The "look and feel" of an ebook: considerations in interface design

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1 Introduction

At the most basic level, an electronic book is just a series of bits, a string of 1s and 0s which require to be encoded in order to become meaningful words and sentences. It is how these bits are presented and packaged that makes a book a readable, desirable product. "Look and feel" has become an issue of central importance to ebook industry stakeholders, and the role of designer is now firmly established as a critical link in the ebook production chain. The excitement surrounding the launch of prototype "electronic paper" which shows electronic text on thin plastic sheets "just like paper" testifies to this [1], as does the investment by Microsoft in ClearType technology [2] for its reader software, which attempts to recreate the experience of reading ink on paper by tripling the resolution of text on screen. ExeBook have even trademarked the phrase, "The look and feel of the real book!"™, for use in promoting their self-publishing services [3].

In answering the question, "How should an ebook look and feel?", the wants and needs of users are paramount. As Nielsen notes, "Users have an infinite potential for interpreting user interface design in new and unexpected ways … You simply must perform some kind of user testing as part of your interface evaluation" [4]. Of course, requirements will vary according to the type of book being used. Whereas novels are read sequentially, from the first page to the last, textbooks tend to be consulted rather than read, dipped in and out of in a non-linear manner. Encyclopaedias, on the other hand, contain facts about many diverse subjects and are referred to for a number of purposes; again, their users will have a separate set of needs. Audience definition is, therefore, the first step in assessing the "usability" of an electronic book.

EBONI (Electronic Books ON-screen Interface), based at the Centre for Digital Library Research, University of Strathclyde, and funded under the JISC DNER Programme for Learning and Teaching [5], is investigating this issue of ebook interface design with a specific audience in mind: students and lecturers in UK Higher Education.

2   Role of the EBONI Project

Specifically, the project aims to:

- Evaluate the different approaches to the design of electronic textbooks, and to identify which styles and features are most successful in enabling users to retrieve, quickly and easily, the information they require.

- Identify and report on the individual requirements of students and academics from different disciplines and backgrounds in learning and teaching using electronic textbooks.

- Compile and promote a set of best practice guidelines for the publication of electronic textbooks, reflecting the usability requirements of the UK HE community.

These objectives are being achieved through a series of evaluations of different kinds of electronic textbooks in a number of subject areas in which users interact with the test material and provide feedback through a number of channels, in order for their needs to be determined.

A specially developed "Ebook Evaluation Model" is being implemented in varying degrees by each of these experiments, which will ensure that the results of each experiment are comparable at some level [6]. This methodology comprises various options for selecting material and participants and describes the different tasks and evaluation techniques which can be employed in an experiment. These range from simple retrieval tasks measuring participants' ability to find information in the material to "high cognitive skill" tasks set by lecturers to measure participants' understanding of concepts in the texts, and from Web-based questionnaires measuring subjective satisfaction to one-to-one interviews with participants discussing elements of interacting with the test material in detail. As such, it offers comprehensive and wide-ranging methods for measuring the "usability" of ebooks, incorporating traditional IR concepts such as accuracy of retrieval, as well as measures which reflect the complex requirements of learners and teachers in Higher Education.

Ebook interfaces can be considered to comprise two components: the text of the book, and the technology used to display the text (hardware and peripherals surrounding a screen, enabling the reader to interact with the book). The construction of both components impacts on the usability of the book;

this gives rise to two main factors which are being addressed by EBONI in its ebook interface evaluations:

- The on-screen appearance of information.
- The look and feel of the physical object or reading device.

Outlined below are some of the design elements being considered, driven by prior or current research which indicates their importance in terms of usability.

3   On-screen appearance

The importance of on-screen appearance in the design of ebooks has previously been the subject of the Visual Book [7] and the WEB Book [8] experiments, with two central themes emerging as fundamental to usability:

- The legacy of the paper book metaphor, and the wisdom of adhering to this, where appropriate, in the construction of the electronic book.
- The different set of requirements arising when the reader interacts with the new medium; in particular, the effectiveness of presenting material electronically in short, scannable chunks rather than a long, linear flow of text.

Both themes continue to be the focus of EBONI's studies.

3.1 Adherence to the paper book metaphor

The Visual Book experiment compared a textbook in paper and electronic formats, and found that the book metaphor plays a crucial role in the definition of guidelines for the design of electronic books [9]. These should consider that an electronic book has to resemble, be consistent with, and work according to some or all aspects of the book metaphor with no ambiguities, conflicts, inconsistencies or confusion. Therefore:

- The page metaphor should be respected. That is, the page should be treated as a visual space where information can easily be found and scanned.

- The logical structure of the book has to be considered. Tables of contents and indexes are essential features. These cannot simply be replaced by search facilities whose complexity makes the reading process more confusing for the user.

- The book template has to be used strictly to present information which is book related, and not any other kind of material, as the result would be a heterogenous system which would confuse users.

- Titles, pagination and typographical aspects have to be designed carefully to enhance text readability.

- Visual clues have to be adapted to exploit the potential of the medium where the book is published.

That readers approach texts in electronic format with expectations inherited from their experience with paper books has been confirmed in EBONI's studies to date. As one reader noted after reading a text on a handheld device, "It didn't feel like I was reading a book. The fact that it was an electronic device rather than a traditional book with a cover and pages somehow seemed to me to take something away from the experience". Results of EBONI's evaluations so far highlight the importance of the following aspects of the book metaphor:

- "opening" an electronic book should be as quick and easy a process as opening a paper book. Where a portion of the text has already been read, navigating to this point in the book should be possible quickly or immediately.

- Indications of a reader's progress through the book should be accurate and visible.

In addition, one feature of reading a paper book has been identified as capable of improvement by the electronic medium. Some readers feel that the action of turning pages slows down the reading process, and that alternative methods of moving through a book offered on electronic devices, such as turning wheels and pressing keys or buttons, increase the speed at which they read the book. One participant in EBONI's experiments commented, "In turning a paper page you lose momentum, albeit for a second or two. I didn't find this at all with the ebook." Another noted, "The ability to change pages by using your thumb on the wheel meant that you could quickly move through a story without breaking your stride".

3.2 Scannability

In his Alertbox for July 26, 1998, Jakob Nielsen suggests that, in order to be a success, an electronic text should not simply mimic its paper counterpart [10]. He believes that the new medium inevitably involves the reader in a different way and that much more powerful user experiences can be achieved by deviating from a linear flow of text. In particular, increasing the "scannability" of a text through use of extra headings, large type, bold text, highlighted text, bulleted lists, graphics and captions, can have a direct influence on its usability [11].

This theory was applied in the WEB Book experiment, in which the original, very plain electronic version of Chapter Five of C.J. can Rijsbergen's "Information Retrieval" [12] was compared to a revised, scannable version of the chapter [13]. In the original version, each version of the chapter is allocated a separate web page and text is organised in a linear way so that users have to keep scrolling down until they reach the end of the chapter. Hyperlinks are used to provide some basic functions: moving from one chapter to the next, from the table of contents to the beginning of chapters, and from citations to bibliographic references. In the revised version, the chapter was divided between ten separate web pages according to sub-headings in the original text, a chapter contents page provided links to each section, and more hyperlinks were used to aid navigation between the sections. Extra headings, coloured and sized, were inserted in the text in order to divide it into smaller, more digestible chunks, diagrams were centred, key words and phrases were coloured red to call attention to important pieces of text, and lists were indented, their numbers or bullets also coloured red [14].

Users of the original version of the chapter disliked the design of the pages. One user described it as "flat and not very appealing"; another noted that the background of the pages made the formulae difficult to read; and a third found the layout of the text distracting: "The text used was very turgid, and combined with the plain web design, it made it hard to concentrate on the information being sought". A lack of user-friendliness was commented on twice, with one user complaining that he found it "very

user-unfriendly", and another stating that "[paper] books are a much more user friendly way of reading something like this than sitting in front of a computer".

Users of the revised version, on the other hand, made positive remarks about the page design. "It was very easy to navigate around the information from the contents list, wrote one participant. Another liked the formatting: "There was plenty of 'white space' on screen and when the information being conveyed is fairly complex and takes a lot of thinking about (as this example does) I would find it very off-putting if the text was more crowded". The same user also liked the fact that it was "clean-looking": "the fact that the background was white and only a few colours were used for emphasis meant it wasn't too busy. Colour and graphics are often overused in web pages. They seem to be for the sake of it rather than any useful purpose and can distract from the subject matter". However, one respondent thought that the use of colour to highlight keywords in the revised version was confusing, finding it unclear which items were hyperlinks and which were not. Another noted that the width of the lines of text, spanning from one edge of the screen to the other, made the text difficult to read. The problem of having to scroll up and down to see the different diagrams and equations was also pointed out: "It is far easier to compare two different equations on paper than scrolling up and down or opening and resizing different windows for comparison" [15].

Users of the revised version made 150% fewer errors on tasks than users of the original version, and users of the revised version reported 48% higher subjective satisfaction than users of the original version. Overall usability scores for the two versions of the site show that, compared to the control version, the revised version is 92% better.

The results of EBONI's early experiments, in particular the evaluations of three e-textbooks in psychology, support these findings, with participants appreciating use of a few colours, but disliking overuse of colour: "Too many bright colours... Lay off the colours". Long pages of unbroken text were felt to be confusing and difficult to read: "Text was set out too much in a block – there was no breaking up of the text, i.e. illustrations, photos. It all appeared a mass of words – not easy to read or follow". Similarly, use of chapter tables of contents, headings and hyperlinks was found to aid navigation: one user commented, "Index and chapter headings were very clear and well laid out ... It

was fairly easy to navigate around the structure to find relevant areas"; another said, "the text was clearly outlined and provided direct links to specific topics within the chapters".

Therefore, under the "scannability" heading, several more ebook interface design considerations emerge:

- Tables of contents for individual chapters, as well as for the whole book, aid navigation and can make it easier to find information on specific topics. Navigation icons and hyperlinks can enhance structure and assist users in moving around the book.

- Page layout is important. Short pages with short chunks of text interspersed with images and diagrams can increase intake of information. Sophisticated use of "white space", page borders (as opposed to long lines of text stretching the width of the screen), section headings and indented, bulleted lists can increase users' ability to scan the material.

- Careful use of a few colours can provide a consistent "style" and draw attention to key words and phrases; use of too many colours can be distracting.

- Diagrams and formulae should be positioned so that they are easily comparable.

4 Look and feel of the physical object

On-screen design, therefore, is a crucial factor in the success of electronic books, and expectations inherited from reading on paper must be considered alongside the constraints and capabilities arising from presenting information in digital format, in order for usability to be maximised. EBONI continues to investigate these issues in detail so that user expectations, requirements and desires can be ascertained, and a comprehensive set of e-textbook on-screen design guidelines constructed.

During Summer 2001, the project is also conducting research into the second factor affecting ebook usability: the hardware surrounding the text, which enables the user to interact with the book. In particular, five portable devices (a Hewlett-Packard Jornada [16] with Microsoft Reader [17], Franklin's eBookMan [18], a Palm Vx [19] with PalmReader [20], a Rocket eBook [21] and a SoftBook [22]) are being evaluated by lecturers and researchers at the University of Strathclyde. At the

time of writing, this research is in the early stages, but feedback indicates several design elements that can enhance or detract from the experience of reading or consulting an electronic book.

In terms of display technology, resolution, glare, contrast, brightness and backlighting have provoked comment, with the ability to read under a variety of lighting conditions cited as a priority. "The screen is really difficult to see unless the lighting is just right", complained one user, while another commented that, "At times the screen could be difficult to read because of sunlight, causing the reader to adjust positioning. On a packed bus or train this proved annoying and very difficult". A third user thought that, "The contrast could have been better. The flakiness. Screen was too shiny, although got used to it". Devices with backlit screens, however, received praise for surpassing the functionality of paper books, at least in terms of allowing the user to read in the dark.

The build of the devices, especially their size, weight and fragility, is also the subject of concern. When it comes to electronic books, size matters. Smaller, lightweight devices are complimented on their portability ("The ebook is small and light so I could carry it everywhere in my pocket or bag"), but criticised for having screens which are too small to read comfortably ("A bigger screen might be an improvement, if the overall size of the device could be kept as it is"). Conversely, the bulk and weight of larger devices is considered a disadvantage, but the size of their displays is appreciated. This paradox was commented on by one user while evaluating the largest of the test devices, the SoftBook: "[It] really needs to be made a lot lighter/more portable. However, having used a Palm I would say that the larger format is much more 'reader-friendly'. So I guess you are left with a dilemma – how do you preserve the size/format but make it more portable? Ergonomic aspects also provoke comment, with the ability to hold ebook hardware comfortably in one hand considered a positive feature. One user wrote that an advantage of reading a book on the Jornada rather than on paper was "ease of use, i.e. single handed use rather than having to use both hands". Another complained of the Rocket, "The device itself was quite bulky and heavy. Some effort had obviously been put into the ergonomics of the device, but it just didn't feel right. I found myself constantly shifting it from hand to hand". In addition, the fragility, or lack of robustness, of ebook hardware in comparison to paperbacks or hardbacks is thought of as a drawback: "You can drop a [paper] book from more than 12 inches without damage", was one observation; another user felt the delicate nature of his device constrained

its usage: "I was always conscious when reading that I was holding an expensive item – one doesn't care so much when holding a paperback. This obviously limits eating and drinking with an ebook, at least until the psychological barrier is crossed".

In summary, early feedback from EBONI's evaluations of portable reading devices points towards the following elements as worthy of attention when designing for usability:

- Display technology should be high resolution, with high contrast and minimal glare. Backlighting can increase portability, in that it enables text to be read in poor lighting conditions.
- Finding the optimum size of ebook hardware is a question of balancing lightness and portability against legibility of text on screen.
- Ebook hardware should be designed for comfort, with the ability to hold a device easily in one hand considered an advantage.
- The number and diversity of situations in which ebooks can be read can be constrained when devices are delicate or fragile.

5   Conclusions

Past and present research, therefore, highlights a number of elements which should be considered when designing interfaces for electronic textbooks. "Look and feel" play a crucial role in allowing users to read and use text in electronic form as much as they did and do with information on paper; thus, it is not surprising that guidelines for the production of good electronic books will have to take into account these issues related to style, layout and ergonomics.

EBONI aims to define heuristic rules for the production of "good" and "readable" electronic textbooks by closely observing readers' reactions to them. These rules, or best practice guidelines, will comprise the results of all EBONI's experiments, and will be sent to relevant organisations in early 2002, targeting publishers of electronic material, libraries and museums involved in digitising collections,

and interested parties in the HE community in general. In addition, they will be available from the project Web site [23], together with an example of a text on which they have been implemented.

EBONI welcomes feedback at all stages, and interested parties are invited to join the project mailing list [24].

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24. To join the EBONI mailing list, follow the instructions at: http://www.jiscmail.ac.uk/lists/open-eboni.html (Last visited 24/07/01)