 stated *"I don't think I've seen a category with such a diverse set of books in other bookshops. I quite like that."* P6 highlighted the need to balance staying within and venturing outside one's interests to promote useful discovery. She stated *"if you've got an author you like, you'd want to read other books by them again. But you also want to venture out of your existing interests,"* echoing the seeking-encountering tension seen in [33].

The section labels and unusual mix of books also encouraged 'slowability' [26] or taking the time to reflect [21]. P8 said the organization scheme forced him to *"browse more slowly, look at things in more detail and consider what I was looking at,"* referring to it as *"a different way of browsing"* that *"forced you to look at each shelf carefully and make your own meaning."* P5 commented *"these labels make my head think. In a common bookshop, you see fiction, non-fiction, poetry. It's easy to understand. But this bookshop is not like that. For example, you see the label 'Dark Times' and try to see what it's about and not about."*

Participants did express some caution about the way the organization scheme affected encountering, though. P8 noted *"I don't think [the structure] really hindered me, because I still discovered new books. But I almost wonder if I could discover more if there was a proper structure."* In contrast to P4, P7 said the structure meant she was 'always filtering' because the it was *"so random and chaotic."*

Topically Diverse Table Displays. These displays had mixed results. Three participants (P6-8) incorrectly applied mental models of traditional bookshops to the center table, assuming books on it were bestsellers or new releases. For example, P7 stated *"I don't look at tables like this because they're all bestsellers possibly. I have a prejudice against bestsellers. I think if they sold well, the content must be lame."* This can be considered a breakdown of the information encountering process [18, 19], where books are *noticed* but not *examined*. This was not true of all participants, though: some participants did find books on these tables, predominantly we suspect because they facilitate exposed covers. The topical diversity did not seem to have any impact on goal-directed seeking or loosely-directed exploration one way or the other, but the design of the tables was poorly understood generally. This element of Libreria's design can be considered broadly unsuccessful.

Author Curated Sections. Although author curated sections were noticed by most participants, some consciously avoided examining any type of recommendation. P5 stated this was because they usually did not align to her interests. She commented *"it's their story, not my story. I want to choose my own thing and not follow someone else's path."*

Those who *did* examine author-curated sections soon dismissed them as they were unfamiliar with the curator, e.g. P2 noticed the 'Curated by Hannah Barry' sign and said *"oh, there's a curator. But I don't know who she is, so don't really care. But if it was an author I loved, I might. If Margaret Atwood curated the bookshelf, I'd expect the books to be quite awesome."*

Recommendation Cards. These cards were also noticed but quickly dismissed by most. Several participants cited the cards obscuring the book cover as a reason for not examining them in more detail; P7 thought they were *"no use for discovering books at all"* as *"when they obscure the book covers, my interest sharply declines."* She stated although the card might still catch her attention, *"when I skim the text on one card and decide it's just promotional, I'd skip any others."* This misgiving about the cards' purpose was echoed by P5, who stated *"it feels suspicious"* as she thought books with cards were those the shop was trying to promote.

6 Libreria's tension between findability and discoverability

The finding that echoed across Libreria's design features is that there is a tension between findability and discoverability at play. This tension between supporting goal-directed seeking and discovery (often through loosely-directed exploration) was noted by several participants. For example, P3 stated *"you can always find something unusual in bookshops like this. But don't expect to find anything you already wanted. Finding particular books is nearly impossible."* P2 expressed a preference for organization that was *"more logical,"* but noted *"I guess this is good for browsing though, as you're looking from one book to another quickly."* On reflection, she decided a more logical organization scheme *"might also be less endearing and take some of the fun away."*

Participants found it almost impossible to find specific known items or topics, other than (ironically) by accident. However, all unexpectedly encountered interesting books, mostly when 'freely exploring' but also during goal-directed seeking. Some aspects of the environment design were key in facilitating encountering, particularly the broad, ambiguous organization scheme and book cover exposure. Other design features, particularly the continuous shelving, author curated sections and recommendation cards did not facilitate encountering. However, the follow-up interviews provided evidence that they might, if implemented differently.

Findings related to Libreria's support for goal-directed seeking and loosely-directed exploration are presented in sections 6.1 and 6.2. Example information encounters during directed and loosely-directed seeking are presented in sections 6.3 and 6.4.

6.1 Seeking but Not Finding: Libreria's Design Poorly Supports Goal-Directed Information-Seeking

Only one participant (P4) found what he was looking for in the goal-directed task - 'an interesting biography'. This may be because his (self-chosen) task was broader than all others. For example, P1 was unable to find books on East Asian History, P3 books by famous novelist Margaret Atwood, and P9 a biography of US president Johnson. However, some participants who performed the goal-directed task first found books (or sections of the shop) related to their goals during the loosely-directed task. For example, P6 did not find a book written by Popular Science author Steven Pinker during the finding task but found one later, by accident, during exploration.

Most participants voiced frustration, mostly due to difficulty understanding the organization scheme. When looking for 'When I Hit You' by Kandasamy, P8 said *"I don't know where it would be. No idea! I know it could be on the random shelves around the bookstore, but I don't know where I should look.*" She stated "*if I want to find a specific book, this bookshop hinders me, as I don't know what the categorization is.*" Other participants were also confused by the organization; P8 stated *"it made me want to stop browsing, it was so chaotic. There needs to be a balance."* P4 was frustrated as the section label ambiguity meant he had to scan the shelves unaided:*"When you had something in mind it could be hard. It was very frustrating. Because the labels don't help you with anything. So you kinda have to walk through the entire store and scan through every bookshelf to find the books you want*" (P4).

Equally, there was confusion about the categories themselves, with P8 discovering books by a single author in disparate locations and P3 noting fiction was mixed with non-fiction. She stated *"the labels with such obscure themes didn't work as guidance. I just relied on memory - thought 'I've seen books about feminism in an area, maybe I can also find Atwood's books there."*

P6 considered Libreria only suitable for loosely-directed exploration, stating *"a bookshop like this might be less useful when you have a purpose. It's only good for browsing."* Similarly, P2 wished for a 'CTRL+FIND' equivalent to find known items. P6 though, commented that Libreria was not supposed to be for goal-directed seeking: other bookstores like Waterstones or Amazon were, and that one visited a place like

Libreria *"to discover new books."* P1 stated if he wanted to find a specific book, he would normally ask staff, highlighting there are other avenues for finding known items.

6.2 Finding While Not Seeking: Libreria's Design Supports Loosely-Directed Exploration Well

While participants struggled with goal-directed seeking, they reveled in exploring the bookshop through loosely-directed browsing. This engendered a highly-enjoyable experience and facilitated several serendipitous information encounters (discussed in section 6.4). As explained by P9, *"even if you walked around the shop repetitively you'll still find new things you didn't see before."*

Unlike several participants, who said they disliked the bookshop's organization scheme, P9 liked Liberia precisely because of it, stating *"I like Libreria precisely because it has no clear labels or organization. I didn't know what to do at first, but then began to feel joy when freely browsing the books" (P9).*

When reflecting on how well Libreria supported exploration, P3 noted independent bookshops may be better suited than traditional ones because they encourage encountering:*"If I go to a normal bookshop, I usually want to find a particular book or latest releases. In an indie bookshop, I would go for an afternoon to browse, to discover. It's like going to a flea market. You might get some nice surprises"* (P3).

6.3 Finding While Looking for Something Else: Information Encountering During Goal-Directed Information Seeking

Three episodes of unexpectedly finding an interesting book during goal-directed seeking (by P5, P7 and P9) were observed. This suggests our reassurance that 'it doesn't matter if you find what you're looking for' may have partly mitigated the 'halo-effect' risk. This may also reflect real-life behavior; P6 said *"often I go to a bookshop for a specific book but end up buying others. It happens all the time."*

All encountered books were unrelated to the goal, for example P5 was browsing the 'Ways of Seeing' section for books on 21st century poetry and trying to understand the organization scheme. She pointed at some photography books, stating *"it's smart to put them together under 'Ways of Seeing'."* She then pulled out and put back several books in 'The Last Interview' series in quick succession and returned to the photography books, browsing them methodically. She picked up 'Movie Journal: The Rise of the New American Cinema 1959-1971' by Mekas and Bogdanovich, a book on the history of American filmmaking. She stated *"oh, Mekas! He's Lithuanian. Oh wow, he's been my hero since I was young. Very important in cinematic history in the 20th century. I knew the author, but I didn't know he'd written a book like this. Only when I saw the cover, I said to myself 'wow, it's him!' I met the icon that affected my life the most in a tiny bookshop in London!"* She commented *"it was especially unexpected to find a book about a little country in a small bookshop in a big city."*

6.4 Finding While Not Seeking: Information Encountering During Loosely-Directed Exploration

All participants bar P5 experienced at least one information encounter during loosely-directed exploration. Twelve encounters were observed overall. As the task was time bound and serendipity is 'regular but rare' [12], this number of encounters can be taken to reflect Libreria's 'explorability'. An example follows: In the goal-directed task, P2 struggled to find a Psychology or Science book as a gift for her brother. In the loosely-directed task, she noticed some illustration books shelved together. She pulled out a comic-book adapted version of 'American Gods' by Neil Gaiman but said she would not want to read it in comic form. As she put it back, she noticed another comic book next to it: 'Baking with Kafka' by Tom Gauld. She flicked through, mentioning she had seen Gauld's illustrations in newspapers and on Instagram, but was unaware he had published a book. She thought this would make a great present for her brother as it *"could spark some good conversations and make him laugh."* She kept the book with her and purchased it afterwards. She considered it an unexpected find as it was not a Psychology or Science book, so was outside her brother's usual interests. She thought he would find it interesting as her brother had previously liked some of Gauld's illustrations shared on a family instant messaging group.

7 Discussion and Design Implications for Digital Environments

All participants unexpectedly found interesting books in Libreria, providing empirical evidence that this bookshop, which was deliberately designed for serendipity, *did* encourage information encountering. However, the bookshop poorly supported goal-directed seeking. This highlights a tension between supporting findability on the one hand and discoverability on the other. Optimizing findability over discoverability may enable goal-directed seeking but inhibit loosely or un-directed seeking (i.e. exploration) and encountering. Libreria was, conversely, designed to optimize discoverability over findability: the opposite of the established focus of information retrieval. Its design enabled exploration and encountering, but inhibited goal-directed seeking.

Digital information environments are designed primarily for goal-directed information seeking, rather than the novelty, diversity and serendipity we saw facilitated by Libreria (see [48] for a review of non-accuracy-based approaches). However, digital information environments are notoriously poor for supporting serendipity, browsing and other forms of loosely-directed or undirected information seeking. The connection between findability-first design and poor experiences of serendipity has long been considered (e.g. see [7,11]), but ours is the first work that has examined the opposite problem: what does serendipity-first design mean for findability? Our study demonstrates a tension between findability and discoverability. Designing a physical environment for serendipity by encouraging users to explore (even get a little bit lost), slow down, and wander makes it difficult for them to rapidly locate known or describable items of interest. It is likely that this is also true of digital environments.

Some, but not all, of Libreria's design features were noted to directly facilitate information encountering. However, some participants found it difficult to understand

even those features that *did* facilitate encountering, such as the organization scheme and display tables. This lack of understanding created tensions in the user experience, but were not strong enough to entirely disrupt experiences of encountering.

Our participants distrusted design features they did not understand, such as curated sections and recommendations. This discouraged them from *examining* potentially interesting books: an essential part of the information encountering process [18, 19]. This highlights that even seemingly innocuous design decisions (e.g. curation by little-known authors, placing recommendation cards on book covers) can inhibit encounters. Designing digital serendipity-related design features to be readily understood should be a priority. Furthermore, these features should be carefully tested to ensure they do not unduly inhibit goal-directed seeking (and vice versa for goal-focused features).

Our participants had different expectations of mainstream bookshops, which were considered useful for finding specific items, and specialist shops, that were considered useful for exploration and encountering. These expectations made interpreting Libreria's unorthodox and at times scant structure hard. Libreria was perceived as deviating too much from norms: its loose structure made even the most specific known-item searches hard and was at times *counterproductive* in facilitating information encountering, confusing and overwhelming rather than inspiring users. In digital information environments there are few established norms. This may either help or hinder online information encounters: on the one hand, a lack of idioms can encourage users to 'slow down' and pay attention to information they might not otherwise have examined. On the other, it can induce reticence and caution, reducing opportunities for encountering.

Some participants made incorrect assumptions about the purpose of certain design features (e.g. display tables). Again, they carried expectations from mainstream bookstores, voicing cynicism that items were grouped for commercial rather than reader benefit. Understanding how to achieve authenticity and transparency in this context should reduce barriers to encountering associated with alien or manipulative structures.

Some disorganization or 'chaos' can liberate, but too much can constrain. Structure can be imposed to 'control' the chaos, but not too much as designers should not 'take the fun away' from what can be a joyful, delightful experience; it must still be perceived as 'endearing.' Others have advocated a similar need for balance for designing recommender systems [34], and 'inspiration-oriented' search tools [49]. The 'right' balance is likely to differ based not only on the environment's design, but also on informational factors such as user needs and tasks [34] and other individual factors, such as mood [19]. We are hopeful that it is possible to design flexible, versatile environments that provide some features that are better at supporting goal-directed seeking, and others more helpful in loosely or undirected exploration and encountering, allowing users to shift the seek-discover emphasis at will. How best to do this, particularly given variations in needs and contexts, is an empirical question for future research.

Our findings do not provide direct design solutions; the empirical insight to form an ironclad set of design guidelines does not yet exist. This study contributes to the still-open research question of how best to design for digital serendipity. However, some of Libreria's serendipity-related design features provide opportunities for potential digital analogues, such as supporting multiple (and perhaps unconventional) information organization schemes; some aimed at supporting known-item finding, others at loosely-

directed exploration; providing tractable ways of showcasing or recommending content (e.g. for fiction, not just new releases or genre, but also books set in a particular location or historical period); introducing ways of 'slowing' information interaction, such as by providing meaningful, perhaps unconventional related content (e.g. trailers of the movie adaptations of a book), integrating annotation, sharing and personal information management functionality within digital environments; or providing 'continuity' by leveraging ontology-based links to facilitate browsing between related digital content. Illustrative design suggestions for addressing the findability-discovery tension include: reducing search-primacy by stronger visual and interaction signaling for browsing; providing novel browsing support (e.g. through socially-contributed subjectively meaningful connections between content) and integrating search and browse functionality in complementary ways that allow for seamless transition from goal-directed seeking to loosely-directed exploration and vice versa.

8 Conclusion

While prior work has suggested some types of environments may facilitate serendipity while others might not, our paper is the first investigation of a physical environment designed primarily for serendipity - a bookshop called Libreria. We used a combined observation and interview approach to assess which, if any, of Libreria's features facilitated serendipity, and whether designing for serendipity had an impact on more goal-directed forms of information seeking (it did, inhibiting goal-directed seeking).

Libreria had several features - such as ambiguous category names, seating, and exposed book covers that were effective in facilitating serendipitous information encountering, even if (as was the case with the ambiguous organization scheme) users did not understand them. Not all of Libreria's features were effective, though. The recommendation cards, for example, were too alien to participants to be trusted; not knowing where the recommendations came from invalidated them in their eyes. They further obscured a feature - book covers - that had the potential to facilitate serendipity. Leveraging the known affordances of serendipity when designing digital information environments will almost certainly result in more experiences of online information encountering, as this study demonstrated in the physical realm, but at what cost?

Digital information environments have traditionally been designed to support information seeking that is at least partly goal-directed; this is what search boxes are for. Digital environments are notoriously poor for supporting serendipity, though - perhaps because of their focus on directed seeking. Our study shows that designing for serendipity dramatically inhibits goal-directed seeking, so the tension between findability and discoverability operates in both directions. This poses an important challenge for digital design (and indeed for design generally): how can we best support all types of information acquisition - from highly to loosely goal-directed and from active to passive within a single interface, or digital information environment? How to address this challenge - ensuring that users can search when they need to, explore when they want to and experience information encounters as a surprising and delightful by-product - remains an important question for future work.

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