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From intertextuality to transphysicality

The changing nature of the book, reader and writer

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Abstract. Recent years have seen dramatic changes in publishing; for a while it seemed that digital technology would supplant paper media entirely. This paper reviews some of these changes, drawing on a number of examples of systems where the authors have been involved in development or design. We touch on various issues including curation and student-generated content and the way books can become the locus of community discussions and learning. Recent reports suggest a resurgence in physical book sales, and advantages of physical study methods such as paper note taking; this suggests new challenges for digital systems to augment rather than replace physical books

Keywords: Collaborative annotation; educational technology, human-computer interaction, hypertext, locative media, physicality, reading lists.

1 Introduction

How do we make sense of the book in a digital age? Will it be replaced by purely digital eBooks on a variety of readers? Will there be a backlash and return to traditional print? Often eBooks seem like plain facsimiles of the paper book with an occasional smorgasbord of other media mixed in, but at its best digital text has potential for interactions such as community sharing of annotations, which are not normally possible with a physical book.

In the case of the textbook and education more broadly, various studies have shown advantages to physical study [1,36], and an OECD report based on international data showed that while limited access to computers improved educational attainment, the schools that used computers most had the worst outcomes [39]. This suggests that there are still lessons to be learnt from physical studying and books, and that part of a digital strategy might be to attempt to enhance rather than replace physical books.

This paper first examines physical books and libraries, starting with the simplistic information transfer model and progressing to richer understanding informed by traditional and post-modern understanding of the book. It then looks at electronic text starting with the simplest eBooks that are mere facsimiles of the physical book, but progressing to more complex uses of digital text including collaborative annotations, digital collections and connections between text and the physical world. Finally, we

return to the physical book, asking how we can develop systems that digitally augment physical texts. The discussion draws on the authors' experience with various systems academic and commercial, deployed and experimental, as well as examples from the wider literature.

2 Traditional Books and Libraries

2.1 The Book

The classic view of a book is as a transformer of knowledge and ideas: from the author, through the book as intermediary, to the passive reader (Fig. 1). There is a similar strawman view of education as pouring knowledge into young children's brains. While both are known to be grossly unrealistic caricatures, the implications of this view are surprisingly persistent, for example, the extensive focus on 'digital content' and its 'delivery' in education (e.g. see [45,17]), and learning objects standards from IEEE [28] and SCORM [49], which apparently suggest that discrete, acontextual units of educational content can be mixed, reconfigured and 'delivered' to students. This is, of course, an over-simplification in many ways.

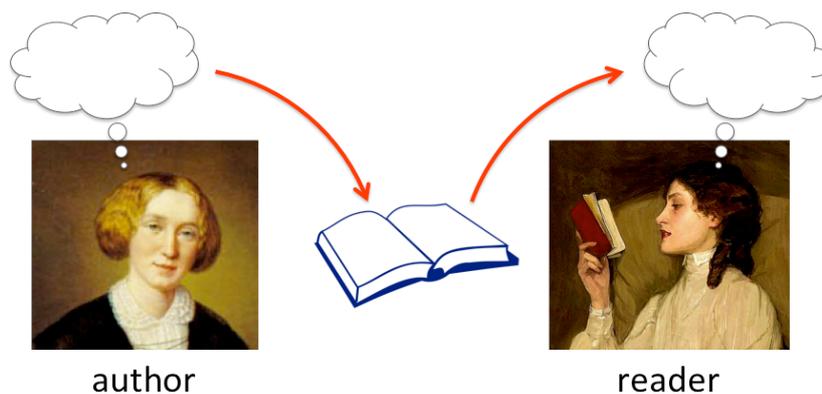


Fig. 1. Information transfer model

Not just the text

First in any book, or indeed any writing, there is a level of intentionality, the words in the book are about something outside the book whether in a real or imagined world. Indeed in Plato's Phaedrus [43] Socrates argues that writing is problematic, precisely

because of the distancing of referent and reference; although it is hard to imagine that this is not without a level of wry humour given Plato is himself writing the words.

Of course texts also refer to one another, from direct citation and quotation to allusion and tropes. In the earliest texts the writer could simply assume the reader knows a canon of standard material, but later more explicit references developed through footnotes in the 17th century [24] to modern citation systems. Kristeva's concept of intertextuality [32] goes deeper, the way the very words, the sign system, is permeated with meanings and connotations from previous texts.

The relationship can go the other way, literature has long escaped the confines of the page, from 19th century pincushions of Dickens' characters [30] to Kit Williams' *Masquerade* and 'Bronte country'. In Laugharne, carved upon the benches strung along the water's edge path are quotations from Dylan Thomas, genius child of the town (Fig. 2)



Fig. 2. Bench in Laugharne (photo Alan Dix, 2013)

Not just the author

Readers have always written to authors, and the common practice of publication through serialization meant that some of this feedback was often available to early novelists during writing. There are also other actors involved including reviewers and editors. Indeed many authors, notably Hardy and Hugo, have explicitly acknowledged the influence of the latter, albeit not always graciously. Often the editors bring considerable value to a work: in later editions of *Notre Dame* Hugo

restores the chapter on the architectural demise of Paris, which his editor had excised and which would clearly have been better left so.

20th century post-modern criticism has further challenged the privileged role of the author. Two aspects which are particularly relevant to current digital writing are (i) emphasis on the active role of the reader in 'writerly texts' intended to engage the reader as meaning maker; (ii) non-linear narrative, from serious novelists such as Fowles to 1970s children's interactive paper comic books (Fig. 3). In the latter young readers were given choices, for example "Should I run (35)" or "Should I attack him before I could use it? (34)" [3]; the page numbers (in parentheses) offered different paths through the same text.

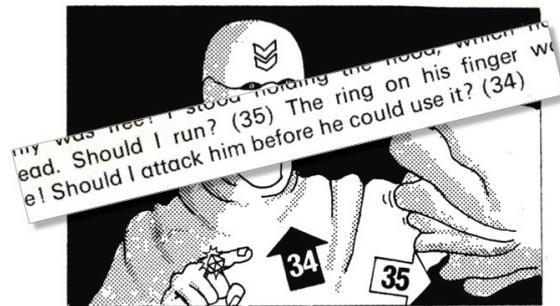


Fig. 3. Interactive Comic Book (illustrator Roger Knights) *Mission to Planet* , 1973 [3]

At a more pragmatic level, readers often assert their *writerly* role by annotating books or writing notes about them: sometimes as marginalia in the book itself or sometimes in secondary places. For example, one of the authors uses a folded sheet of blank paper as a bookmark and then writes notes on this (Fig 4.) The line between annotation and writing blurs further in book reviews, which become significant works in their own right. For example, Dreyfus commentary [16] on *Being and Time* [26] presents a clearer and arguably more coherent philosophy than Heidegger himself; certainly it is referred to heavily (over two and half thousand citations in Google scholar).

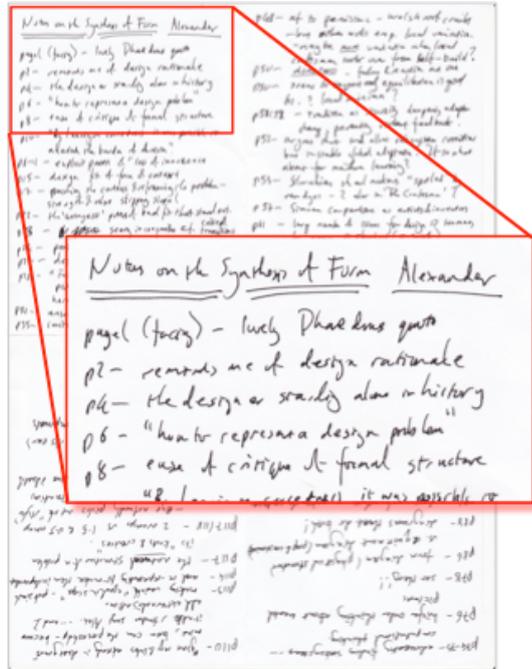


Fig. 4. Handwritten book notes

2.2 Libraries and collections

Libraries are almost as old as books themselves, the Library of Ashurbanipal (in Kouyunjik, ancient Nineveh, 7th century BC) contained over 30,000 items (albeit many fairly mundane administrative and accounting documents) [41], and Payne [42] describes how Cicero enlisted the aid of his friend Atticus to provide carpenters and an educated Greek to bring order to his growing personal collection.

When one thinks of physical libraries, it is hard also not to think of the library catalogue, and the once ubiquitous card file. Hyland-Wood suggests that meta-data is nearly as old as data [27]. In ancient Sumer, around ten thousand years ago, documents were enclosed in bullae, clay envelopes to protect the contents from being tampered with (rather like wax seals on paper envelopes in more recent times). However, in order to identify which bulla was which, an indication of the contents was inscribed on them – rather like the title on a book spine. This practice spread and was effectively one of the foundations of early western information science.

"Metadata can be viewed as an invention of the Near East with substantial refinements by the Greeks. Its spread westward formed the basis for Western libraries. Reasons of culture and governmental authority tended to suppress the use of metadata in the east." [27]

It is interesting that millennia before *Fahrenheit 451* [7] both knowledge and meta-knowledge were regarded as potentially dangerous or subversive. Indeed this is also a theme in Eco's *Name of the Rose* [18], where only the librarian knows which books are contained in the monastery library and how to locate them.

The very act of collecting creates a value beyond the individual items, hence the steps taken by libraries and museums to preserve famous collections intact. This value is also recognised in collection copyright.

Of course just as annotation blurs into review, the boundaries of collection and writing can blur as detailed literature reviews become valuable in their own right both as entrées into a literature and structuring of that literature. This is one of the values educators often bring, drawing together course material: selections of textbooks, articles and other sources, becoming co-creators with the original authors.

3. Going Digital

The nature of the book has hardly been static, but it is the rise of 'digital', which has prompted this special focus section of IxDA.

eBook (the reader)

The most obvious change to the book and reading is simple digital delivery, effectively following the information transfer model. This has often had little impact on the nature of underlying text apart from the physical medium.

Many of the earliest electronic texts tried to emulate the physical appearance of the book and bookshelves, albeit on low-resolution black and white screens [4,5]. These examples of, what would now be called, skeuomorphic interfaces continued as graphics improved allowing rapid feedback on high-resolution colour displays; for example the Butterfly Visualiser [34] for citation-based browsing, showed 3D library shelves and an open book between them. Some eReaders still use page turning and newsstand-style interfaces, although rarely spine-style bookshelf views, and many use reflective rather than emissive digital paper screens to emulate the properties of real paper.

Much more interesting is the way that digital text has opened new possibilities. from the ability to resize text, or invert colours at night to the ability to add rich media, search, hyperlink and comment. The challenge is often to see past the book to the unique potential of digital technology.

In some ways annotation can just be a poor digital version of writing in margins, but when networked allows new opportunities, for example Kindle finding 'hot sections' of books. At Talis a pilot research project Lighthouse has allowed tutors and students to share annotations on academic texts, videos and other media (fig. 5).

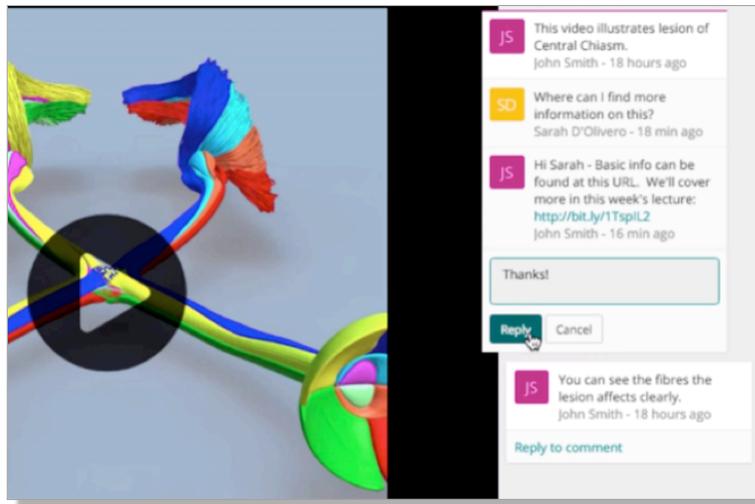


Fig. 5. Talis Lighthouse Pilot – discussions using video annotation

Similarly, while rich media may simply be embedded, like a traditional figure, online materials from the first author's HCI textbook are being semantically tagged, to enable, for example, dynamic cross-linking between video, slides, exercises and text [15]. Fig. 6 shows one of the multiple choice questions for the book tagged with the chapter ("e3:ch.5") and section (e3:sc.5.2) it relates to in the book. By also tagging slides and videos, it makes it possible, for example, to present a multi-choice question and then if the student gets the wrong answer to suggest which part of the book to revise or video to watch.

```
{
  "id": "e3-5-1",
  "kind": "CHOICE",
  "text": ["Trade-offs are important in design because:"],
  "options": [
    {
      "id": "A",
      "text": "the user is always right"
    },
    {
      "id": "B",
      "text": "there may be conflicting goals"
    },
    {
      "id": "C",
      "text": "e-commerce is becoming increasingly common"
    }
  ],
  "answer": "B",
  "tags": ["e3:ch.5", "e3:sc.5.2"]
}
```

Fig. 6. Multiple-choice question tagged to corresponding textbook topics

Authorship and publishing

The digital impact on paper production has been at least as dramatic. In publishing, movable type and 'hot metal' typesetting was replaced by computer systems, and eventually to on-demand printing. This had an impact way beyond publishing, in the UK, the Wapping dispute in the 1980s [33], when Rupert Murdoch's News International imposed new processes and sacked the majority of its workforce, was the warm-up act to the miners' strike in Thatcher's dissolution of the British labour movement. In writing, the typewriter and carbon paper was replaced first by document mark-up systems such as SGML, Troff and LaTeX, and then current word processors and desktop publishing such as InDesign.

If course, writing is more than typesetting and there has been long-standing research on tools to aid individual and collaborative writing [40,38] as well as many current commercial applications such as Scrivener and Storyist. In addition, some of the earliest work on hypertext emphasised its use as a management aid for linear writing [25], and, in this spirit, one of the authors has used a bespoke WordPress plugin to export sections of blogs as LaTeX.

Collecting and linking

A defining (albeit problematic) feature of web browsing has been the bookmark, and this has spawned numerous individual and social platforms from del.icio.us (now almost digital archaeology) to more recent systems such as Pearltrees. This can be an aid both to reading or studying, and for research and authoring, especially when content is also included as with Evernote.

Although there have been many such systems since (including Evernote), Snip!t (snipit.org) was an early example of content-focused bookmarking [13]. It was prompted by study of bookmarking in 2003 intended to understand bookmark visualisation [12]; however, one of the frequent comments was not about the survey topic, but users' desire to be able to refer to some portion of the page, not simply the overall URL. Although standardisation of page selections was still poor at that time, Snip!t used bookmarklets to enable users to select a portion of a web page and then to store and sort them as well as provide 'intelligent' suggestions for further action (fig. 7).

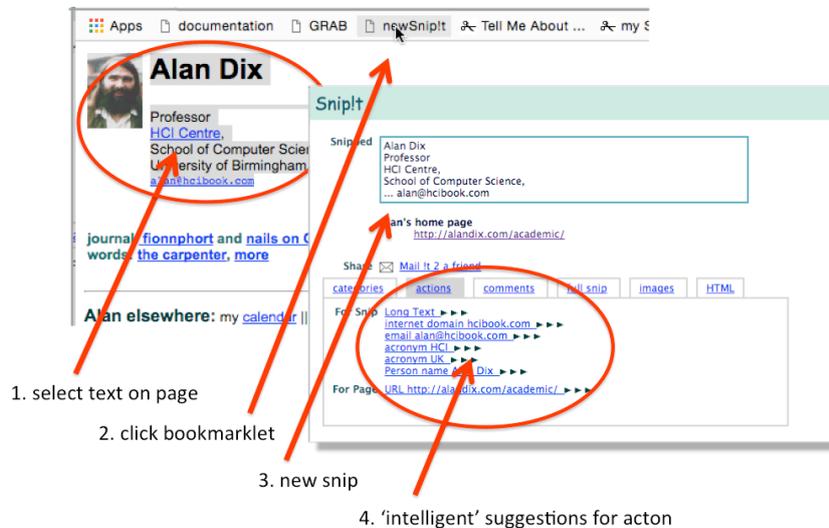


Fig. 7. Snip!t in action (snipit.org)

In the context of this paper, the role of such systems is most interesting when published as a form of digital curation. This can be simply an appropriation of social sharing sites, or as a specific design choice, for example the way Storify creates narrative from social media posts.

In the educational domain academics collate course material using plain web pages or documents, virtual learning environments (VLEs) such as Moodle, or dedicated reading list management tools such as Talis Aspire Reading Lists (TARL). Typically both VLEs and reading list applications allow lists to be structured under headings and have additional tutor-authored material included either as external documents, text elements in the lists, or to be annotations/descriptions of linked resources.

As with Storify, educational curation can blur into authoring. OB3, a product developed over some years by the second author, is a web tool for collaborative study activities [22,23]. It allows teachers and students to tool to create media-rich online study documents including the embedding of external content such as YouTube videos, directly into the document using oEmbed.

In Context: Books And The World

As noted, books have always been intentional, *about* the world, but they are also intimately related to the world, from manuals to tourist guides. Geographic and spatially organized hypermedia have a long history, from Brown's Post-it note metaphor [8] to more recent locative media and narratives. The blogs of the first author's walk around Wales [14] are being semantically tagged, much of which is geographic.

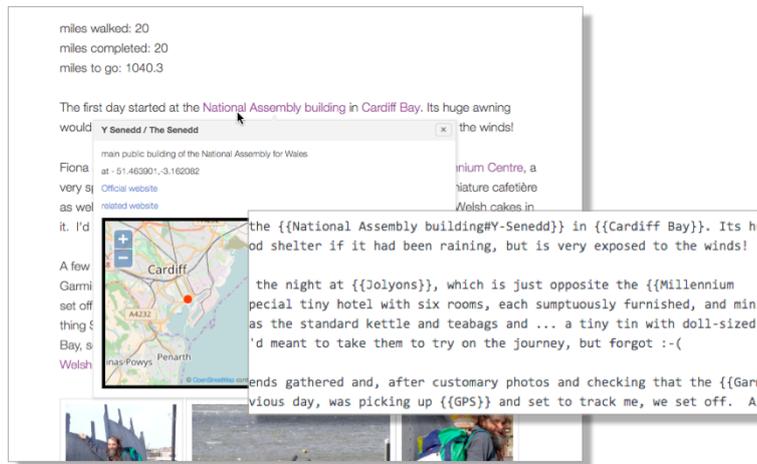


Fig. 8. Alan Walks Wales blog including semantic mark-up of entities (inset) and pop-up generated by WordPress semantic plugin. <http://alanwalks.wales/data/>

Typically linkage is achieved through mobile devices using GPS or other forms of geolocation. However, some of the most interesting examples are where information is distributed in the environment, with links back into digital material. The most extensive example is MonmouthpediA, "the worlds first Wikipedia town" [35]. Across Monmouth, in nearly every shop, historic building and even lamppost, you find QR codes linked to specially authored Wikipedia pages (fig. 9, left). Less intensive, but more widespread, HistoryPoints (historypoints.org, fig. 9, right) allows a form of crowd sourced local history; you can register historical sites with accompanying information on a web site and then print small labels, similar to those in MonmouthpediA, to place at the site and hence allow visitors to access site-specific information through their mobile device.



Fig. 9. Linking from the environment to digital text: Ceramic plate in Monmouth incorporating QR code for further information (left); HistoryPoints crowd-sourced local history (right). (photos Alan Dix, 2013)

Academic co-creation

A special case of contextual books are those used in education. Often early textbooks were derived from lecture notes, indeed Springer's flagship computing series is "Lecture Notes in Computer Science". Crucial for this is the relationship between text and course, and the role of the academic as co-creator: curating, annotating and linking resources (digital and physical) to courses. Indeed, this is precisely the purpose of TARD and similar software, connecting into university course-structures so that academics are curating within an explicit educational context.

However, while the principal aim of TARD is to help academics curate material for students, part of Talis' goal in the Lighthouse pilot is to enable annotation by students. Some of this is for their own personal notes and studying, but partly it is to enable them to share with others, that is become co-creators of their own study materials. This builds on pedagogic research on the value of peer learning, which is central to many MOOC platforms, such as FutureLearn [19], and is the defining feature of Peer-to-Peer University (p2pu.org).

So far Talis' experience has been in encouraging sharing within a course, but looking forward there is the potential to allow sharing between students who are using the same textbook or electronic resource in different courses and institutions. This would potentially open rich paths of communication within the student community and also between students, academics and authors.

4. Physical Book Redux

A few years ago, many were suggesting that the growth in eBooks signalled the end of paper publication; indeed in the newspaper and magazine industry there have been high-profile examples, such as The Independent's move to digital-only publication. However, like Mark Twain, the reports of the death of the book are perhaps exaggerated; recent reports suggest a resurgence of the paper book [20].

In education, the evidence paints a mixed picture, but seems to suggest that at very least an all-digital approach is problematic. An OECD report based on global data found that restricted use of computers improved attainment, but where heavier use was made of computers this led to negative educational effects [39]. While this report compares different cultures, so may have confounding effects, other more controlled studies have likewise found that laptop and tablet use in class leads to distraction [31,46], poor student satisfaction [50], and reduced attainment in tests and examinations [10,51].

In a widely reported result, Mueller and Oppenheimer [36] found that note taking by hand gave better results than computer notes, supporting previous studies [1]. However, they also report that this effect maybe due to different styles of note taking, with students spending more time cognitively processing to create shorter handwritten notes, whilst taking a more transcription style for computer-based notes. Other experiments that force styles of note-taking seem to show that, if anything, computer notes may be better, but only if students apply the same style [9]. That is, it may be that if one can learn appropriate practices from paper note taking, computers may actually be better. This mirrors some of the earliest results comparing physical and CD-ROM textbooks, which found that results depend critically on the kind of learning outcome measured [44].

Given this complex picture, rather than replacing the physical book with a digital equivalent, is it possible to digital augment the physical book, to gain the advantages of both physical and digital media? Methodologically, attempting to answer this question might also help us understand future digital requirements, as the case of digital note taking illustrates. In the rest of this section we'll look at some examples where this is already happening in products and research systems and then return to consider future opportunities.

4.1 Connecting Digital Tools and Physical Books

Traditional library OPAC systems, TARD and bibliographic systems such as Zotero and BibTeX are about physical books or articles. They are digital systems, but maintain a connection to physical books through meta-information. Some of this meta-information is about the book as an abstract or virtual entity (the *work*): the idea of Plato's Phaedrus; some is about a particular printing or edition, such as the Penguin paperback edition of Phaedrus ISBN: 0140449744; and some refers to a specific copy, such as the tattered Phaedrus you have currently borrowed from your local library.

Bibliographic systems such as Zotero or BibTeX are typically at the more abstract end, when you reference a paper or book, you don't care which particular copy the reader has. Library MARC records [21] are more complex as they need to be able to

refer to specific copies, as well as maintain generic information about the book; the standards have developed pragmatically, but it is quite complex to model the semantics precisely [47].

TARL (Talis Aspire Reading List, Fig. 10) sits somewhere between these two, the basic reading list for a course is about generic works: the student is required to read Chapter 5 of Dix et al, Human–Computer Interaction, but the tutor doesn't care whether the students read their own copy, a copy belonging to a friend, or a copy from the library. However, in order to make library access easy, TARL integrates into the library OPAC system, so that students can link directly into the library record for the book, and thence to the actual copy on the shelf.

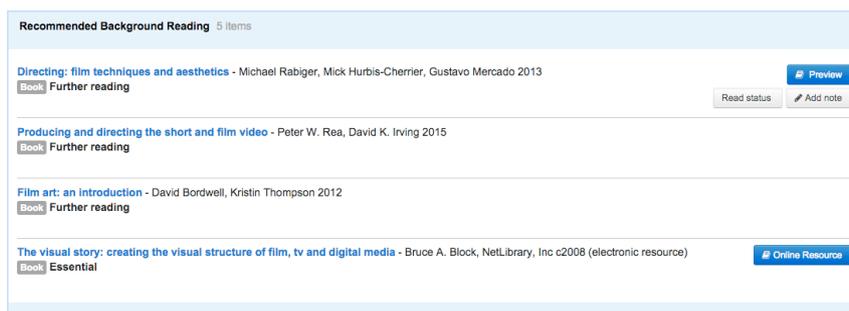


Fig. 10. Example Talis Aspire Reading List from [37]

Moving the other direction, most books have barcodes printed on them, which encodes the ISBN and through this creates a link to digital information about the book. A more complex example of this is the augmented office PimVis [48] which includes small LEDs on folders so that when you find a document digitally the LED flashes to show you where it is on the shelves.

Moving deeper into the content of the book AR (alternative reality) systems allow dynamic, sometimes interactive material to be superimposed over book pages. For example, MagicBook [6] one of the early systems of this kind not only had 3D scenes pop up as the pages turned, but enabled the reader to zoom into the scenes for a fully immersive experience.

Finally, physical materials maybe be ingested totally into the digital world. Another Talis product Talis Aspire Digital Content (TADC) makes it easy to import and manage scanned physical documents, and Evernote manages photographically captured text; that is both bring physical materials into the digital world.

4.2 Searching Printed Text

When the second edition of the first author's HCI textbook [11] was being produced in 1997, he and the books co-authors asked the publisher permission to create an online version, in the belief that this would not only increase access, but also increase sales. However, at the time this was somewhat radical for the publishing industry and so they were not allowed to provide a readable online version (except for visually

impaired readers). The book authors considered what might be possible to provide online given this.

To do this, the advantages of an online book were analysed. One advantage was ease of reading on electronic devices, but this was specifically disallowed. Another advantage was the ability to search the text. It was decided to provide this as an online service even though the text itself would not be available to read.

Fig. 11 shows the online HCI book search in action. The user enters a search term (here 'reading') and this is looked up in a digital copy of the text. The search result page shows each paragraph or section heading that contains the term in a similar way to a standard web search, with the paragraph acting rather like the snippet of the page on a web search result page.

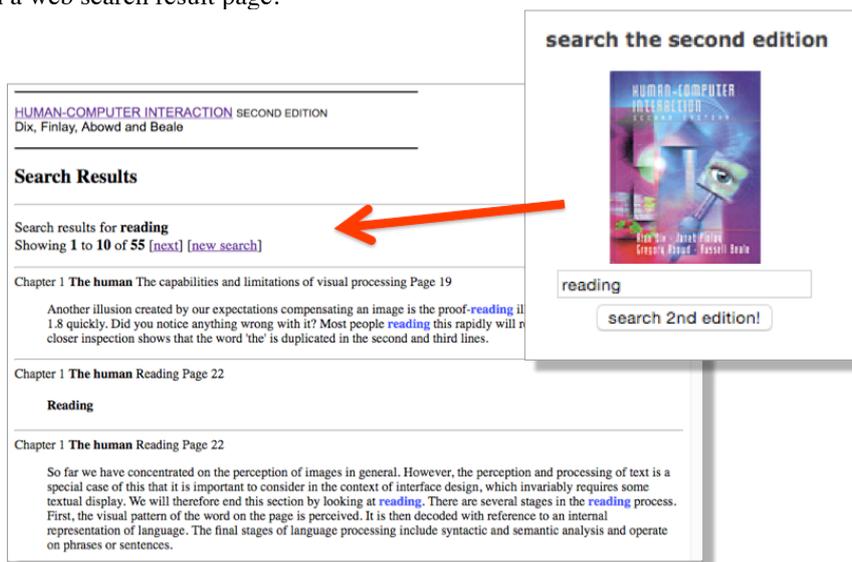


Fig. 11. HCI book search for 'reading'

Note how each result includes not only the text of the paragraph, but also the chapter, section and page number in the book. This allows the physical book to be searched in a similar fashion to an online text. Of course the physical book also has an index, but this has slightly different uses in that (a) the index is more about key concepts and (b) the index is not exhaustive. That is, the index and free text search serve slightly different purposes.

4.3 Annotation

Booknotes was inspired by the handwritten notes that the first author kept as bookmarks in his personal library, as discussed earlier. Figure 4 shows a scan of the notes taken from Alexander's "Notes on the Synthesis of Form" [2]. These are typically of the form 'page number - note', with occasional additional embellishments (e.g. "(facing)" in the first entry).

These hand-written notes are useful when one returns to the book, but cannot easily be searched (except by opening each book to look at the notes), nor shared with students. BookNotes was designed to enable the academic to either quickly transcribe these notes, or to enter them directly into a mobile device whilst reading (a paper copy of the book!), in a similar way to annotating an eBook.

To use BookNotes, the academic user simply types notes into a plain text file in a Dropbox folder using a minimal formatting (page number -- note). The user tells BookNotes where to find the file in Dropbox and then BookNotes reads and formats the file for the web. Fig. 12 shows the raw file corresponding to a portion of the notes in Fig. 4. Because this is simply a Dropbox text file, it can be created using any Dropbox enabled text editor, including those available on iOS, or Android.

```
Notes on the Synthesis of Form
Christopher Alexander

p.1 (facing) -- lovely [Phaedrus] quote
p.2 -- reminds me of design rationale
p.4 -- the designer standing alone in history
p.6 -- "how to represent a design problem"
```

Fig. 12. Booknotes entered by user

The BookNotes application then reads the Dropbox file and formats it for web viewing. Figure 13 shows the formatted book notes. In particular, note the infobox populated with bibliographic data and links to online bookshops and other sites and also the reference to Plato's "Phaedrus" on page 1 has become a live link to further bibliographic information.

Note how the input format is designed to mimic as closely as possible the original hand-written notes, but because these notes are digital, they can be searched, automatically linked to other digital information, and shared with others through the web. However, while the notes have obtained added value through being digital, they still refer to a physical book.

The screenshot shows a web application interface. At the top, a dark red banner contains the text "Notes by Alan Dix on 'Notes on the Synthesis of Form'" and a "logout" link. Below the banner, there is a link to "See more booknotes by Alan Dix". The main content area is titled "Notes on the Synthesis of Form" by Christopher Alexander. On the left, under the heading "Notes", there are four entries with page numbers and descriptions: "p.1 (facing)" with a "lovely Phaedrus quote", "p.2" with "reminds me of design rationale", "p.4" with "the designer standing alone in history", and "p.6" with "how to represent a design problem". On the right, there is a book cover for "Notes on the Synthesis of Form" by Christopher Alexander, published by Harvard University Press in 1964, with ISBN 0674627512. Below the book cover are links to buy the book on Amazon and Waterstones, and logos for Open Library and Google Preview.

Fig. 13. BookNotes application

4.4 Augmenting and Studying Physical Reading

These two examples show two ways in which features that are found in digital texts (search and sharable annotation) can be made available for physical books. BookNotes requires the user to explicitly type page numbers, but there have been many technologies that connect paper to digital content.

The earliest real example was Xerox Paperworks, which printed glyphs consisting of slashes ('\' and '/') that acted as a sort of barcode. When scanned it was possible to identify the sheet and what its original (un-annotated) contents were and hence detect any additional marks, for example, filling in a paper form [29]. This was a little intrusive and required the whole page to be scanned, but patterns used by Anoto pens are invisible to the naked eye and identify not only a sheet of paper, but individual locations on that sheet.

One could imagine a version of Booknotes where you used a non-writing Anoto pen to select an area of text in a book and then make digital annotations on a device. These could be shared and not only refer back to the page in the book, but perhaps use a pocket-projector to shine a laser highlight for the precise words in the text. Given this would know the actual text that was being highlighted, this could even work across different editions (a problem with page numbers) or between physical and digital versions of the text.

Studying digital augmentation of physical books has two benefits. First it takes seriously many readers' preference for physical books and also potential advantages of reading a physical book (e.g. ease of rifling through the pages), while also

accessing some of the unique features of digital technology. Second, we saw how the fact that the HCI book authors were not allowed to make the actual text available, forced them to consider features beyond simple content delivery; that is studying digital augmentation of physical books may lead to better digital books.

6. Conclusions

Although no one overtly believes the information transfer model of writing and education, often it still lies implicitly behind many digital initiatives. However, we have seen how the active role of the reader emphasised in discussions of *writerly* texts is being amplified and given concrete form in various forms of co-creation. In particular, we have seen how curation and annotation can be part of this co-creation process in education allowing new modes of communication and dialogue between students and tutors.

Early forms of eBook often focused too strongly on creating facsimiles of the physical book, and only showed their true potential when they looked to do things you could not do in a physical medium. However, numerous studies have shown that physical materials have distinct advantages, especially in study.

We are thus faced with two related challenges: (i) to make digital media as rich educationally as physical media; and (ii) to design ways to connect digital and physical media so that we can make the best of the strengths of each.

By investigating the second of these, we may paradoxically learn about the first as exploring digital augmentation of physical books helps us focus on distinguishing what the physical book does well from what it cannot do and thus is suitable for digital enhancement. The latter was particularly evident in the HCI book search case study.

In addition, technologies that allow linkage between the physical page and digital media are maturing, offering new possibilities for synergistic technology.

Perhaps the golden age of the paper book is yet to come.

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