

# The Reading Desk: Supporting Lightweight Note-Taking in Digital Documents

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**Abstract.** When reading on paper, readers often write notes, fold corners or insert bookmarks without apparent conscious effort. Research into digital reading has discovered that electronic tools are far less intuitive, require significantly more attention, and are much less used. This paper introduces “The Digital Reading Desk” – a document reading interface that enhances existing digital reading interactions by adopting effective elements of paper interaction, and combining those with digital enhancements.

**Keywords:** Annotation, Placeholding, Digital Documents.

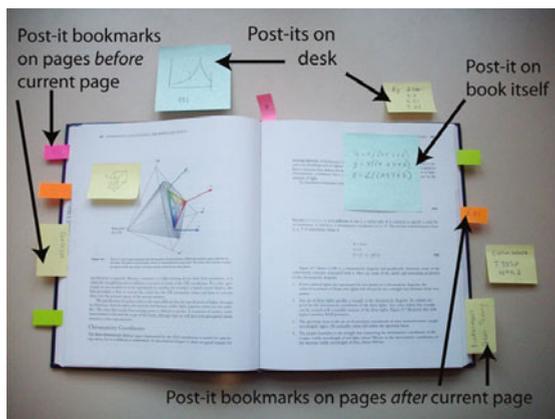
## 1 Introduction

In the physical world, the act of note-taking requires very little conscious effort. The lightweight [2] properties of paper coupled with years of learned behaviour facilitate easy manipulation and use of paper based mark-up tools. The equivalent interactions on digital document readers however, do not offer the same affordances and consequently suffer from poor rates of use when compared to their physical paper counterparts [2,3]. One contributory factor may be the over-specialised nature of digital tools, compared to print. This can be observed when using Post-Its on a physical document. Post-its can have multiple uses depending on their placement: they can sit entirely within a page (to make notes about it), protrude from the side of the document (acting as a bookmark) or even on the desk next to the document (for a note about the whole document). See Fig 1.

We are endeavouring to answer Marshall and Bly’s [2] challenge to produce digital tools that mirror the apparently fluid and effortless actions seen by users of paper documents. The “Digital Reading Desk” mirrors some features of working with paper that have been absent from previous designs, and that may be essential for a truly usable system. The advantages of the design have been established by an initial user study.

## 2 Physical versus Digital

In terms of interaction, the way in which users can manipulate digital notes is drastically different from paper. As discussed above, there are several ways in which paper can be exploited that lack digital solutions. For example, the



**Fig. 1.** An example of Post-its being used in a physical book

majority of digital reading systems do not provide a workspace comparable to a physical desk to make notes. Previous studies [1,4] have proved that the margins and indeed the space surrounding the document (the desk for example) perform an integral role in the physical mark-up process, yet thus far, little attempt has been made to integrate this feature into digital reader designs.

As discussed in the previous section, paper also easily facilitates multi-functionality within tools (e.g. Post-its that can act as notes as well as rudimentary bookmarks), whereas digital systems typically separate these functions.

### 3 Interaction Design

The ‘Digital Reading Desk’ is a system designed to overcome the problems associated with electronic reading. Our interaction is informed by the effective interactions of reading on paper. We present the PDF document as a double page spread (see Figure 2), that appears like a book on a desk – cueing the user to the potential for paper-like interaction. A key feature of the design is the incorporation of the ‘virtual desk’; an area that provides an additional workspace, that can, like a physical desk, hold notes about the document. To mimic the way physical notes perform multiple functions, we have combined the note-taking and bookmarking into a single lightweight tool that will in turn reduce the time and effort required for learning. In both cases, we have therefore made an interaction that is as complete a reproduction of the book metaphor as is beneficial.

To the right of the virtual desk sit three ‘piles’ of inexhaustible Post-its that can change colour using the palette above. To create a Post-it, the user drags from a Post-it pile directly onto the document (see Figure 2). This approach eliminates the need for a menu system, as they are removed in same fashion, i.e. by dragging back onto the pile. The Post-its can contain text, making them mimic their physical equivalents. They can be moved, resized (to mimic folding and cutting) and ‘lifted up’ (to reveal the text underneath).

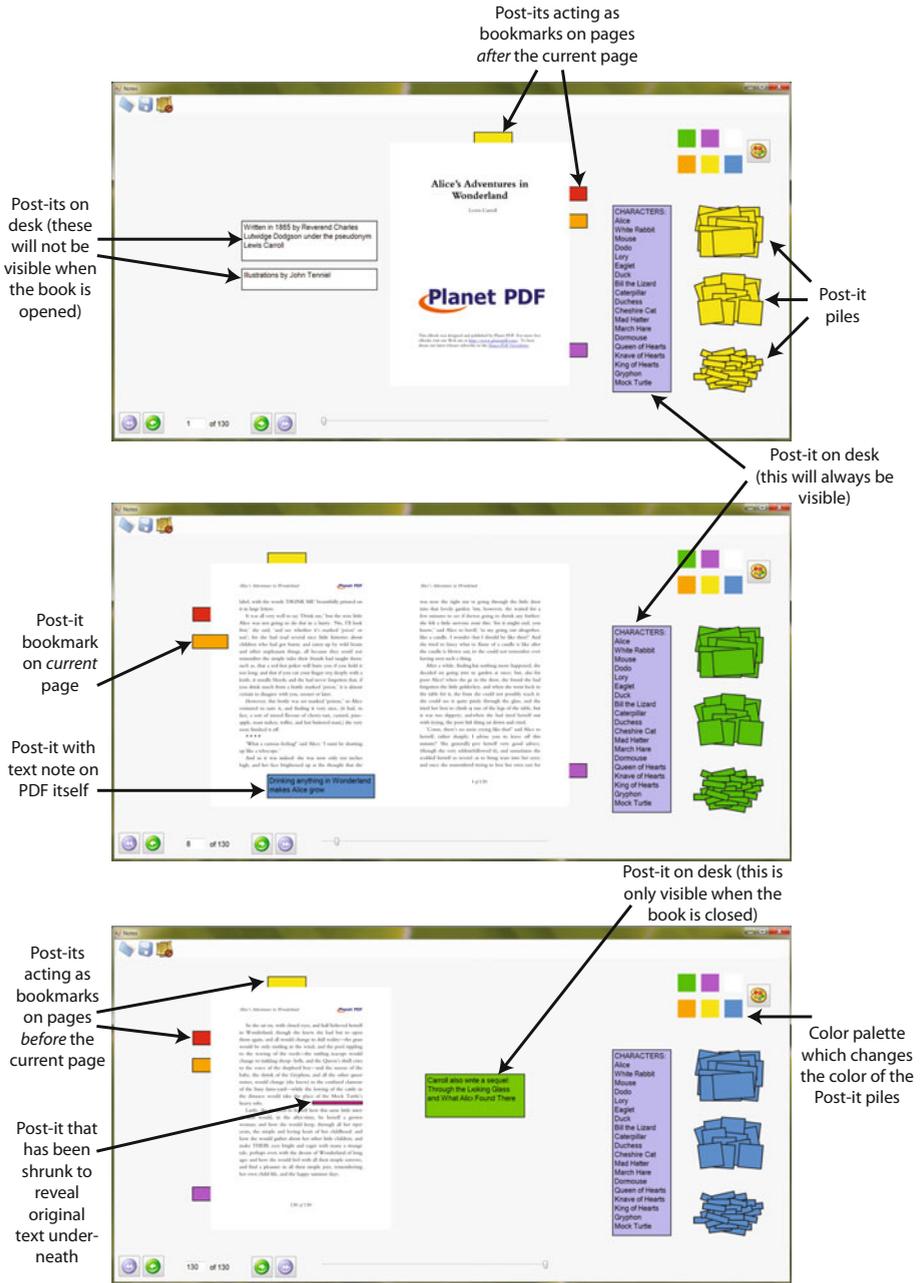


Fig. 2. Screen Shots from the Drag-and-Drop Notes System

Finally, and most importantly, to ensure the Post-its behave in the same way as on paper we wanted to ensure there were no constraints as to *where* they could be positioned. Specifically then, Post-its can be placed either:

1. Completely on the document;
2. On the desk next to, or behind (if the book is closed) the document;
3. Protruding the document which will cause it to act as a bookmark.

Thus, one tool now performs three separate functions: first, to make notes on specific pages; second, to make notes about the book as a whole and thirdly support placeholding. Post-its that also act as bookmarks not only navigate to the correct page when clicked, but also ‘flip’ from one side of the book to the other depending upon which page is open i.e., Post-its that bookmark pages that are sequentially *before* the current page appear on the left, and those on pages that follow *after* the current page are on the right.

## 4 User Study

We have conducted a sixteen participant user study on the Reading Desk, compared to two benchmark systems that replicate current “state-of-the-art” interfaces for reader software. This three-way comparison resulted in establishing clear benefits to two key features of the Reading Desk’s design. First, participants subjectively approved of the provision of the ‘virtual desk’ area; second, the unified Post-it style tool that provides both bookmarking and note-taking simultaneously. Furthermore, participants used annotation much more extensively in open tasks with the Reading Desk than with the traditional designs.

## 5 Conclusions

We wish to create an effective digital system for attentive reading, that encourages users to make extensive use of annotation, as they do on paper. Our underlying hypothesis is that an extended workspace and multi-purpose tools will minimize the user’s interaction effort during close attentive reading, and that the high demands of digital annotation tools contributes to their low use.

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