Lightweight Realistic Books: The Greenstone Connection

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Categories and Subject Descriptors

H.5.2 [**Information Interfaces and Presentation**]: User interfaces – *graphical user interfaces, interaction style.*

General Terms: Algorithms, Design, Human Factors.

Keywords: Electronic book, Flash application

Realistic physically-based computer models of page-turning have been around for years, but are rarely deployed in practice except as eye-catching demos. This demo shows a connection from the Greenstone digital library system to a lightweight Macromedia Flash-based page turning mechanism that allows books in certain styles of collection to be automatically presented using animated page-turning. The system is reactive: it opens books quicker than Adobe Acrobat does and responds instantly to the user's mouse gestures. It capitalizes on a particular style of structural metadata shared by many Greenstone collections, and uses metadata to enhance browsing the library's contents.

There are opposing views on whether readers may gain any advantage from using a 3D physical book model. There is enough evidence, both anecdotal and from formal user studies, to suggest that the usual (HTML or PDF) presentation of documents is not always the most convenient, or the most comfortable, for the reader. On the other hand it is quite clear that while 3D physical book models have been prototyped and demonstrated, none are in routine use in today's DLs. Given the remarkable historical success of the book form, and the fact that the superiority of HTML or PDF presentation is at least questionable, why are physical book models not more widely available in practical digital libraries? We suggest that the answer is not because of any proven drawbacks, but is purely technological.

Chu *et al.* [1] add a realistic book representation to Greenstone. However, although it makes an eye-catching demo the system is not used for actual reading, for several reasons: special "turning the pages" software must be installed on the reader's computer; the system does not have access to external metadata such as cover images or internal metadata such as section breaks; and it is painfully slow. No doubt these could be ameliorated by improved implementations. However, informal observations of people using digital library collections in many different countries and environments is that *even PDF readers are too slow*, mainly because of the start-up delay. A different approach is called for if page turning is to be deployed in practice.

MODELING PAGE-TURNING

Consider starting to turn a page from the lower right-hand corner and creasing it flat to reveal a triangular-shaped region of the page beneath, with a corresponding triangular region that shows the text on the reverse side of the page. Continue by creating a sequence of successively larger dog-ears. This would be difficult physically (and would make a creased mess of the page), but is trivial in a computer model—and not messy at all. As the motion continues, the triangle grows and becomes a quadrilateral when it eventually subsumes the top right-hand corner of the page.

We call this effect "peeling". Although the underlying model is entirely 2D, visual details have been added to simulate the effect of a smooth bend rather than a sharp crease: shading on the bend, on both sides of the crease, and on the top of the visible edge of the page being turned. The method was proposed by Beaudouin-Lafon [2] to handle overlapping windows, and has been used to simulate a page turning effect for a 2D book constructed using Macromedia Flash.

Each book consists of a cover, a title page, the table of contents, and the main text. Book covers can be soft- or hard-bound: the user is free to switch between the two types while viewing a book. Each section of the text begins on a new page, and is paginated into several physical pages as necessary. The reader can grab the next page anywhere along the top, right, or bottom edge by pointing there and depressing the mouse button, and turn the page by moving the mouse. There is complete freedom to move the page, within the physical constraint imposed by not tearing the paper, and the crease and visual shading details follow instantly. If the mouse is released while still to the right of the centerline, the page floats back to its original position. Otherwise, the page floats down to the turned position. For serious use, we would strongly recommend controlling the device with a touch-screen rather than a mouse.

The right mouse button opens up the Flash menu, which gives readers control over aspects of the book simulation. Readers can choose the style of tab—whether tabs are on or off, whether tabs for top-level sections are more prominent, and whether tabs are colored according to section depth. They can choose whether tabs indicate sections or pages containing pictures—for readers often want to browse the book's illustrations. They can choose whether the mouse opens the book at any page or gravitates to the nearest tabbed page. They can choose how fast the book goes to another page—whether immediately, page by page, or either way depending on the distance to travel. Since the system is so fast, readers can easily explore the choices that the menu offers.

PAGE TURNING IN GREENSTONE

We have implemented a realistic page-turner based on the Flash animation technique and incorporated it into Greenstone. The implementation does not require any change at all to the Greenstone 3 runtime system: everything is accomplished by specifying XSL transforms. However, operational installations generally use the earlier production version Greenstone 2. This requires modifications to the run-time system (which is written in C++) to implement the page turning functionality.

REFERENCES

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JCDL'07, June 18–23, 2007, Vancouver, British Columbia, Canada.
ACM 978-1-59593-644-8/07/0006.