Paranga: An Electronic Flipbook that Reproduces Riffling Interaction

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ABSTRACT

The authors propose a novel book-shaped device for flipbooks called Paranga that embodies both physical features of paper and e-book interactivity. Paranga detects how quickly a user is riffling and provides the user with visual, tactile, and auditory feedbacks of turned pages by employing an LCD monitor and a rotatable roller mechanism with pieces of real paper. Using this device, the authors created several electronic flipbook installations in which the story changes depending on page-turning speed. This paper details the implementation of this device, describes the users’ reactions at a conference exhibition, and discusses Paranga’s possible applications.

Keywords: Book-Shaped Device, E-Books, Page-Turning Interface, Tactile Feedback, Virtual Reality

INTRODUCTION

Everyone must have been absorbed drawing on the end of textbook pages and creating a flipbook in his/her childhood. Flipbooks are enjoyable because the characters in the picture come alive just by turning pages. In addition, flipping the pages creates comfortable tactile sensations and sounds that contribute to the flipbook’s enjoyment.

On the other hand, e-books have recently grown in popularity. Most e-books only provide static documents, but some advanced approaches now exist that utilize e-book interactivity. Alice for the iPad (www.atomicantelope.com/alice/), for example, enables us to interact with the characters and objects in the pictures by shaking or tilting the device. This implies that e-books potentially offer users attractive and entertaining interactions beyond paper-based books. Nevertheless, e-books also have the drawback that they have lost physical features such as the shape of a book, paper-like textures, and page-flipping sensations. These features...
are quite important for effective navigation and reading (O’Hara & Sellen, 1997), and they must also be important for enjoyable and comfortable reading.

Much research has focused on reproducing the physical features of paper, including proposals of page-flipping interaction methods on tablets (e.g., Fishkin, Gujar, Harrison, Moran, & Want, 2000) and development of a mechanism that detects the bending of pages, as with a paper-based book (e.g., Yamada, 2010). However, these methods only partially recreate paper features and most do not provide tactile feedback when turning pages. There are few studies that achieve a flick interaction through a large number of pages, which is essential for enjoying flipbooks.

Thus, we focus on the flipbook as an example that emphasizes these physical features and propose a novel book-shaped device for flipbooks called Paranga. The name Paranga comes from an abbreviation of *parapara manga*, which is the Japanese word for flipbook. The main feature of Paranga is that it offers users the flipbook experience with both e-book interactivity and paper-book physical features.

To achieve this, we first examined the mechanism that fully recreates the input and output of page-flipping interaction. Figure 1 shows the overview of Paranga. Paranga has a rotatable roller with pieces of paper located at a user’s thumb position. The user experiences tactile sensation from the rotation of the roller in conjunction with page-by-page animations on a liquid crystal display (LCD). Inside the device, there is a bend sensor and a rotary encoder to measure how fast the user intends to flip over the pages. Second, we also explored a new way of interactively enjoying e-books with Paranga: We created several installations in which the story changes depending on the page-turning speed and observed user reactions at a conference exhibition. We conducted two experiments to evaluate how real the page-flipping experience is with Paranga and how much it entertains people, and then we discuss practicality as an entertainment device or page-turning interface.

*Figure 1. Overview of Paranga: Paranga is a book-shaped device that has a rotatable roller to provide a user with the tactile sensations of page turning*