

# Putting Books Back on the Shelf: Situated Interactions with Digital Book Collections on Smartphones

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## ABSTRACT

We consider the reasons why we organise books in a physical environment and investigate whether situating interactions with a smartphone could improve the user experience of e-readers. Our prototype uses the Kinect depth sensor to detect the position of a user in relation to sections of a physical bookshelf. We also built a mobile application that allows users to browse and organise digital books by moving between each section. We present our initial observations of a user study that evaluated search and categorisation tasks with our prototype. Our findings motivate reasons to explore digital books in a physical environment and indicate issues to consider when designing situated interactions with e-readers.

## Categories and Subject Descriptors

H.5.0 [Information interfaces & presentation]: General  
General Terms

Design; Experimentation; Human Factors.

## Keywords

Mobile Interaction; Situated Information; User Experience.

## 1. INTRODUCTION

E-book readers (*e-readers*), such as Amazon's Kindle, are a popular way to consume hundreds of books without the clutter of their physical form. Although the sale of e-books has overtaken physical books on Amazon<sup>1</sup>, digital books are often used interchangeably with physical ones [7]. One reason why e-readers have not fully replaced paper books is that they constrain our interactions to its private display. Therefore, they lack the rich user experience that we expect from physical books. Apart from unique haptic experiences, such as annotating a page or marking it with a dog ear, physical books afford the ability to be organised in the context where they are used. For example, one might keep recipe books on a different shelf or in a different room than science fiction

<sup>1</sup> Amazon Press Release, August 2012:

<http://phx.corporate-ir.net/phoenix.zhtml?c=251199&p=irol-newsArticle&ID=1722449>

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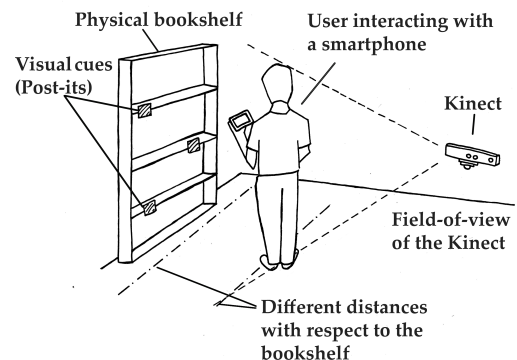
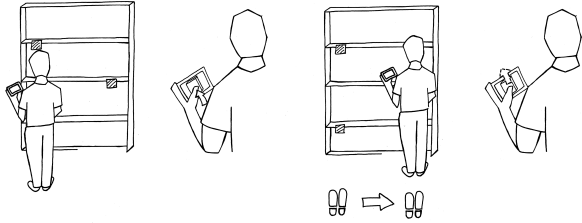


Figure 1: A user stands at a section of the bookshelf and views a collection of e-books on his smartphone.

novels. We can then use our familiarity of the physical layout to find where each collection is. This has the additional effect of making our interactions with our books visible to others. As a step towards improving the user experience of e-readers, we propose integrating digital books into the structures that exist in our physical environment. We designed a prototype that uses the Kinect to detect movement between sections of a physical bookshelf, and we developed a mobile app that allows digital books to be explored by moving between each section, illustrated by Figure 1. Though our prototype considers situating interactions around a single bookshelf, we could imagine spreading our digital book collections in multiple rooms. We continue with related work, followed by a discussion of our prototype and an initial user study and we conclude with opportunities for future work.

## 2. RELATED WORK

In 1995, Kirsh considered how the spatial arrangement of artefacts in a physical environment can simplify choice and perception [4]. Similar to his approach, we aim to reduce the cognitive load of mobile applications through spatial layouts. Our work is also inspired by 'situated information spaces' [2], a term that describes the principle of anchoring digital information to physical objects so that it may be browsed and manipulated in the context in which it originated. This is a converse approach to the 'Internet-of-Things' [5], which is concerned with indexing physical objects in the digital world. The 'Bohemian Bookshelf' [8] considered the visual presentation of digital book collections as an information visualisation. The 'Digital Bookshelf' [1] demonstrated a way to present e-books using a projector in combination with the Microsoft Kinect, a depth sensor that provides natural interaction and has been recognised as a platform for prototyping interactions in combination with smartphones [6].



**Figure 2: ‘Drag-and-drop’ metaphor (left to right): A user stands at a section of the bookshelf, grasps an e-book, drags it to a different section and drops it.**

### 3. PROTOTYPE

Our prototype consists of three parts: 1) a bookshelf that has been labelled with handwritten notes that act as visual cues for the digital book collections, 2) an Android application that displays the digital books, and 3) a positioning application that uses the Kinect placed 1 meter behind the user to detect when they enter a section, and communicates this to the mobile device via a Wi-Fi network. While there are several approaches to detect the position of a user in relation to a physical artefact, we favoured the Kinect [1, 6] over tag-based [3] or capacitive sensing [9] approaches. This gave us freedom to anchor book collections anywhere on the bookshelf without limiting our design to the number and placement of tags or to the size of the capacitive surface. In the mobile app, books are displayed as images in a scrollable, horizontal list. We designed interactions to browse between collections of e-books (*filter*), gain an overview of all sections (*take a step back*) and organise e-books into categories (*drag-and-drop*). The ‘filtering’ metaphor extends the physical action of standing in front of a section of a bookshelf to zoom in on a particular category, by filtering the mobile app for books in this collection. ‘Taking a step back’ and increasing the distance to the bookshelf displays all collections and provides an overview of what is there. The ‘drag-and-drop’ metaphor allows digital books to be moved between collections by dwelling a finger on the e-book (to ‘grasp’ it), walking to a new area of the bookshelf (‘drag’) and then letting go (‘drop’). This is illustrated in Figure 2. We provided tactile feedback on the mobile phone to indicate when the user filtered a collection, when a book was selected and when a book was successfully placed in a collection.

### 4. EVALUATION AND DISCUSSION

We performed an evaluation to gain feedback on the design of our prototype. 9 participants, aged between 21 and 30 and with a technical background, were invited to find and categorise computing science books in an office environment. The search task required participants to select a sequence of e-books. The categorisation task required participants to move e-books from one collection to another. Each task was performed 10 times using the ‘filter’ and ‘drag-and-drop’ situated interactions, and again using a menu interface on the device alone. After the tasks, we led a discussion to gain qualitative feedback about our design. In general, all participants were able to relate the sections of the physical bookshelf to the mobile interface and use these to find and organise digital books on the smartphone. We found that the handwritten notes were considered to be part of the interface. P4 ‘always looked at the post-it [...] even if [the category] was displayed on the device’. This suggests that the artefacts should be clearly marked and discoverable. Future work might consider evaluating the extent to which physical artefacts can represent elements of the mobile interface. We also

highlight the importance of keeping the position of artefacts consistent with the digital information associated with them. This would be particularly important if the artefacts could be moved. For example, if we were to use bookends to mark each section, then the position of the bookends would move depending on the number of physical books present on the shelf. In this case, their position might be better tracked using tags instead of the Kinect. Participants also expressed the desire to personalise the artefacts. P4 stated that ‘If I knew that I kept my pictures in a corner then that would be enough for me to go over and see them on my phone’. Personalisation might explicitly discourage discoverability, by requiring external viewers to know the physical layout before they can make inferences about how a user is interacting with their device. Viewing a user in an area could also bring to our attention if they are browsing our personal content. This could be valuable as a tool that prompts social behaviour. In the experimental setting, movement was perceived to be engaging. However, participants could imagine times when they would and would not want to move around to interact with their device. P1 considered ‘If I was sitting down [...] then I would just use the menus [but] if I couldn’t find it then I would use [the situated interface]’. We therefore consider situated interactions to be supplementary to the menu interface but that they may be valuable in certain circumstances.

### 5. FUTURE WORK

This paper is a first step in exploring how situated interactions with digital book collections could enrich the use of e-readers. The next step is to explore the impact of this design on the social aspects of situated interactions and the extent to which physical environments can be used to visualise the mobile interface.

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