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DESIGN OF A RICH – PROSPECT BROWSING INTERFACE FOR SENIORS

A Qualitative Study of Image Similarity Clustering

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ABSTRACT

This paper examines inclusive design delivery through interface design, with a particular focus on access to healthcare resources for seniors. The goal of the project was to examine how seniors are able to access drug information using two different online systems. In the existing retrieval system, pills are identified using a standard search interface. In the new browsing prototype, all of the pill images appear on a single screen, where the user identifies images by clustering the pills displayed by choosing similarity criteria related to the database search terms (e.g., all white pills or all pills of a certain size). The feedback mechanism in this interface involves re-organization of the pill images that are already visible to the user. We used a qualitative, task-based verbal analysis protocol with 12 participants aged 65 and older who were asked to locate pill images in each database and to discuss their preferences for navigation, aesthetics and the results that appear on the screen. By assessing the features of both interfaces, the results suggest possible models that could be applied in meeting seniors' information retrieval needs.

INTRODUCTION

As the general population ages (and as life expectancy rates increase), seniors are increasingly faced with complicated medical regimes. Sorting pills, to ensure that certain medications are taken at particular times of the day with or without meals, can be a daunting task for many patients, yet this task is a vital part of personal health management. As individuals age, visual and/or motor impairments make sorting, holding and identifying pills a challenge. Designing effective reference materials—including websites—can aid in patients' and caregivers' awareness and recognition of the range of available medications and help them to locate valuable drug information (e.g., side effects). This project was designed to explore the viability of a prototype,

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a visually based interface that would meet seniors' specific searching and retrieval needs. This empirical study addresses a theoretical issue raised by Ruecker and Chow (2003), which called for further research into the use of browsing strategies in interfaces for seniors accessing health information of various kinds. Qualitative interviews were used to explore participants' general information searching strategies, and computer tasks (employing a verbal analysis protocol) were used to assess two interfaces – including a prototype that was designed to bridge the physical (e.g., vision-related) and cognitive/emotional (e.g., issues of trust related to health information) needs of older adults.

The goal of this project was to see if an alternative visual browsing interface, showing photographs of 1000 pills, could be useful for seniors interested in pill identification. Usefulness in this case involved a number of factors, ranging from the basic question of whether 1000 photos would simply be overwhelming, to concerns about the best methods for providing tools to manipulate the display, down to detailed questions about specific design choices relating to contrast, legibility and control size. The images could be magnified and also clustered by participants based on similarity in two visual dimensions: color and shape.

INCLUSIVE DESIGN — A REVIEW OF THE LITERATURE

Previous relevant research includes a wide range of studies on information design, browsing interfaces, information-seeking behaviors and public health information. In the design of human-computer interfaces, for example, Shneiderman and Plaisant (2004) provide a comprehensive overview of issues to consider, including concepts drawn from human factors, principles of interaction design, the importance of expert

evaluation and user testing, and the role of support materials such as tutorials and help systems. In the more specialized area of browsing interfaces, a wide variety of examples have been discussed, including Small (1996) who proposed a 3D prospect view for browsing texts of Shakespeare's plays and Pirolli et al. (1996) whose scatter/gather browser represented documents by colored dots that could be organized under user control. Bederson (2001) describes a system for organizing thumbnails of images. More recently, designers working with the public API from www.flickr.com have developed a number of browsing interfaces that extend some of Bederson's ideas through tools such as the color picker by Bumgardner (2005).

In addition to the discussion of browsing interfaces and their features, there has also been some discussion in the HCI community of the methods of evaluation. For instance, Plaisant (2004) suggests the need for new and more comprehensive strategies for evaluating the success of browsing interface designs. In particular, she emphasizes the importance of considering new metrics that involve not just isolated measures of performance or preference, but also look at the longer duration of user interaction with an interface, both within a given session and across multiple sessions: "we need to consider other evaluation approaches that take into account the long exploratory nature of users' tasks, the value of potential discoveries or the benefits of overall awareness (p. 109)."

In the area of information design specifically for seniors, there have been a number of useful studies relevant to interface development. Ogozalek (1994) compared text and multimedia as information media for seniors, and found that multimedia gave better results in measures of both performance and preference. In fact, her participants preferred video to both online and printed text, suggesting that reducing the amount of required reading can make information more accessible to the elderly" (p. 70). In terms of design strategies, the principles of universal (U.S.) or inclusive (U.K.) design suggest that the number of successful and satisfied users of any technology can be increased by giving conscious attention to the needs of specialized users and incorporating those needs into the design brief, not of specialized technologies, but of technologies intended for use by everyone. A classic example of this approach is the design of a door knob in comparison with a door lever: door knobs require grip strength, while door levers do not even necessitate grasping. Door levers are not therefore just a better technology for anyone who has trouble with grip strength, but are also beneficial

to people whose hands happen to be full of grocery bags—the door can still be negotiated using an elbow. In their confirmation of this strategy in the context of web browsing, Chadwick-Dias et al. (2003) identified that participants aged 55 and older experienced more difficulties than younger participants in using the web, but also found that specific design changes based on needs identified for older users also improved performance measures for younger individuals.
However, as Shneiderman and Hochheiser (2001) point out, the goal of universal usability can often best be met through strategies that involve layered approaches, where different kinds of users are able to select appropriate degrees of interface complexity. Another factor to keep in mind during the research process is that it is as easy to stereotype the 'senior' as it is any other group. In fact, people over 65 represent a heterogeneous mix of individuals who may share a social identity, but in fact, have as many differences as similarities (Ogozalek 1994; Ito et al., 2001). That said, the proper identification and use of medication by patients is an ongoing concern in the health information community (Alemagno et al., 2004; Gleckman, 2003; Logue, 2002; Ahrens, 2003; Jorgenson et al., 2001). Seniors are particularly vulnerable to difficulties in this area, since many of them deal with complicated treatment arrangements involving multiple medications, each with its own requirements and precautions. Systems for storing pills to manage daily regimes are also vulnerable to difficulties when the pills become disarranged, at which point it becomes particularly important to correctly identify pills that have been disassociated from their packages

DESIGN

This project implements in a preliminary form a strategy for research interfaces based on the combination of factors that Ruecker (2003) uses to define a rich-prospect browsing interface. The purpose of these factors is to increase user control over the research task and to provide a heightened sense of cognitive reassurance for searchers. To these ends, rich-prospect browsers show within the default interface some meaningful representation of every item in the collection, combined with tools for manipulating the display. In addition, each representation should access more data, the form of the representation should vary under user control, and the tools should be emergent from whatever data or metadata are available in the underlying database.

The design used in this project is an early attempt to create a rich-prospect browsing interface, and as such it only meets three of these five criteria. It shows a meaningful representation of every item in the collection, has tools to manipulate the display, and provides more information linked to each representation. However, there is only one form of representation, namely the photos of one side of the pills. The prototype also has only generic ways to manipulate the display—sorting by shape or color, magnifying, panning and optional grid-lines—rather than providing tools that are emergent from the data.

Since our proposed users for this study consisted of people aged 65 and over, best design practices for interfaces intended for seniors were followed (Strickler and Neafsey, 2002). These consisted of a wide range of relatively subtle but important design choices, including providing sufficient contrast for controls and images, providing clear visual cues and designing text labels using a comparatively large font size. The rich-prospect tools provided additional features of benefit to this demographic, including the ability to magnify the display by three orders of magnitude.

It is important to note here that using a prototype design that is in its early stages of development is ideal for this type of project, as it allows for user input into the design process prior to investing large amounts of time and/or money on a fully-formed design that may or may not work for real end-users of the database in question. This project was designed, then, in keeping with the work of such usability experts as Jakob Nielsen (2000, 2002), who recommend involving users in the design process before final design stages are completed. However, revised versions of the prototype will address the two design factors missing from the current version: providing opportunity for the user to change the form of the display (e.g., by showing the back side of the pills or by allowing the user to fully rotate a pill); and, providing specialized tools that are emergent from the data—for example, some mechanism to identify potentially harmful drug interactions.

METHODOLOGY

The design-related research questions for the project were: 1) To what extent does interface design affect the usability of online drug databases; and 2) To what extent can visually-based interface design principles facilitate the usability of online drug databases?

Twelve participants, all aged 65 or over and comfortable with basic computer use, were recruited for this project; six men and six women were included, ranging in age from 65 to 80, reflecting a diversity of ages, backgrounds and levels of experience with computers and/or web resources. Ethics approval was obtained for this project and a full disclosure of participants' rights occurred during the consent process; all participants (identified in this paper only by pseudonyms) signed consent forms to acknowledge their agreement to participate in this study. Ads were placed in seniors-only apartment buildings, public libraries and community centers to attract individuals from a range of backgrounds. Qualitative, task-based interviews were conducted which included a 20-minute discussion of participants' general information-seeking strategies and a 40-minute task-based session involving searching for pill information. The interview data provided the context for a series of information retrieval tasks that participants performed using two drug information databases: a publicly accessible, text-based retrieval system (i.e., www.drugs.com website; see figure 1); and, a newly designed, visually-based retrieval prototype that grouped 1000 pill images using similarity clustering (figure 2).

Participants were shown a series of three pills and asked to identify the pills and provide information on each one using the interfaces under evaluation. The task was carried out differently in each interface. The online www.drugs.com site provides this information in the form of a searchable database of pill images; as search terms relate to the characteristics of the pills, a typical search in this database might use keywords such as 'small,' 'round' and 'white,' with results provided on separate web pages. The task in this interface therefore consisted of being given a pill to identify, choosing search terms to enter, then examining the results (both text and images) to see if the pill could be correctly identified. This task was repeated for three different pills.

The owners of the www.drugs.com website gave the researchers their complete database of pill images, allowing the images in the prototype to be exactly the same quality and resolution as those found in the existing website. Since we were re-using these images, we did not have much control over their consistency and resolution, although we did

remove extraneous background colors that were present on a few of the pills. The owners also gave permission to include screen captures of their website in all research publications.

The second interface (figure 2) is a rich-prospect browsing prototype that displays all the pills in the collection at once and allows the user to search by sorting, sub-sorting and zooming in on the various images. Previous work on the design of browsing interfaces suggests that there are a variety of new perceptual advantages and new opportunities for action that can be made available through these strategies (Ruecker 2003; Rodden et al. 2001; Ruecker et al. 2005). The task using this interface therefore consisted of being given a pill to identify, then comparing it to the images on the screen. The images could be grouped in two different ways (color or shape) or in a combination of these ways. The images could also be magnified. When an image of a pill was clicked, the information about it appeared on the left-hand side of the interface.

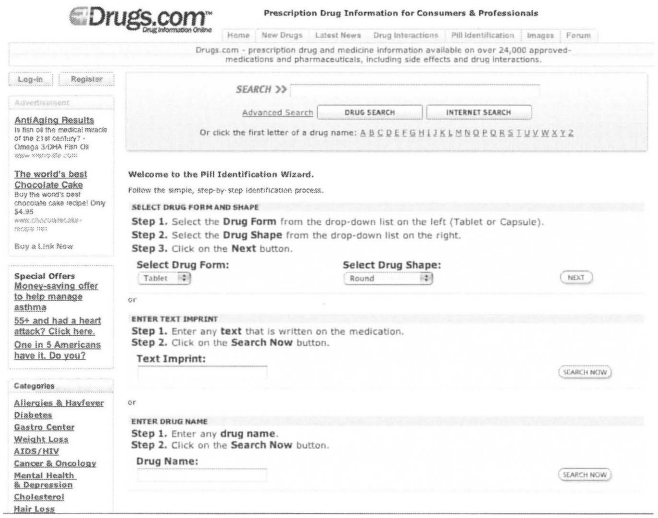

Figure 1. The original interface for pill identification is the one publicly available on the site of www.drugs.com. The interface is a retrieval design with an associated wizard that guides the user through a step-wise process. Only at the last step does an image of the selected pill or pills become visible. (This screen capture is used with permission of www.drugs.com.)

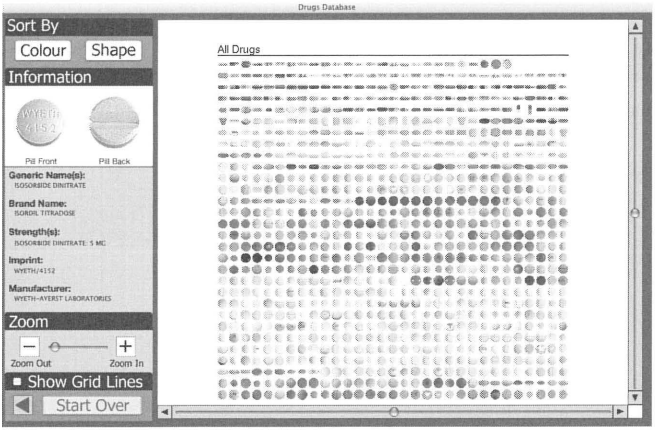

Figure 2. The home page of the rich-prospect browsing prototype shows all the pills in the collection at once, in no particular order.

The related tools allow the user to sort the images by color or shape, which creates subsets that can either be further sorted or else selected for subsequent sorting. For example, someone starting at the home page in Figure 2 would get to the image in Figure 3 by pushing the 'Sort By Color' button on the top left side of the interface. The groups could then all be further refined by also pushing the 'Sort by Shape' button, which would show smaller groups divided by combinations of color and shape. Alternatively, the user might prefer to begin in a different order, first with sorting by shape, then sorting the shape groups by color. Another option is to do the first sort, then enlarge a single group to fill the screen by rolling the cursor over it (the group highlights) and clicking. Subsequently pushing the second button then fills the screen with the sub-groups of the single group already selected. In this case, the other groups are still sorted off in the virtual spaces beyond the edge of the screen—the user can access them by zooming out or scrolling.

One of the side effects of the process of creating and selecting a subset is that it is automatically enlarged to fill the screen. In addition, the interface also allows the user to actively zoom in or out on any of the individual pills (figure 4) or subsets. The tool for doing this magnification task is a slider bar with accompanying plus and minus buttons on the lower left panel of the interface.

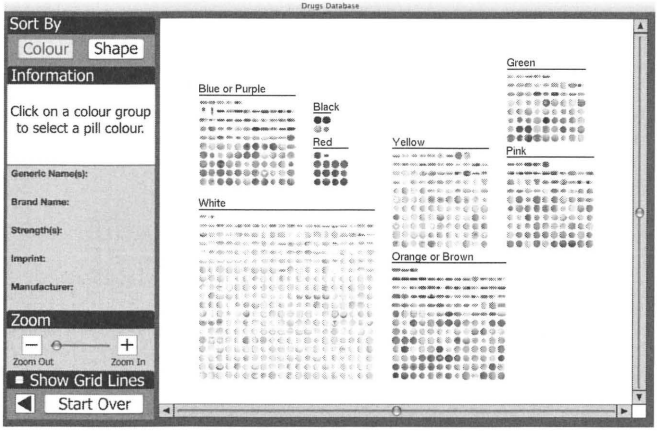

Figure 3. After sorting the display by colour, the user sees the same total number of pills, only now they have been reorganized by groups with group labels.

Figure 4. This screen shot shows the state of the rich-prospect browsing interface once the user has zoomed in as much as possible for closer inspection of a particular pill.

At any point, the user also has the ability to click on individual pills in order to display information about the pill. This information includes the generic and trade names of the drugs, any text imprinted on the pills, and in some cases an enlarged image of the pill reverse. Additional information would clearly be beneficial, especially with respect to possible alternative medication and warnings about potentially harmful drug interactions, but in this study we were primarily interested in the potential of the browsing interface for identifying pills.

Participants were asked to locate information about three different pills in each of the two databases, using color images of pills (both front and back) printed on 3x5 recipe-style cards; eleven pills were examined, in total, randomly assigned across the interviewees. Digital audio recordings were used to gather the interview data and to record individuals' perceptions during the task-based sessions and were fully transcribed. Digital video was used to capture screen images during the task-based activities. A verbal analysis protocol was used to allow participants to comment on their preferences for navigation, layout, aesthetics, etc. in each interface. 'Task completion checklists' were also used to track which search features (e.g., zoom button) the interviewees used on their own and which ones they used only when prompted to do so by the researchers.It should be noted that participants were first asked to search for each pill using any search process and/or feature that they felt was appropriate; once they had done so, the researchers pointed to any additional (unused) features, so that each participant commented on all available search features. This was an important step in the design of the project as some participants simply did not see (or did not understand) particular design features; these findings are discussed in detail, later in this paper.

The digital audio recordings were subsequently transcribed and coded using a qualitative text analysis method described by Given and Olson (2003), which emphasizes the usefulness of developing the coding schema according to knowledge organization principles long established in the library and information science field (figure 5). By balancing requirements for specificity against exhaustivity and precision against recall, this strategy provides a conceptual framework for coding data that avoids extremes both of detail and generality. In our project, the coding scheme was developed by isolating the specific research questions for the study and examining each one (separately)

to identify emergent themes. Results across all questions were then examined to identify additional themes across categories (e.g., where seniors discussed a preference for personal contact with medical providers, but relied on internet resources due to lack of contact time with a physician). As few qualitative method texts provide guidance for completing the intellectual work of coding (e.g., the level of specificity needed for theme categories), this model provides strategies for effective iterative coding across multiple transcripts. In the future, this data analysis step for the audio feeds will be combined with an assessment of the video data from the project (i.e., showing seniors' in-context search strategies), in order to point to specific elements of the interface that (for example) slowed the individuals down in their search process or that the seniors regularly selected during the tasks.

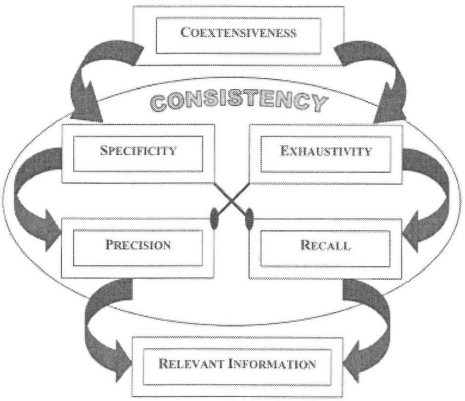

Figure 5. The Knowledge Organization Model as developed by Given and Olson (2003) provides a framework for developing qualitative coding schema, in addition to identifying strategies to manage quantitative and textual data. (Reprinted from *Library & Information Science Research,* Vol. 25, Lisa M. Given and Hope A. Olson, Knowledge Organization in Research: A Conceptual Model for Organizing Data, 157-176, Copyright 2003, with permission from Elsevier.)

One advantage of using this method is that the resulting coded data address very clearly the research questions for the study. Further, it provides a way for researchers to weed through information that is interesting, but not relevant to the project at hand (an ongoing concern for qualitative researchers, who regularly collect very rich data that require substantial time to mine for relevant results). In this way, the same data set can be coded in different ways to represent different research goals, while at the same time isolating specific data points that are of interest; with lengthy interview sessions, this approach saves researchers time by allowing for exhaustive, yet highly focused, analysis procedures. In this study, for example, the interviews and verbal task protocol resulted in an average of 5,000 words per participant, for a total of 60,000 words across 12 participants—a short novel's worth of text.

RESULTS AND DISCUSSION

Interface Comparison

None of the participants were fully satisfied with either the prototype or the www.drugs.com interface, although measures of both performance and preference did favor the rich-prospect browsing prototype. Participants questioned every element of the design process, from the viability of providing online pill information in the first place, to examining the design details of the two interfaces. Insofar as there was a consensus, it might be summarized in the words of Aaron, a 70-year old retired chemist, who at once grudgingly allows some possible benefit to the strategy of rich-prospect browsing, while also pointing out the need for additional data to further subdivide the subsets of pills:

Yeah they both stink. But uh, this one [indicating the prototype] if it allowed you to put in letters or numbers it would be much better. Because it appears as though there's something on each of the pills... I mean you want to do it by um, whatever subdivides them the quickest, and color and shape is not unreasonable, but you're still left with... I mean those grids [of pills sorted by color or size] were roughly a hundred pills.

Search Task Results – www.drugs.com

When searching the www.drugs.com database for information on three different pills, none of the seniors could complete the task and locate information on those pills. Generally, the participants found the interface to be too crowded and confusing and many had a hard time distinguishing between 'drug search' and 'internet search.' The participants were also confused by the descriptions of the pill shapes, as there were no visuals to show the differences between the options (e.g., 'tablet' shape versus 'capsule' shape), and being unable to distinguish between color categories in the search options (e.g.,'black/grey' color combination from the drop down menu was often presumed to mean a pill that was half black and half grey, as opposed to this being a category including pills of both colors). In addition, the online interface for www.drugs.com includes sidebars with drug advertisements, and many of the participants found these drug advertisements very distracting to their search tasks. As Aaron noted at the end of one of his tasks, *"Um... well what do we have to do? Restart this thing? Well it's already turned up no results. At that point I would give up."* Many participants noted that a simpler interface with clearer options and more visuals would have been more efficient and easier to use.

Search Task Results - Prototype

Compared with the www.drugs.com site, most of the participants found the prototype much easier and quicker to use and were able to complete all search tasks. As Vicki, a 66-year-old semi-retired secretary noted, "... this one is easier to use ... because the colors are easier to identify for me. [It's] faster and simpler." Many of the seniors liked the "simpler" interface of the prototype, noting that there was less "guess work" involved in the pill identification. The pill images were described as very helpful and they found the sorting options and tools much easier to use.

However, the prototype design also raised concerns, particularly for those participants who felt "overwhelmed" with the number of pills on screen at one time. Many of the participants found the pills very hard to see and wanted larger images; although the prototype did include a 'zoom' feature, most of the seniors did not see this on screen. Others did not see the 'sort' feature, which would have allowed them to reduce the number of pills by color and/or shape. Reducing the cognitive load and highlighting available search features remains an issue, even in this simpler interface design. In addition, distinguishing between colors was a problem in both the www.drugs.com site and in the prototype. Some of the participants misjudged a pill's color, leading

to a misidentification of drug information. As Martha, a 68-year-old retired social worker, noted, "Well you see, they don't look very orange and brown to me. It looks like a very pale red and an off-white." Distinguishing between similar shapes (e.g., round vs. oval) was also a concern. In any visually based interface, resolution and clarity of images will effect quality of retrieval results. Although sorting by color was frustrating for the one participant in the study who was color-blind, sorting by size was much more efficient for him than in the www.drugs.com interface.

Implications for Design

In general, the rich-prospect browsing interface used for the working prototype showed some advantages over the standard search interface (as modeled in www.drugs.com) for this particular group of users. However, the prototype can be improved in a number of ways, some of which derive from our user feedback and some of which are suggested by principles of interface design. For example, the transitions between the unsorted and sorted versions are currently accomplished by swapping one display for another. Although this is a common method of moving between screens, it can be disorienting and more importantly, it can introduce doubt as to whether all of the pills on the original panel are actually present in the subsequent sorted version. In order to provide some cognitive reassurance, a better strategy suggested by the theory of rich prospect browsing would be to animate the sorting of the pills. If this were done, it would be necessary to explicitly question its effectiveness through subsequent user study. Also, for reasons of technical simplicity, the working prototype used a white background for the pill images. This avoided the need, for example, to use gif formats instead of jpegs, since the transparency on gifs slows loading times for the images. However, since contrast is identified as an important issue for seniors by Strickler and Neafsey (2002), it would be worthwhile to consider developing a variation of the prototype that would allow users to select a colored background. Once again, the specific implementation of the mechanism for increasing contrast would need to be an object of future user study.

The principles of rich-prospect interface design also suggest that it may be useful to look for alternative ways to represent the items in the collection. In this case, the images of the reverse sides of the pills are a natural choice, since in some cases this image contains information that could make the selection process easier. The large number of white, round pills, for example, suggests that the system should provide

additional means for further sub-sorting the pills, including factors such as whether or not the pills have split lines or text. In order to avoid disorienting the viewer, one potential strategy would be to have the interface rotate the pills through an animation that would leave them in place but visually flip them, to show the other side. Lack of contrast within the images (e.g., of the white pills) is another issue which could be addressed through the provision of a third representation. In this way, where the color of a pill makes the embossed or printed text on the pill difficult to read, vector-based drawings of the pills could aid the viewer by allowing the user to enlarge the display without losing definition on the images.

The number of images in the collection is another factor to consider in the design. The current prototype only uses 1000 images; although the upper limits for the underlying database have not been determined, it may be useful to consider strategies for dealing with cases where there are significantly more images. One possibility explored in this study was to provide prospect in the form of a sliding navigation panel across the bottom of the screen, which would visually subset a portion of the entire collection for display in the main panel. However, as the participants of this study identified a number of problems with this potential redesign, further research is needed to examine how best to display large sets of pills in ways that will meet these users' needs.

CONCLUSIONS

In addition to findings related to future redesign of this particular interface, and of areas for further research, this project was particularly innovative in its combination of inclusive design and web usability principles, with a qualitative task-based interview design that allowed seniors to be involved in critiquing existing and potential interface designs. Often, designers create and launch products that leave seniors (and other end-users) to learn how to use the system and to modify their own search strategies to suit the technical limitations of the interface itself. By bringing real end-users in at the early stages of this type of design, revised versions of the interface will be more robust and the end-product will meet these users' specific searching needs. As seniors remain one of the most under-utilized populations for this type of interface design testing, this project also provides useful insight into some of the design 'do's and don'ts' for individuals in the 65 and over age group. With subsequent redesign and retesting (both with other members of this population and with other potential end-users),

findings will transfer across a large sample of people and will lead to a drug information interface that is aesthetically pleasing, easy to navigate and suitable for a variety of health-related information contexts.

FUTURE RESEARCH

As an initial foray into the design of a visually-oriented interface for seniors and as a study designed to put seniors at the forefront of the design process, this project is not only unique but provides useful findings related to inclusive design for older adults. While there are certainly additional design decisions to be made (and additional tests to complete prior to launch), this project provides a solid grounding in seniors' health-related information needs and in the ways that they prefer to search for and locate online information. In addition, the findings of this study point to potential areas of use with other consumers of health information (i.e., younger people; caregivers), as well as individuals working in the health-care sector (e.g., pharmacists; emergency room nurses). By expanding the content and search features of existing drug databases and by developing interfaces that employ inclusive design theory, the opportunities for relevant use of these databases will also grow.

REFERENCES

Ahrens, J. 2003. Combating medication errors in home health. *Caring* 22, 56-9.

Alemagno, S. A., Niles, S. A., & Treiber, E. A. 2004. Using computers to reduce medication misuse of community-based seniors: results of a pilot intervention program. *Geriatric Nursing* 25.5, 281-5.

Bederson, B. B. 2001. PhotoMesa: a zoomable image browser using quantum treemaps and bubblemaps. *Proceedings of the 14th annual ACM symposium on User interface software and technology,* 71-80.

Bumgardner, J. 2005. Flickr Colour Fields Experimental Colr Pickr. http://www.krazydad.com/colpicker.

Chadwick-Dias, A., McNulty, M. & Tullis, T. 2003. Web usability and age: how design changes can improve performance. *ACM CUU'03,* November 10-11, 2003, Vancouver, British Columbia, 30-7.

Given, L. and Olson, H. 2003. Knowledge organization in research: A conceptual model for organizing data. *Library & Information Science Research* 25, 157–76.

Gleckman, H. 2003. Seniors' big drug problem misusing medications is a leading cause of death among the elderly. *Business Week* New York December 22, 90-1.

Ito, M., O'Day, V. L., Adler, A., Linde, C., Mynatt, E. D. 2001. Making a place for seniors on the net: SeniorNet, senior identity, and the digital divide. *Computers and Society* September, 15-21.

Jorgenson, T., Johansson, S., Kennerfalk, A., Wallander, M. A., & Svardsudd, K. 2001. Prescription drug use, diagnoses, and healthcare utilization among the elderly. *Annals of Pharmacotherapy* 35, 1004-9.

Logue, R. M. 2002. Self-medication and the elderly: How technology can help. *American Journal of Nursing* 102, 51-5.

Nielsen, J. 2002. Usability for senior citizens. Alertbox, Retrieved January 20, 2006 from http://www.useit.com/alertbox/20020428.html

Nielsen, J. 2000. Designing web usability: The practice of simplicity. Indianapolis, IN: New Riders.

Ogozalek, V. Z. 1994. A Comparison of the use of text and multimedia interfaces to provide information to the elderly. *Human Factors in Computing Systems.* Boston, MA. April 24-8, 65-71.

Pirolli, P., Schank, P., Hearst, M., and Diehl, C. 1996. Scatter/ gather browsing communicates the topic structure of a very large text collection. *Proceedings of the SIGCHI conference on Human factors in computing systems: common ground,* 213-220.

Plaisant, Catherine. 2004. The Challenge of information visualization evaluation. *IEEE Proceedings of AVI,* 109-116.

Rodden, K., Basalaj, W., Sinclair, D., & Wood, K. 2001. Does organisation by similarity assist image browsing. In *Proceedings of Human Factors in Computing Systems* (CHI 2001), 190-197.

Ruecker, S. 2003. Affordances of prospect for academic users of interpretively-tagged text collections. Unpublished doctoral dissertation. University of Alberta, Edmonton, Alberta, Canada.

Ruecker, S., & Chow, R. 2003. The significance of prospect in interfaces to health-related web sites for the elderly. In *Proceedings from Include 2003*. London: Helen Hamlyn Institute, Royal College of Art, 273-277.

Shneiderman, B. and Hochheiser, H. 2001. Universal usability as a stimulus to advanced interface design. *Behaviour and Information Technology* 20.5, 367-376.

Shneiderman, B. and Plaisant, C. 2004. *Designing the user interface: Strategies for effective human-computer interaction.* 4th ed. London: Addison Wesley.

Small, D. 1996. Navigating large bodies of text. *IBM Systems Journal* 35, 3–4.

Strickler, Z., & Neafsey, P. 2002. Visual design of interactive software for older adults: Preventing drug interactions in older adults. *Visible Language* 36.1, 4-27.

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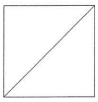
VISIBLE LANGUAGE FOR THE EXPRESSION OF SCIENTIFIC CONCEPTS

MIKE ZENDER  KEITH A. CRUTCHER

ABSTRACT

The accelerating rate of data generation and resulting publications are taxing the ability of scientific investigators to stay current with the emerging literature. This problem, acute in science, is not uncommon in other areas. New approaches to managing this explosion of information are needed. While it is only possible to read one paper or abstract at a time, it is possible to grasp concepts presented visually in milliseconds. This suggests the possibility of developing a visual language to represent concepts from a multitude of published papers in an accurate display that is highly condensed, yet readable in seconds.

This paper describes the initial exploration of a visual language approach to the display of concepts found in published scientific papers: in this case, some hypotheses surrounding the etiology of Alzheimer's Disease.

The approach is based on deriving propositions from papers or abstracts, breaking propositions into concept objects, designing a visual object system (consisting of icons, signs, glyphs and combinations) to represent all the objects in the relevant concept space, displaying the objects as a networked constellation and linking the visual display back to the papers from which they came.

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The ultimate goal is to develop visual language techniques capable of revealing patterns, pathways and conceptual connections not readily apparent from text-based list of findings and using such visual language to make interactive displays that accurately represent large quantities of data in a condensed conceptual form. Such an approach has potential application to any field of study that has a controlled vocabulary.

FACETS OF A PROBLEM

You can see a lot. Thanks to the computer and the Internet, there is a lot more to see, read and comprehend than ever before. According to Lyman and Varian, in the year 2000 the world produced between one and two exabytes (a billion gigabytes) of unique information, about 250 megabytes for every man woman and child on earth (Lyman and Varian, 2000). By 2003 this was five exabytes annually.

Those leading the pursuit of specialized knowledge, whether in science or other areas, are also on the forefront of dealing with this growth of information in dramatic ways. In science, the primary source of new information is peer-reviewed papers and abstracts published in specialized journals. In the area of medical research, the National Library of Medicine manages an online resource known as PubMed that currently

hosts over 12,000,000 journal articles. Users can type a text query and retrieve all of the relevant references (with abstracts) based on key words. A recent (10/24/06) PubMed query using "Alzheimer*" as the search term, for example, returned 54,430 citations. The rate at which the literature in this field has increased during the lifetime of one of us (KAC) is shown in the accompanying chart *(figure 1)*.

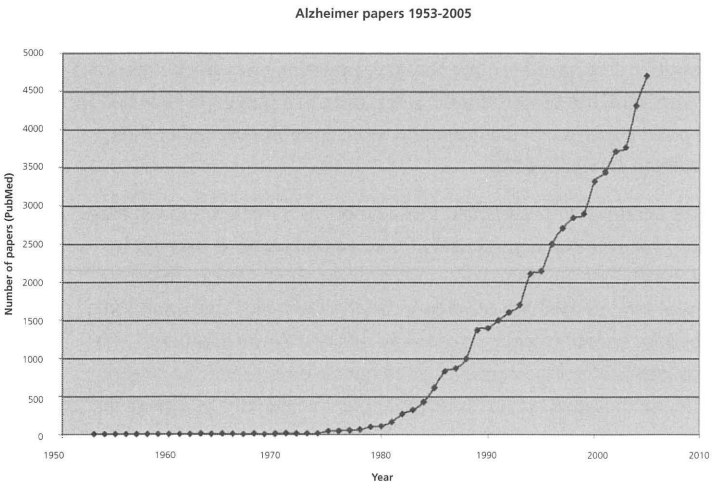

Figure 1.

Let's imagine that a new investigator wants to become familiar with this literature. At fifteen minutes per paper, it would take seven years of reading to get through all 54,000 – allowing for eight hours of reading per day with time off for weekends, holidays and vacations! To master the literature in the area of Alzheimer's Disease, however, would also require reading new papers, which are currently published at a rate close to 5,000 per year. By the time the investigator had finished reading what is available today, the new stack of unread papers would be 35,000 (assuming no further increase in the number of papers per year). Yet staying abreast of what is happening in their field is exactly what scientists are expected to do. Clearly, reading every paper is not viable. This constant growth in information, acute in medicine and science, also occurs in other fields.

As if this explosion of data was not problem enough, biological systems have inherent complexity and relevant data come from various fields of study and various levels of analysis, ranging from atoms to populations. Add to this the desire to compare results from different laboratories and approaches and the need for improved techniques for experiencing information is clear.

The growth in information and the problems this raises have not gone unnoticed. The field of bioinformatics has evolved, in part, to respond to this issue. Various approaches to managing the literature and scientific data have been put forward. However, even when important information has been retrieved in response to a query the information is often displayed in quantities and forms that obscure rather than facilitate understanding.

One approach to overcoming these problems is information visualization. The fact that a great deal of the cerebral cortex is devoted to processing visual information has led scientists to convert data into visual form to facilitate cognition. Graphs and images are common tools for scientific communication (as the first figure illustrates). The advantage of using images for communication is clear from history. The use of glyphs and icons in ancient languages such as Egyptian and Mayan, and even earlier uses of pictures in cave art, such as that found at Lascaux, attest to the utility of symbolic and direct representation of images for communication. The major advance provided by invention of alphabets (and, eventually, the printing press), on the other hand, was the rapidity and efficiency with which information could be stored, reproduced and communicated. The time and labor needed to reproduce images in pre-computer history simply could not compete with the advantages of the alphabet. However, the capabilities of modern computers (including hardware and software advances) now make it possible to reproduce images and recover the advantages of visual language with much less labor and time. Thus, the technological advances that have contributed to the problem of too much data also provide possible solutions.

Pre-computer computational approaches demonstrated the benefits of using visual form to gain understanding from data. Jacques Bertin advanced the idea that through interaction with graphics (visual displays of data), one can gain insight and convert data into knowledge

(Bertin, 1983). Bertin's work predated contemporary computer systems and relied primarily on physical manipulation of paper cards containing drawn graphics, but the principles, rather than being diminished by time, are more applicable than ever with the advent of computationally-based interactive media and data processing.

In the past twenty years, Information Visualization has grown into a specialized field with its own journals, conferences, theoretical basis and research foci (generating its own information explosion!). Books by Jacques Bertin, *The Semiology of Graphics* (1967) and *Graphics Information Processing* (1983) and several works by Edward Tufte (1983–97), though relatively recent, are nevertheless considered to be seminal works in the field. In 1986, the National Science Foundation (NSF) launched a new initiative in scientific visualization and the first Institute of Electrical and Electronics Engineers (IEEE) Visualization conference was held in 1990 (Card et. al., 1999). There is great interest in information visualization in the scientific and medical communities as evidenced by the birth of Informatics sections at Universities and grant funding opportunities in the United States at the National Institute of Health (NIH) and National Science Foundation (NSF) calling for research in information visualization. Scientists, computer engineers, and programmers are entering the fields of bioinformatics to move visualization forward. Most of the contemporary computer-based visualization approaches they develop use some combination of simple graphics and text, such as the link node diagram. These approaches have demonstrated effectiveness yet still often fall short of supplying understanding. Using words as labels to communicate concepts in such visual displays has several inherent flaws: it is language-based, takes time to read and the visual form of the word has nothing to do with the concept or idea it represents.

Even though visualization is defined as a form of communication (DeFanti, Brown and McCormick, 1989), visual communication designers have not been deeply involved. One potential impediment is the relative paucity of collaborations between scientists and graphic designers. To address this challenge, one of us (MZ), a designer, and the other (KAC), a biomedical scientist, formed a collaboration to introduce scientific approaches to information designers and to make scientists aware of the capabilities of visual communication.

CONTEXT FOR A SOLUTION

Recognizing that much was being done to visualize data, the authors wondered whether it might be possible to visually represent the key concepts and ideas found in scientific papers in a more immediate way than text-based approaches. The ability of visual form to summarize large data sets is well established (Tufte, 1983; Ware, 2004). The ability of icons to communicate concepts is similarly well documented and a part of everyday life (Arnheim, 1974). The utility of scientific and mathematical visual notation systems is also commonplace, although these systems, like all sign-based systems, require special learning. We wondered if key concepts in fields with controlled vocabularies, such as medicine, might be efficiently communicated with images such as glyphs or icons, and, if so, whether these images might then effectively illustrate the web of conceptual connections spread across hundreds or thousands of journal articles and papers within a specific area of investigation. If such a system were interactive, we suspect that it might lead scientists to insights more quickly than scanning mountains of papers. If such a system also remained linked to individual papers then such a visual display might be an improved means of exploring a literature database such as PubMed.

Several impediments to a visual solution to a language-based system exist. One problem is language itself. Language is notoriously vague. The meaning of words depends on context. N. T. Wright explains this well in his description of word meanings (Wright, 1992):

First, the meaning of a word (following Wittgenstein) I take to be its use in a context, or an implicit context; that is, its use in a sentence or potential sentence. If I say 'book,' the meaning of this is in doubt until I form a sentence: 'I am going to book tickets'; 'The book is on the desk'; 'The criminal was brought to book.' Even where a word is clearly univocal, we can never rule out possible metaphorical meanings, and in many cases we only know the univocal meaning through experience of sentences in which it has become plain.

In other words, meaning in language is not easily defined. The controlled vocabularies noted below confirm the existence of this problem as they attempt to solve it.

Visual language faces the same challenge. Humans use context to assign meaning to the stimulus of visual perception (Arnheim, 1969). Current icon-based communication systems generally rely on their environmental context, such as an airport or highway, to provide context that helps define meaning. Even so, existing icons do not communicate as precisely as written language. In particular, icon systems, while effective at communicating physical objects, rarely communicate processes and actions (Zender, 2006). This is like a spoken language with no verbs. Attempts have been made to develop universal systems of non-verbal visual communication, notably Isotype, but these have been widely regarded as failures (Lupton, 1989). Investigations into means of expanding the scope and effectiveness of icon-based non-verbal communication are being made (Zender, 2006), but such efforts are still embryonic.

Finally, the conceptual spaces that all languages, visual or otherwise, attempt to describe are not always well defined themselves. Ontologies have different structural qualities and may not easily map onto real-world objects. One familiar analogy is the parent-child relationship found in tree structure ontologies. Each term can be categorized based on known relationships. However, not every field of study has a defined conceptual structure, let alone clear analogies. Furthermore, the relationships between conceptual objects are often not understood until more information is obtained. As a result, it is not possible to strictly define a concept space in advance.

Fortunately, in the sciences in general, and medicine in particular, many of the problems noted above have been addressed. In relation to our proposed question, we identified several developments in science that might support a visual language solution. The issue of language vagueness, for example, can be partially addressed with the tools available through the Unified Medical Language System (UMLS). One of these tools, the Semantic Network, is a system of categorization for concepts that are contained in the UMLS Metathesaurus, which is a database of

terms relating to health and biomedicine. The Metathesaurus provides a means to identify and resolve synonyms and a variety of specialized vocabularies that apply to defined contexts. For example, 'to dress' from a doctors' perspective may mean to bandage an incision, whereas from a nursing perspective it may mean to put clothes on a patient in preparation for discharge. In addition, PubMed uses a vocabulary known as MeSH (Medical Subject Headings) to classify and categorize the content of papers. This is an open vocabulary (recent new descriptors have been added, for example, as a result of interest in avian influenza), but it seeks to retain control over the indexing terms used for this database. Another related technology is the growth in Natural Language Processing (NLP) software, which is able to parse electronic texts and correctly identify key words, such as UMLS terms.

In addition to developments to overcome language vagueness, new techniques for visualizing information have evolved. Some, such as Fish Eye Views (Furnace, 1989) clarify hierarchy in large bodies of text while maintaining essential context *(figures 2-5).* Others have focused specifically on visualizing documents. TitleBars uses topics provided by users to find documents and build a visual display in the form of a bar for each document with relevant portions of the bar highlighted in various gray values. "Themescapes is a 'thematic terrain' that communicates the primary themes of a collection of documents and relative prevalence of those themes." (Wise et al., 1995 quoted from Spence, 2001) The terrain metaphor visualizes conceptual structure with higher levels, mountains, being more general conceptually and lower levels, valleys, being more specific. Another approach, self-organizing maps, sometimes called Kohonen maps, represent content as a grid of diverse puzzle shapes whose size and location, in the case of document visualization, represent quantity and conceptual relationship, respectively. All of these approaches combine a graphic and typographic representation with words defining concepts. Telemakus is a more recent system for extracting concepts from journal articles which displays them in a graphic/typographic form (Revere, 2003).

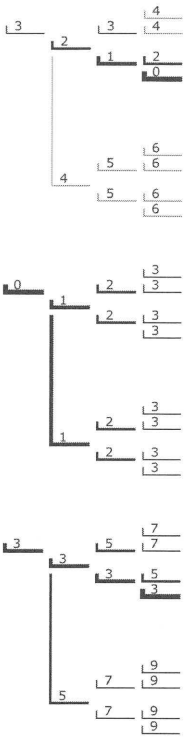

Figure 2. The Fisheye view for tree structured content. The top diagram illustrates the focal point: a data node of interest, given a value of 0. Each step further removed from the focal point is given a higher number: 2 - 6. Furnas calls this the distance from focus, D(.,x), and is calculated thus: D(.,x) = d(.,x). The middle diagram illustrates what Furnas calls the level of detail (LOD), the intrinsic importance of each level of content measured by the distance from the most important root of the tree, being 0. The formula is: LOD(x) = -d(r, x). The bottom diagram illustrates what Furnas calls the degree of interest: the sum of the focal point and the level of detail. In this technique, lower numbers are nodes that are closer to the interest and the key organizational structure of the content.

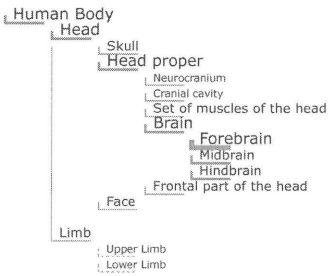

Figure 3. The Fisheye view is applied to a content tree. Assuming the search was on the term "Forebrain" the type sizes and line thicknesses are progressively smaller based on the distance from the search term plus the degree of interest in proportion to the Fisheye formula.

Human Body (36)
Head (3)
Head proper (5)
Set of muscles of the head
Brain
Forebrain
Midbrain
Hindbrain
Frontal part of the head
Face
Limb (7)

Figure 4. Using the Fisheye technique, content further from the search term (focus) may be eliminated because relevant context is retained by the formula. In this example, numbers indicate how many items are under each tree section and small rules represent content that is not shown.

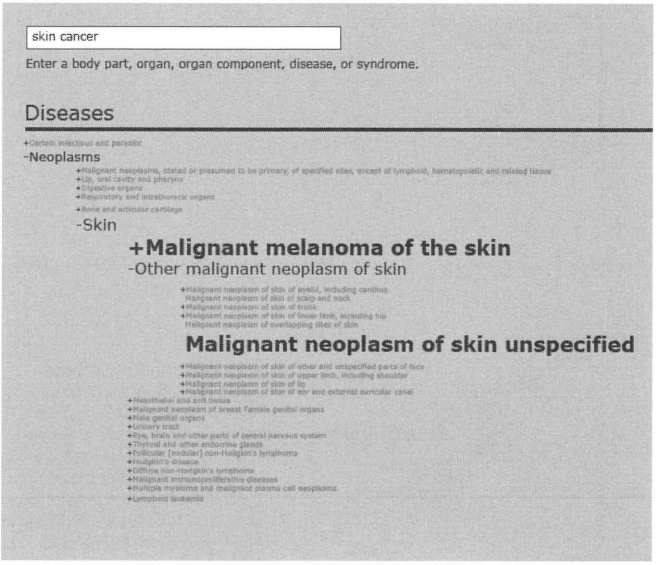

Figure 5. A student designed example using the Fisheye technique. Designer: Weston Morris

Based on advances in the science of perception, and the work of Colin Ware and others, perceptually based theories have been advanced to facilitate information visualization (Ware, 2004). In particular, the parameters governing pre-attentively processed visual form have been shown to have a positive relationship to information that 'pops-out' from its surrounding. Designers are studying pre-attentively processed form. For example, one study defined the pre-attentively-processed feature of blurriness as a ratio of solid to tinted pixels *(figure 6-7).* The ratio at which the blur was immediately distinguished was established. It was noted that lighter value objects, having less edge contrast, required more blur than darker, higher edge contrast objects, to be equally pre-attentive. Establishing ratios that have a proven effect could help visualization designers control how strongly various parts of a visualization appear. The control of hierarchy is essential for effective visual communication. While much remains to be done to define the parameters of pre-attentively processed visual form, it is hoped that design principles based on it can be used by designers to create computer mediated systems where the data, the computer and a user can cause various and alternate data features to pop out based on user interactions.

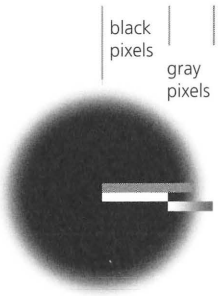

Figure 6. Blur was defined as the ratio of black (solid) to gray (tinted) pixels. Research designer: Chrissie Talkington

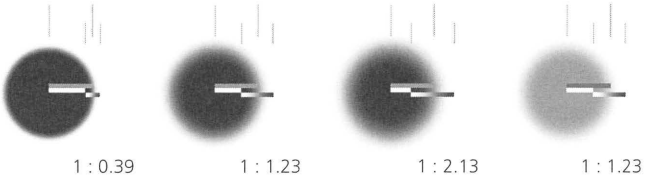

Figure 7. Various ratios were tested for pre-attentiveness (recognized immediately, technically under 10 msec). The gray lines indicate the circle size prior to blurring; the white lines indicate the number of black (solid) pixels; the gradated lines indicate the number of gray (tint) pixels. A ratio of about 1:1.2 and above was determined to be pre-attentively processed when the circles were black. A higher ratio, greater amount of blur, was needed for gray to appear equally burred within a field of sharp and blurred gray dots.

Other studies have explored means of expanding the communication potential of glyphs and icons (Zender, 2006). For icons, the role of context is as relevant to non-verbal communication as it is to verbal communication. Three levels of context were defined and shown to have promise for refining communication with icons. Other manipulations of context have shown potential, such as degrees of abstraction and icon sequences. In addition to icons, glyphs, which are non-representational visual form systems, have promise for visualizing multivariate data (Ware, 2004).

FACETS OF A SOLUTION

Together, developments in controlled vocabularies, information visualization and the design of visual icons provide a foundation for representing medical concepts published in papers. A key remaining obstacle to designing a prototype solution is the scope of the problem. Medicine, even the UMLS, is so broad as to be difficult to effectively design and test. In order to make the problem tractable, a large but defined domain was selected. We hypothesized that demonstration of the feasibility of this approach in one area should be extensible to other areas of science. As a test case for graphic visualization, we focused on how to visualize what is known about a large knowledge domain that is defined yet incompletely understood: the etiology of Alzheimer's

Disease. Another remaining obstacle is the paucity of collaboration between science and design. These two fields, though related in problem-solving methodology and complementary in concern for bringing understanding to data, seldom work collaboratively. To address this obstacle the authors formed an interdisciplinary collaboration. One of us (KAC) works in the field of Alzheimer's Disease research. The other one of us (MZ) works in the areas of digital visualization and non-verbal communication.

Having selected a focused domain and having the necessary expertise to guide the project, we sought to represent key biological/medical concepts associated with Alzheimer's Disease using glyphs and/or icons. Key concepts are defined as those that are essential to describe a hypothesis or experimental finding.

The general approach was to identify key concepts, connect those concepts in summary statements, break those statements into their essential conceptual objects, illustrate those concepts using icons and glyphs and present these visual objects in an interactive concept space where they can be immediately perceived and understood in relation to each other. The perception of concepts in context is expected to facilitate exploration and discovery.

A key problem at the outset was how to extract propositions from published papers. For our project, papers were reviewed manually based upon a random selection of forty papers from PubMed based on a search with the terms 'Alzheimer's Disease' and the protein 'ApoE' (one area of Alzheimer's disease research with which one of us [KAC] is familiar). From these papers, twenty propositions were extracted that express key concepts. These statements *(figure 8)* are stated in positive and negative terms in order to expand their meaning to include both sides of the proposition.

With advances in Natural Language Processing (NLP) and related techniques, the process of extracting concepts from published papers should eventually become automated. Significant progress has been made in this area by others (Revere, 2003) and demonstrated in the Telemakus system (www.telemakus.org). Our study focused on the visualization and display of concepts rather than their extraction from the literature. In the final analysis, extraction of data is of little or no use in solving the problems stated in the introduction to this paper

1	Polymorphisms of apoE are (not) associated with the risk of Alzheimer's disease.
2	Polymorphisms of apoE are (not) associated with the risk of multiple sclerosis.
3	Polymorphisms of apoE are (not) associated with the risk of autism.
4	Polymorphisms of apoE are (not) associated with glaucoma.
5	Polymorphisms of apoE are (not) associated with outcomes following head injury.
6	Polymorphisms of cathepsin D are (not) associated with the risk of Alzheimer's disease.
7	Proteolysis of apoE is (not) associated with neuronal degeneration.
8	ApoE does (not) regulate metabolism of ß-amyloid.
9	Estrogen does (not) modulate the expression of apoE.
10	Polymorphisms of apoE do (not) interact with herpes simplex virus to modify the risk of Alzheimer's disease.
11	Cathepsin D does (not) degrade apoE.
12	ß-amyloid does (not) cause neuronal degeneration.
13	The C-terminal fragment of apoE does (not) bind to ß-amyloid.
14	ApoE is (not) required for plaque formation.
15	Cathepsin D is (not) present in plaques.
16	ApoE is (not) present in plaques.
17	ApoE is (not) produced by macrophages.
18	ApoE is (not) produced by nerve cells.
19	ApoE is (not) produced by astrocytes.
20	ApoE does (not) affect long term poteniation (LTP).

Figure 8. Propositions (or hypotheses) from papers

unless the data are effectively presented. This has been demonstrated repeatedly in Edward Tufte's seminal works, particularly with the story of the 1986 space shuttle Challenger disaster (Tufte, 1997).

The proposition statements were then categorized roughly in line with the UMLS and with the relevant MeSH terms *(figure 9)*. We referred to these categories as 'objects' in the sense of modular conceptual elements, like individual words, that could easily be rearranged to make statements. Such objects fall broadly into things, actions and modifiers, analogous to nouns, verbs and adjectives/adverbs in language. One interesting challenge is to communicate processes as objects. Such objects are roughly similar to gerunds, or verbal nouns, in language. Gerunds in English are generally formed by adding 'ing' to the end of a word, such as 'time'. 'Timing' is a noun that denotes a process (verb) by adding "ing" to "time." In the propositional statements we analyzed, "neuronal degeneration" is one example of a process object: a neuron (thing, noun) degenerates (dies). This would be a conceptual entity in the UMLS.

Following the identification of the necessary objects and their conceptual categories, student designers, working under the direction of the authors, converted each conceptual object into a visual icon/glyph. The icon/glyphs were conceived not as isolated visual objects but as an integrated system of communication objects designed to be read together. Designing icons to work together adds to the context of the entire system so that each icon helps inform the interpretation of every other icon. The role of Proximate Context, the field of interaction where images in a system interact with other images in the same system, has been described elsewhere (Zender, 2006). The ultimate aim was to combine icons with more abstract visual shapes and icon modifiers in a system that could express complex visual concepts; one such system is illustrated here *(figure 10)*.

BIOLOGICAL OR BIOCHEMICAL OBJECTS
polymorphisms of apoE / apoE
C-terminal fragment or apoE
cathepsin D
ß-amyloid
estrogen
herpes simplex virus
plaques
macrophages
nerve cells
astrocytes
PROCESS OBJECTS
proteolysis
neuronal degeneration
long term potentiation (LTP)
DSEASE OBJECTS
Alzheimer's disease
multiple sclerosis
autism
glaucoma
head injury
herpes
ACTIONS
does regulate / does not regulate
does modulate expression / does not modulate expression
does interact with / does not interact with
does cause / does not cause
does bind / does not bind
is associated / is not associated
is required / is not required
is present / is not present
is produced by / is not produced by
does affect / does not affect
does degrade / does not degrade
to modify

Figure 9. Objects found in extracted propositions

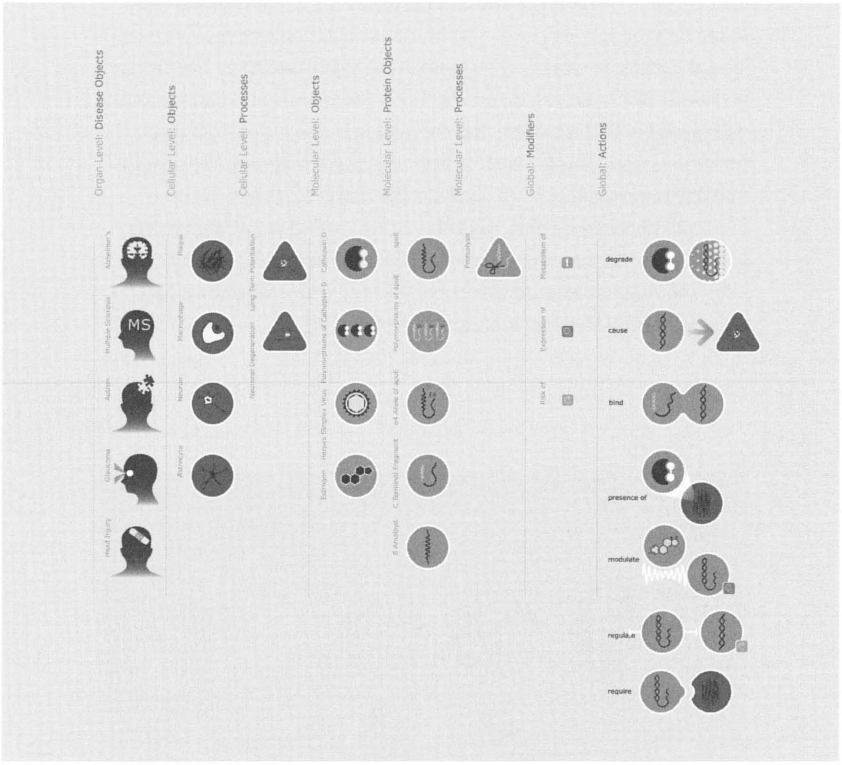

Figure 10. Icon system to express medical concepts design: Sean Gresens, David Kroner, Nolan Stover and Luke Woods

This system is organized by physiological levels moving (left to right) from the higher level to lower: organism (in this system human – not illustrated), organ, tissue, cellular and molecular levels. The disease objects are represented at the organ level by a human head in very dark purple. The darkness and complexity of the contour of the head shape differentiate this level from the others. At the next level, the cellular, the icons are enclosed by medium dark purple circles. The cellular and molecular levels are in turn distinguished by medium dark and light purple circles. In this system, the containing shape is serving a glyph function: a non-representational form used systematically to distinguish one physiological level from another. The ability of glyphs to communicate multivariate data has been well documented (Ware, 2004). In the system shown, the containing shape serving the glyph function adds important context to the icons. An additional containing shape, a triangle, is used to designate processes *(figure 11).*

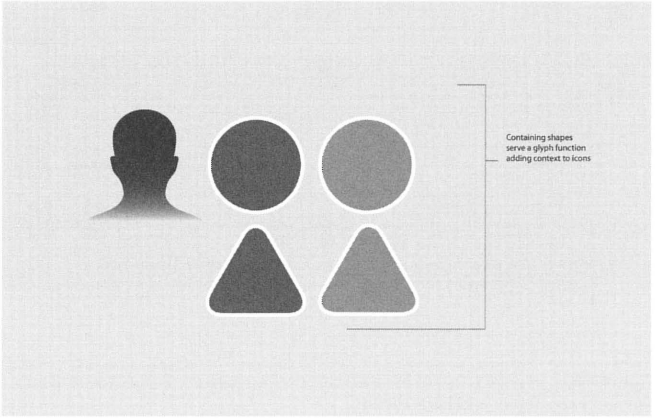

Figure 11. Containing shape serves glyph function

In addition to containing shape glyphs, the icons themselves were designed using a continuum of detailed organic form to geometric form to support reading of icons at the proper physiological level. More organic shapes, those having less regular contours, were used consistently for higher physiological levels while more geometric or regular shapes were used for cellular and molecular levels *(figure 12)*.

The visual representation of physiological levels in this example was deemed important not only for scientists' conception of the organization of information but also to provide sufficient context to interpret the icon meanings. The role of context in clarifying meaning has been explored previously (Zender, 2006). As noted above, context informs meaning in everyday experience as well as in written language. The UMLS accounts for the role of context in its use of specialized vocabularies that assign the correct meaning to a word by placing it in its

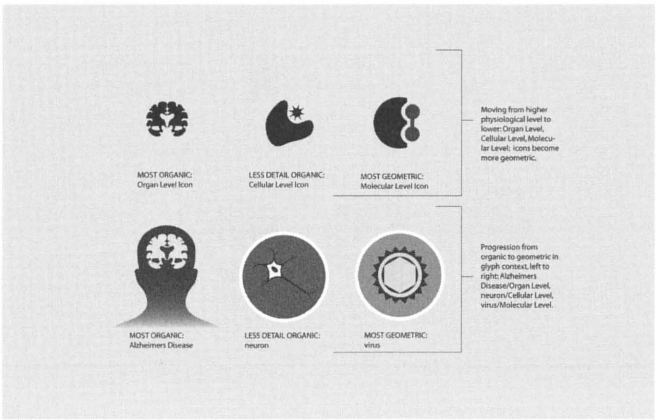

Figure 12. Icon shape contour: Organic to geometric, contributes to understanding

relevant vocabulary context. The same principle holds for visual language where an icon's meaning is influenced by its context. In the system shown here *(figure 13),* the globular form seen in the context of the cellular level was interpreted correctly by a viewer as a macrophage, whereas a similar globular form in the context of the molecular level was correctly interpreted as a protease (cathepsin D).

In addition to using containing shape as a glyph, this system also uses three signs as modifiers: 'metabolism of,' 'expression of' and 'risk of' (top to bottom). The meaning of these symbols must be learned, as all symbols must be, because they have no direct representational connection to the concepts they express.

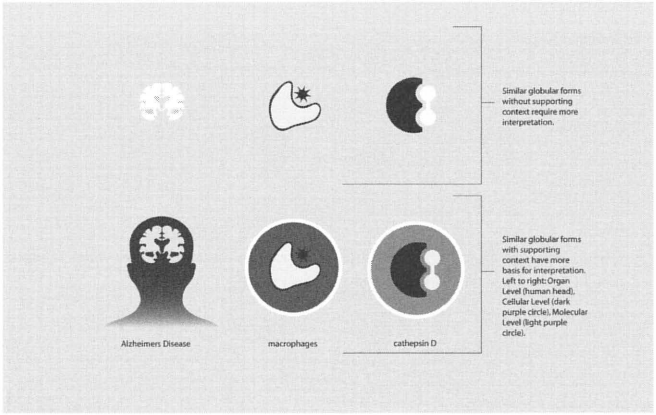

Figure 13. Globular forms clarified by glyph context

Other icon studies have used more suggestive visual form as modifiers, e.g., glow for heat, or scribble for negation (Zender, 2006). An orange glow, even in a very abstract form, is more representational than an arbitrary symbol such as an exclamation point. An orange glow in the right context can suggest the concept of heat, and in the context of a more representational icon such as an icon of a hot dog, a glow might mean warm hot dog. The glow just described is intermediately abstract: it suggests a representational experience without representing a specific recognizable object. Using higher degrees of abstraction to represent higher conceptual concepts and lower degrees of abstraction to represent more tangible objects has been explored by one of the authors (Zender, 2006). In this system example, the icon for 'degrade' uses an intermediately abstract series of dots to eat away at the icon, similar to corrosion of metal *(see figure 14 below).*

At each organ level glyph, a human head for example, are one or more additional icons to represent different diseases. For example, a bandage icon is placed on the head icon to represent head injury (trauma). Although this system generally adds only one icon to the head shape to specify meaning, the 'glaucoma' icon suggests that more than one icon could be imposed on the head to build more specific meaning. Other icon systems developed by other student teams more fully demonstrated this possibility. Note that with one exception (the head icon containing the letters 'MS' representing multiple sclerosis), none of the icons relies on letters or words, though words were added later as rollover 'tool tips' to enhance clarity and speed learning.

The icon system shown here makes effective use of Proximate Context: one icon in the system informing the interpretation of other icons in the system. For example, at the molecular level the icon for 'apoE' *(figure 10, top)* is repeated with modification to represent 'polmorphisms of apoE' and 'the E4 allele of apoE.' A fragment of the 'apoE' icon: the zigzag form, is used elsewhere to represent other protein concepts such as 'C terminal fragment' and 'proteolysis.' The same zigzag portion of the 'apoE' icon is used alone to represent a different protein fragment, 'beta amyloid.' A similar pattern exists at the cellular level with the 'neuron' icon and the process icon used to represent 'neuronal degeneration.'

As noted above, the objects visualized include both nouns and verbs. Visualizing actions (verbs) is a significant challenge yet essential for representing the propositions above. Existing icon systems typically do not have icons for verbs (Zender, 2006). One approach to visualizing an action is to combine a physical icon with a separate action icon or glyph. The action objects are represented in the system example by icon/glyph combinations that were created in both static and animated forms. The static ones shown below *(figure 14)* in some cases apply a glyph modifier to two existing icons to suggest an action, e.g., dots 'degrade' a protein icon. In other cases the surrounding shape is modified to suggest the action: the C terminal containing shape and protein containing shape are fused to represent 'binding.' This is an inconsistent solution but, in the limited scope of this system, it functions reasonably well. As noted above, the static versions of the actions shown here also had animated versions, making the meaning more explicit. The use of animation to clarify iconic and glyph-based visual communication has not been widely explored but shows great potential (Ware, 2004). With the common use of computers for both creating and displaying information, animation can be used to express data and is relatively inexpensive to develop.

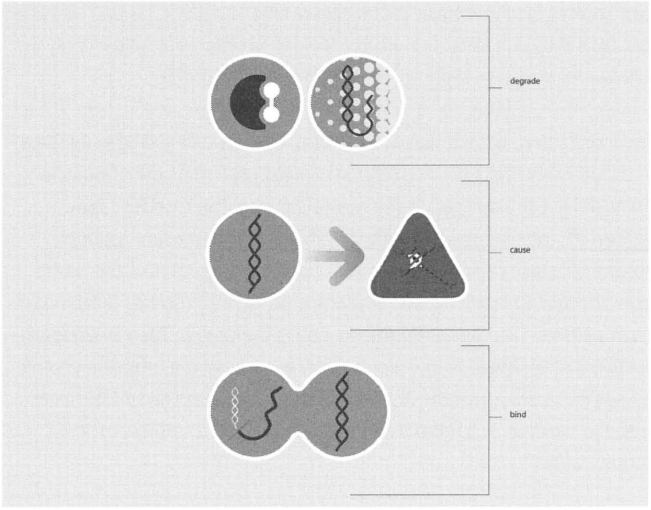

Figure 14. Action objects

The icon systems developed were not ends in themselves but were designed to be composed into statements representing the original propositions extracted from the papers extracted from PubMed as the basis for this work. In the icon system shown here, icons were tested as combinations that could be read as propositions. An example of two such icon proposition statements are shown in Figure 15. In informal testing, subjects were able to quickly read each proposition accurately from the icon/glyph presentation after minimal experience – one to two minutes - with the iconic system.

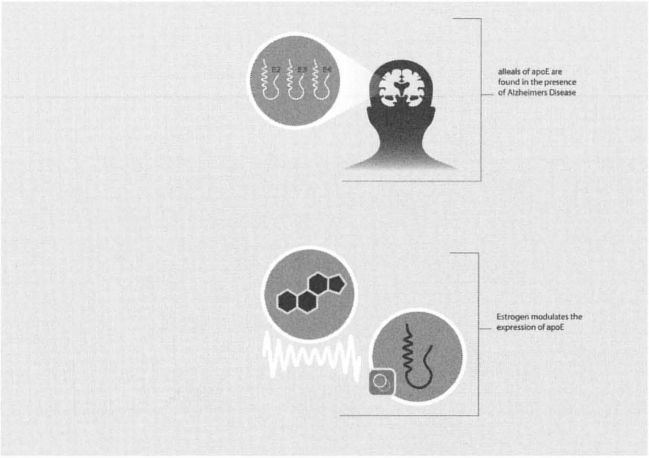

Figure 15. Icon proposition statements

The final step was to combine visual propositions like those shown above into an interactive display. The display example shown is an interactive prototype only, not driven by a database. The intention for the final display is for the icons and other graphic elements in the system to be stored in the database with tags to the data and displayed in response to a query. In the prototype shown below *(figure 16)* this is simulated by typing in 'apoE.' The result is a cluster of icons in various sizes. The center icon is the search term, surrounded by associated concepts.

Surrounding icons are clustered loosely into zones reflecting the organizational levels: disease in the lower right moving clockwise through cellular and molecular levels. The smaller the surrounding icon and the further from the central icon, the less support there is for the association (quantity of papers in PubMed or some other relevant measure). Roll over each icon and a tool tip identifier appears. Click on a concept pair and a window displays all the relevant papers that report on the concepts. The concepts can be sorted by function using a pull-down menu. Sorting the display by the concept 'association' blurs the concepts that do not have 'associative' relationship. Similarly, the display can be resorted by clicking on any icon, which launches a new search, pulls in additional icons and reorganizes the display with the newly selected search term in the center.

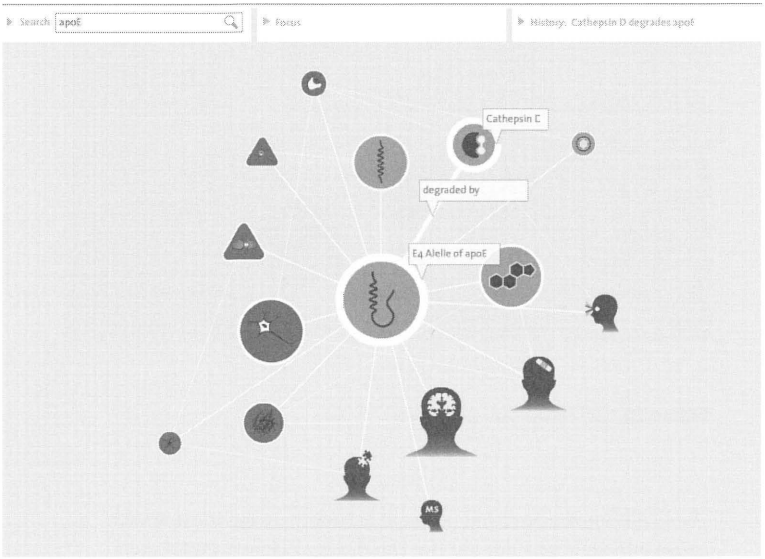

Figure 16. Interactive information design – Alzheimer's display

There are many more possibilities yet to be explored with this display approach and it is clear that development of an optimal system will require an interative process. The example shown above has been informally tested with scientists with positive results. Most are able to quickly read the concepts and find the interaction to be both intuitive and informative.

Failings of the example shown include the failure to display the animated verbs in the original icon display. This reduces the effectiveness considerably. The display has not been tested in direct comparison with similar displays presented as words. Further testing is definitely needed, even though the results to date are promising.

SUMMARY

You can see a lot. And as we have suggested in the introduction of this paper, you can see a lot more quickly than you can read. We believe that visualization holds great potential, not to replace reading, but to summarize verbal content. In areas with controlled vocabularies and clear ontologies, we believe icon/glyph systems may be developed that effectively communicate with their constituents. By making such visualizations interactive they have the potential to move beyond description to become tools of discovery. Simpler graphic means have been proven to do so (Bertin, 1989), why not more explicit means? If such visualization techniques are developed it may be possible to expand the dialogue of science beyond the verbal realm into the visually symbolic realm. We may discover that cave paintings and tomb hieroglyphs were a good idea awaiting the development of technology that can generate icons and glyphs rapidly, interactively and inexpensively.

REFERENCES

Arnheim, Rudolf. 1969. *Visual Thinking.* Berkley: University of California Press.

Arnheim, Rudolf. 1974. *Art and Visual Perception.* Berkley: University of California Press.

Bertin, Jacques. 1981. *Graphics and Graphic Information Processing.* Berlin: Walter de Gruyter & Co.

Card, Stuart, Jock D. Mackinlay and Ben Shneiderman. 1999. *Information Visualization Using Vision to Think.* San Francisco: Morgan Kaufman.

DaFanti, Thomas A., Maxine Brown and Bruce H. McCormick. 1987. *Visualization,* NSF Report, Computer Graphics / IEEE Computer.

Furnas, G. W. 1981. *The FISHEYE view: a new look at structured files.* Murray Hill, NJ: Bell Laboratories.

Lyman, Peter, Hal R. Varian. 2000. How Much Information, report, University of California at Berkeley, School of Information Management and Systems. (see also 2003 edition) excerpt from http://www.press.umich.edu/jep/06-02/lyman.html

Lupton, E. 1989. *Reading Isotype. In Design Discourse: History/Theory/Criticism.* Chicago: University of Chicago Press.

Revere, Debra. 2003. A New System to Support Knowledge Discovery: Telemakus. In *Proceedings of the American Society for Information Science and Technology Annual Meeting.*

Spence, Robert. 2001. *Information Visualization.* Harlow, England: Addison-Wesley.

Tufte, Edward. 1983. *The Visual Display of Quantitative Information.* Cheshire, CT: Graphics Press,

Tufte, Edward. 1997. *Visual Explanations.* Cheshire, CT: Graphics Press.

Wright, N. T. 1992. *The New Testament and the People of God.* Minneapolis: Fortress Press.

Ware, Colin. 2004. *Information Visualization: Perception for Design.* San Francisco: Morgan Kaufman.

Zender, Mike. 2006. Icon Systems for Global Non Verbal Communication. *Visible Language* 40.2, 177-206.

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AUTHOR NOTES

MIKE ZENDER is a third generation designer, following in the footsteps of his grandfather, father and now teaching and working with his son Micah. Mike founded the firm Zender + Associates Inc. after attending the University of Cincinnati and Yale University. He currently teaches digital design at the University of Cincinnati with teaching and research emphasis in information design, visualization and informatics, including recent studies in icon systems, glyph systems and their role in communication and visualization.

KEITH A. CRUTCHER, Ph.D. is a professor in the University of Cincinnati's College of Medicine and a neuroscientist with active research programs in Alzheimer's disease and neuronal plasticity. He has co-authored several scientific papers and deals daily with the problem of how to cope with the explosion of relevant literature in his areas of research.

BINDING THE ELECTRONIC BOOK
Design Features forBibliophiles

STAN RUECKER | KIRSTEN C. USZKALO

ABSTRACT

This paper proposes a design for the electronic book based on discussions with frequent book readers. We adopted a conceptual framework for this project consisting of a spectrum of possible designs, with the conventional bound book at one difference pole, and the laptop computer at the other; the design activity then consisted of appropriately locating the new electronic book somewhere on this spectrum. Our data collection consisted of a web-based survey and two focus groups, all of which used a set of questions based on five human factors, to collect information on the opinions and practices common to graduate students in English and other frequent readers. Our purpose was to identify features considered crucial by frequent book readers. We addressed the goal of incorporating these features by developing an electronic book design called the Bi Sheng, which attempts to accommodate the significant features of conventional books while adding functionality derived from the electronic form of the text.

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Visible Language 41.1
Ruecker and Uszkalo, 50-69

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Rhode Island School of Design
Providence, Rhode Island 02903

INTRODUCTION

The electronic book and electronic book reader have not yet been widely adopted by the majority of frequent book readers. This paper addresses the question of what an electronic book might look like that would appeal to this demographic. We ran a study with frequent book readers, in an attempt to gauge their reaction to existing e-books and e-readers, in order to identify what elements they consider crucial in the reading experience. We found that frequent readers would reasonably wish to retain the familiarity and benefits of regular book-reading that they have enjoyed, but would be interested in a technology that added still more benefits. In response, we propose a new design for the electronic book, the Bi Sheng,[1] which will combine the pleasure of book-reading with the flexibility of the e-book and e-book reader.

Although he aptly concluded, in 1992, that manipulating electronic text was still more difficult than manipulating paper, Andrew Dillon also proposed that there might be better ways to organize information. However, by the time the second edition of *Designing Usable Electronic Text* (2004) appeared, Dillon's assessment on paper preference and usability had not really changed. He claimed that research still "suggests that paper is by far the preferred medium for reading" and that transferring

texts to the "electronic medium is insufficient and often detrimental to use" (p. 4). The book is not a limiting form, he suggested; one could argue for "paper being the liberator as at least the reader always has access to the full text" (p. 117). Proposing a way to shape the electronic text for greater Human-Computer Interaction (HCI), Dillon suggests the TIME framework (task, information, text and ergonomic variables) in an attempt to work with readers' tendency to impress structure on information (p. 126). For the purpose of our study, we look to a skill which is learned early and is easily transferable – text manipulation (p. 139). Manipulating paper and pages is a crucial and familiar aspect of interaction with a text; any attempt to create an electronic book for the frequent reader must, in some form, reproduce this (p. 179). Because electronic texts, especially e-books and e-book readers, have yet to provide the visual and tactile affordances provided by paper texts (e.g., the two dimensions of the electronic book give no indication of text size, content quality, age or usage (p. 125), an electronic book which provides those elements would serve as a mid-point between the useful familiarity of the paper text and the potential of the electronic. The Bi Sheng would provide what Dillon (2003) calls for: an e-book reader with a "richer sense of user experience, one that allows for aesthetics as much as efficiency" (p. 68).

A VERSION HISTORY

In the year 2000, D.T. Max looked back at the already cooled e-book industry, recollecting in "1994, when I first reported on the proposed electronic-book industry, I drank a lot of cappuccino with pony-tailed men who quoted Marshall McLuhan. That was a more interesting time in e-book history" (p. 20). Six years after Max's melancholic reminiscences, we still do not have a practical, working and, more importantly, commercially successful electronic book. E-book readers as unique physical devices have existed in the popular imagination for at least fifty years, in part fueled by widespread interest in burgeoning technologies, and in part through the influence of various science-fiction treatments. *The Hitchhiker's Guide to the Galaxy* series, for example, marks a significant point in the fictional life of the electronic book, featuring as it does a book that contains relevant information on every topic of interest in the known universe – a kind of futuristic implementation of the Renaissance wish for a compendium of all knowledge.

There have also been periodic attempts at producing commercially viable e-book readers. Early attempts date at least to the late 1960s, with Alan Kay's Dynabook. Later entries include the Sony Bookman of the early 1990s, and the Rocket eBook, the SoftBook and the EveryBook in the late 1990s. These e-book readers were, however, more like computers than books. Although these devices found markets among readers of technical documentation and technophiles, they have all but disappeared from the marketplace. In 2004, Sony introduced the Sony Librié (EBR-100EP), its first electronic reader, which featured E Ink's electric paper as a reading surface; however, the Librié's inability to store files for more than 60 days (based on copyright restrictions which Sony calls Open MG) and exclusive use of BroadBand e-Book, Sony's own proprietary format, made it impossible to import any other form of documents or store any file indefinitely (Lewis, 2004). Also released in 2004, Panasonic's SigmaBook[2] was revolutionary, with its two screens and (although it also had restricted titles) ability to download texts from a secondary source: 10 Days Book. At twice the weight and size of the Sony Librié, Phred Dvorak (2004) argued that the SigmaBook was simply not user-friendly: it had no internal memory, required different software to read text from different sources and suffered from sluggish screens with poor contrast. Sony's Portable Reader System (Sony Reader PRS-500) is one of the latest efforts to create a viable e-book. David Pogue (2006) praises the advances made with the Sony Reader, especially noting how its E Ink screen provides a pleasant and natural reading experience. Its problems lie in the screen's refresh cycle, page size, counter-intuitive controls, and lack of search function. Pogue forecasts that the Sony Reader will find a niche market, but concludes that the masses may still continue to prefer the freedom and familiarity of "p-books."

According to Nick Bogaty, executive director of the International Digital Publishers Forum (IPDF), the market for electronic books has seen a steady thirty to forty percent growth for many years. However, the total still represents less than one percent of the overall book industry (quoted in Bradbury, 2006). The cost of existing e-books presents difficulties for some libraries, as well as for private readers. Clyde Laurel (2005) argues that the ongoing licensing fees of e-books present formidable problems, including annual payments and subscription upkeep; at the end of the day, libraries own nothing physical (p. 45).

Heather Wicht (2006) notes that the pricing of texts from the EBook Library involves fees for both the platform and the individual titles; the prices end up comparable, but involve a platform fee of up to 6000 dollars (p. 16). In this vein, Karlin Linlington (2001) concludes that there is no benefit to buying e-books; coupled with the limited selection of e-titles (compared with traditional format books), the equivalent cost of ephemeral e-books is simply not worth the discomforts of onscreen reading (p. 37). Beyond cost factors, fear of piracy has begun to make authors, publishers and distributors wary of the electronic text. Whereas Project Gutenberg offers open access to over 19,000 copyright-free electronic books, and Google has embraced the copyright-free text for distribution (Richmond, 2006), the issues of digital rights and piracy are still hot topics in any kind of discussion of e-books. Striphas (2006) argues that, because of their fluid, electronic nature, e-texts lend themselves to piracy, promising unbridled and unchecked reproduction and ominously "leading to unrestrained copying and to who knows what" (p. 245). The e-book text-file seems to be understood as an expensive threat to capitalism.

As such, e-books and e-book readers would seem to find a perfect partner in the academy; producers of e-books and e-book readers often use academia as a testing ground for their products. However, in a recent study, Anuradha and Usha (2006) found that only one-third of students who used e-books were "very satisfied" with their experience; many disliked both the e-book reader hardware and the e-book software (p. 58). The subjects simply concluded that "they are used to reading printed books and do not want to change the habit" (Anuradha and Usha, 59).

In response, researchers have begun to rethink the e-book. Arguing that the e-book's lack of success has to do with function, rather than form, Paiano and Padurino (2004) envision the e-book reader as a hypermedia device, which would change the way readers interact with the e-book reader. Their e-book reader would modify what they saw as "passive attitudes at the start of the production chain," by getting authors together with multimedia experts to improve the quality of the e-book reader and by improving the experience of using one (p. 443). Sun, Harper and Watt (2004) also propose that they can make the e-book more user-friendly, and by using information retrieval techniques, make it more interactive (p. 510).

Although research aimed at making e-book readers work better will necessarily improve existing technologies, ultimately, the electronic book, one which seamlessly combines the e-book and the e-book reader, has yet to succeed because it has yet to be produced. The designs are not working – people already have little laptops (with a 7.2 inch screen and weighing in at just above two pounds, Toshiba's Libretto was a reading surface and a laptop), so thinking in terms of making the book into a computer has not worked. Another option seems to be moving readers back to the broadsheet, scratching the book out of the equation entirely, and embracing the single sheet of e-paper. Tiny black and white microcapsules are suspended in a liquid and laminated between a clear electrode and an opaque one. When a charge is applied, the black or white capsules move to the top or bottom of the sheet, creating patterns and text. E-paper is light, flexible, maintains a long-charge, and doesn't require back lighting. Well-marketed by the E Ink Corp, e-paper is a fantastic development in displays;[3] however, especially for heavy readers, a sheet of e-paper does not a book make.

Harrison (2000) concludes that the two largest factors predicting the success or failure of the e-book are the quantity, quality and cost of content material, and the "feel of reading compared to that of traditional books" (p. 38). Kozak and Keolelan (2003) note that critics of the e-reader are right to argue that current e-readers are hard on the eyes, are one more thing to buy and learn and "lack the tactile appeal and 'atmosphere' of conventional books" (p. 295). Robert McCrum speculates that, until the geeks and entrepreneurs can invent something that "looks like a book, feels like a book and behaves like a book," frequent readers will continue to savor that which they already love – the book. E-books and e-book readers have yet to succeed because producers have yet to fully incorporate the familiar pleasures of reading into the design (Ruecker, 2006).

The goal of our study was to bring the readers' emotional, tactile and practical needs into focus, and to design an electronic book which mimics, as closely as possible, the reader's relationship with the paper book while providing the benefits and functionality of the e-book reader. Our proposed electronic book, the Bi Sheng, is designed for those who like to, need to and will continue to have a relationship with books.

PRIMARY RESEARCH

In order to develop an electronic book that would be more attractive to frequent readers of conventional books, we needed to determine what kinds of features these readers consider essential. A research project was therefore developed that used a web survey and two focus groups to elicit comments about books from frequent readers. The cohort consisted primarily of women between the ages of twenty-six and fifty, with at least one university degree. Half were currently graduate students. There were a total of fifty-eight respondents to the survey, of whom seven were also focus group participants. The sample size used in this study gives approximately a ninety-five percent confidence level with a plus or minus ten percent sampling error, given that the majority of participants tended to agree on key opinions (Salant, 55). In general these readers preferred books to other media, although they tended to spend slightly more time reading from the monitor than they did reading from books. They bought nearly four books a month on average for themselves and borrowed twice as many again. They had fairly large personal libraries, with three-quarters of them owning more than two hundred books at home; their work or office libraries were smaller – more than half had fewer than two hundred books at the office.

SUMMARY OF RESULTS OF PRIMARY RESEARCH

The results of our study illustrate the depth of the reader's close personal and professional relationship with books. While appreciating a good scholarly apparatus, these readers interact with books not only out of professional necessity, but also for escape and relaxation. They also enjoy exchanging recommendations. In physical terms, the participants liked handling books, collecting them and re-reading them, in some instances leaving marks on them. The Internet text was seen as either utilitarian or escapist; participants were willing to read short passages off the monitor, but printed longer documents for both reading and retention. Portability and ease of reading were key elements in their reading enjoyment. They enjoyed the smell, feel and shape of books, turning and marking the pages and the weight and feel of books in their hands while they read. In addition, some pointed out that books are portable, comparatively cheap and relatively permanent. Our research subjects regularly read newspapers, Web newspapers, comic books, magazines, E-mails and CD liner notes. Although photocopies offered the opportunity

to mark up text without the danger of guilt and electronic media were preferred for functions, such as searching, scanning, quick answer, fast access and retrieval of the most up-to-date references, books remained part of these readers' private and social lives. Respondents expressed doubt that they would ever prefer an electronic book or an electronic book reader over a regular paper book; however, the e-book they would chose would be one which was physically as close to the conventional bound book as possible while retaining the advantages of electronic text.

IMPLICATIONS FOR THE DESIGN OF THE BI SHENG ELECTRONIC BOOK

The Bi Sheng should:

- look and feel like a light, compact and waterproof book with reflective pages.
- provide the ability to annotate individual pages and to mark them with bookmarks or Post-it-type notes.
- be comfortable to hold while sitting or lying down reading and light enough to hold comfortably in one hand.
- incorporate some organic element – a wooden box, a cloth cover, or an earthy smell.
- accommodate any material currently available in conventional bound form, including fiction, nonfiction, scholarly apparatus, illustrations and large print.
- display an individual cover with author, title, cover design, indication of genre, blurbs, reviews and information as to whether the book is part of a series.
- offer a variety of sizes and shapes.
- be interactive and searchable, and allow for scanning, quick answer, fast access and retrieval of the most up-to-date references, as well as a dictionary.
- operate silently with a long battery life; include a mechanism whereby reading can be easily suspended and resumed.
- have files that are retrievable onto a computer.
- provide two formats: one for permanent storage as part of a collection and another for ease of overwriting and reuse.
- allow for collection, display, searching and annotation of short documents tailored for that purpose by the user (i.e., course packs).
- not exceed their conventional bound equivalents in price.

PROTOTYPE: THE BI SHENG ELECTRONIC BOOK

The design solution involves three parts: the book itself, the printer and the software. The design features of the book have been divided into two levels: basic and advanced. The basic features are fundamental – the design would be a completely different solution without these items. The advanced features are also very important in that they include many of the functions by which the electronic book distinguishes itself over the conventional book.

BASIC FEATURES

Each Bi Sheng book will be printed and assembled by the user as required, using a laser-like printing device which will also serve for subsequent disassembly. A book consists of several signatures, bound to each other by a tongue-in-groove strip that forms the spine of each signature. The back faces of the strips on the signatures together form the spine of the book. The number of signatures required will be determined by the length in pages of the longest title store.

The result is a book which will be as thick as the number of signatures required. Once the signatures are assembled, upper and lower boards are attached by means of the same locking system, and a cover image is loaded into the boards and spine. Signatures are advantageous in that they provide additional strength and stability to a book, as opposed to cut sheets which are more apt to be torn loose. They are also easier to bind, since the locking mechanism can be firmly affixed through the punctured stack in a manner similar to that used for Smythe sewing of hardcover books. The locking mechanism also provides points of contact for the leads used to connect the signatures to the computer.

The idea of using multiple pages, rather than a single display screen, may strike some people as too literal an interpretation of the characteristics of a bound book. However, our research suggests that people feel a strong emotional bond to the form of the book – they are comfortable with an object that has hundreds of pages and a cover. A book without pages forfeits several other functional advantages which were mentioned by participants, including the ability to quickly and easily estimate overall length and to continuously monitor for proportion completed. Simplicity of backtracking for the purpose of re-reading

previous paragraphs or pages is also a factor, as is physical recall of page position and the visual appearance of individual pages of type, which are used by some proficient readers for quick subsequent reference.

The electronic paper used in this model is non-volatile – that is, it will display its contents in a static form for an indefinite period, requiring the application of current only when the paper is being cleared or loaded with an alternate text for display. The visual flicker caused by monitor refresh cycles is a factor in the irritation reported by many people who have been required to read from a monitor.

E-paper, like that produced by the E Ink Corporation, has a reflective surface which mimics more closely the qualities of actual paper. For instance, the reader would need to provide a light source in order to see the pages, in much the same way a light source is currently required for reading from paper. Ideally, the e-paper should closely mimic the physical attributes of high-quality rag paper. It should have paper-like texture, thickness and flexibility that allow it to bend fairly easily. Ultimately, it should have or display an attractively warm tone.

Another advantage of electronic paper is the comparatively low cost of additional or replacement signatures, which has been estimated by some sources at pennies per page. Although people are willing to own portable electronic equipment, this becomes a source of anxiety simply because of the replacement cost in the event of loss, theft or damage.

Although it would be simpler and easier to provide a standard blank set of boards to protect the electronic signatures, it seems clear that the particular cover of a given book is an important feature and should not be neglected. This intuition was reinforced by comments made in the focus groups and on the survey, which might be characterized as "apologetic but firm" in the unequivocal statement that covers, however personally embarrassing it might be to make the admission, are important both in the initial choice of a book and in its subsequent enjoyment. Covers serve the function of providing initial attraction to the potential buyer and add to the aesthetic appreciation of the book as a collected and treasured object.

The Bi Sheng therefore comes with a choice of default cover designs, one of which privileges the author and the other the title, and also comes with custom cover designs that would be associated with the currently active title. In order to make this possible, the outside surfaces of the boards are covered with electronic paper that can display in color.

The spine of the book is formed by the outer surface of the locking mechanism on the signatures. It perforce consists of a series of strips running the length of the spine, with small seams between the strips. The software must divide the spine image for display on these strips.

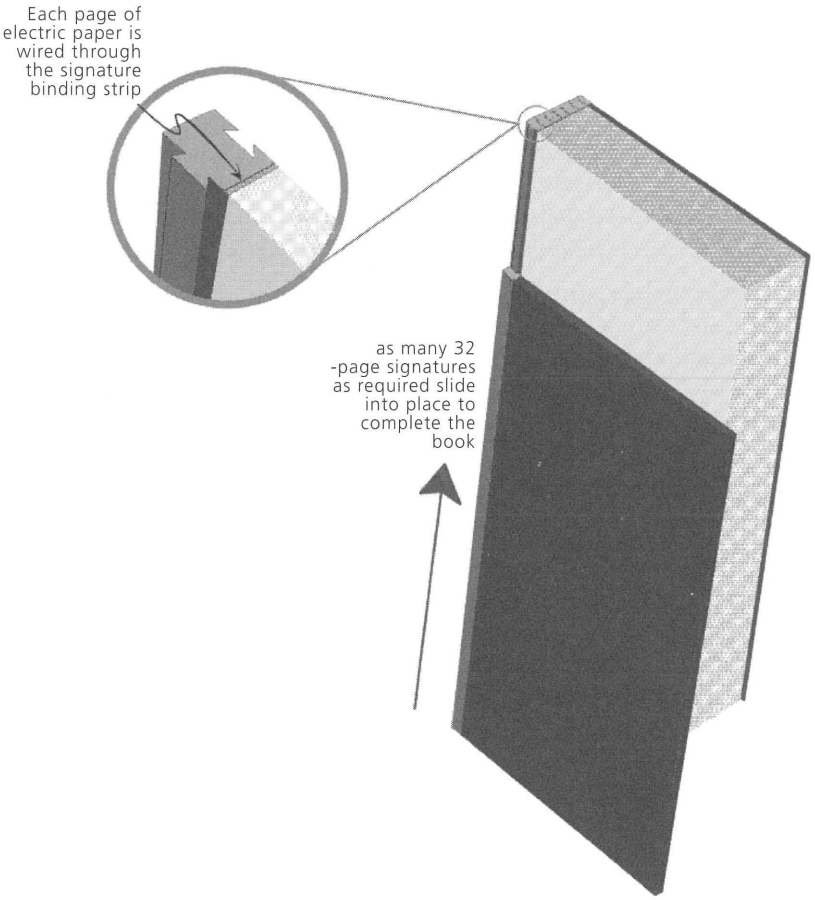
The first feature necessary in order to provide any kind of interactive processing is a power source. The basic design assumes that power is applied at the time of printing. The Bi Sheng could also come with an AC adapter, a rechargeable battery, or solar cells.

ADVANCED FEATURES

The Bi Sheng should have the ability to store additional texts for subsequent display without reprinting. These titles are listed on a special multi-book contents page in the front matter, which also has triggers to change the display from the currently active book to one of the alternate titles. The storage mechanism for the multiple titles could be kept in one of the boards. It would also be possible to provide a mechanism for storing and loading alternate titles in a removable cartridge which would in turn be loaded from the computer.

The primary disadvantage of this option is that occasions will inevitably arise on which readers want to store books that vary in length from each other by more than a few pages. The simplest solution is to allow collections of books of any length, and determine the necessary number of signatures in a given assembly by the number of pages in the longest title – regardless of whether that happens to be the title that is chosen as the currently active one at the time of assembly.

The reader who chooses to assemble this kind of collection will naturally be forfeiting some of the advantages of a multi-page electronic book, in that the physical length will be an accurate indicator of overall length only in the case of the longest title and those closest to it.



61 **Figure 1.** Bi Sheng is a book-like electronic device with modular characteristics.

There are a couple of possible strategies to alleviate this problem. One is to allow the reader to generate anthologies (see below). Another is to have the last page in a particular title marked along the edges with a dark strip, in order to indicate where a given display ends.

In addition to being able to store multiple titles within a single electronic book, the Bi Sheng should also allow the user to collect short documents together into a single title. This feature is particularly important for graduate classroom use, where students and professors routinely refer to items from course packs, which are collections of photo-copied material originating from fiche, conventional printed sources and the Internet.

The Bi Sheng also includes a search function that uses a text search for the currently active book, in order to produce an index of successful matching text strings. There are basically two options for providing the Bi Sheng with the search string. One possibility is to allow the user to print the search string using the digital stylus, and to have the software interpret the handwriting in much the same way that some PDAs read writing. An alternative is to have the user type on a miniature keyboard displayed on the touch screen.

Adopting the model of marginalia writers in conventional books, who read pen in hand, each bound Bi Sheng will come with an electronic stylus that allows the reader to write digital remarks directly to the pages of digital paper. In laptop-based design, a single stylus would of course be adequate, but in the case of the Bi Sheng, it is possible to print an indefinite number of books at the same time, and each book would require its own pen, which would be stored in a slot in the lower board.

The reader's annotations, underlines or illustrations – in short, any marginalia or page marks of any kind – would be stored in conjunction with the text on display, so they could be retrieved again when the text was subsequently overwritten with an alternate stored title, then redisplayed. The printer also allows the user to upload the contents of the Bi Sheng back into the computer with annotations intact.

The need for a mechanism to accommodate annotation arose both in the focus groups and in comments made in the survey.

One possible advantage (suggested by the focus group participants) of having the annotations stored and later copied back to the computer, is that people might be able to begin exchanging annotated versions of texts, either through E-mail or via the Internet. On a commercial level, it may even be valuable to have available for resale some of the electronic copies that have passed through the hands of domain experts or even celebrities.

In order to facilitate several of the advanced features, it would be a reasonable solution to incorporate their interfaces into specialized pages in the front matter. This location allows the body of the book to serve as a working surface, whereas placement in either of the boards or as an appendix would tend to require the reader to work at a table, in order to keep the entire book comfortably balanced.

In addition to the standard table of contents page, for example, there would also be a table of stored titles, with a thumbnail version of each cover shown next to the matching title. In order to unload the current title and load one of the stored titles, the user would activate the thumbnail by touching it with the end of the stylus stored in the lower board.

The specialized pages in the front matter would provide the other advanced features which require an active interface and text analysis programming. The search analysis, for example, would display keyword in context, number of hits and matching page numbers and also highlight keywords on a given page.

The Bi Sheng should be able to display books from any existing application, in much the same way that a laser printer can handle text from a number of applications. Like a laser printer, the Bi Sheng printer would accept pre-formatted text – in this way whatever formatting decisions are required can take place while the text is still on the computer, rather than once the titles are loaded into the Bi Sheng. Font changes, for example, would be made prior to printing, rather than after, and the required display fonts would be downloaded to the Bi Sheng along with the text. The Bi Sheng software will install a custom printer driver to output the application's content to an XML-based format, which is then transferred to the Bi Sheng printer.

DESCRIPTION OF THE PRINTER

The Bi Sheng printer is physically and procedurally modeled on a standard laser printer, although users can not only download texts from the computer to the Bi Sheng, but can also upload the Bi Sheng contents back into the computer in order to preserve annotations and other stored material prior to disassembly.

The printer consists of a large compartment with a lid, which is in turn divided into two parts. The first part contains a rack where the unwritten and unbound signatures of electronic paper hang from the ends of their binding strips. It also contains several pairs of unattached upper and lower boards, which are similarly suspended. Each upper board contains non-volatile memory for storing books that will be available, but will not currently be displayed. Each lower board contains a battery pack for use in changing the current book and also for use in functions such as searching and annotating. The second compartment of the printer is the holding rack. It is used during the printing process to hold the parts of the book currently being assembled. It is also the compartment where the user places a book for unloading and disassembly. Once the book is completed, the user opens the lid on the holding rack and removes the completed book. An alternative would be to have the book ejected from the printer, in much the same way paper is ejected from a conventional printer. Since the books will be of variable thickness, however, and since in any case the user needs somewhere to put books for disassembly, a static rack with a lid seems preferable.

CONCLUSIONS

Current research on e-books illustrates interest in improving the design. Although the research done through E Ink and Plastic Logic brings us closer to the kind of light, waterproof, reflective e-paper that makes electronic reading easier on the eyes and cheaper to produce, companies such as Sony have yet to take the needs and experiences of reading longer texts into their designs. The Bi Sheng stands at the mid-point of these varied approaches. Merging what works with current e-book readers with the improved navigation proposed by Paiano and Pandurino (2004) and Sun, Harper and Watt (2004) and adding the technologies currently produced by E Ink and Plastic Logic,

the Bi Sheng finally brings the reader into consideration, suggesting, as Back et al. (2001) have, that the form of the text is inextricable from the meaning. For the e-book to make sense, it must preserve the affordances of the conventional book while embracing the unfulfilled promises of the e-book.

The Bi Sheng, along with its printer and software, is an attempt at the design of an electronic book for frequent readers. Plastic Logic is currently using a kind of inkjet printer which can serve as a prototype for the creation of the Bi Sheng desk top e-printer. Combining their plastic electronics with the electronic paper produced by the E Ink Corporation should make the production of the Bi Sheng possible. The text can be erased or overwritten, and the signatures detached from each other in the printer so that the book is disassembled for reuse. It can be searched and annotated using a digital stylus. It can, in its deluxe form, store more books than it currently displays. The cover and spine can contain designs specific to each title, in much the same way conventional books feature cover and spine designs. The titles would be created by standard computer layout programs and printed to a format that the book can display. The Bi Sheng could therefore display fonts and graphics in a manner similar to the conventional bound book. Its physical thickness can represent the number of pages in the largest title currently stored, and readers can mark their spot with a slip of paper, or can judge proportion remaining against total length at a glance or touch. Rather than telling readers what they need and want out of an e-book, the Bi Sheng is a response to readers' needs and proposes how we can change technology to fit our lives, rather than changing our lives to fit technology.

ENDNOTES

1 The prototype is named after the 11th century (Song Dynasty) inventor of moveable type — Bi Sheng.

2 Panasonic's Words Gear e-book Reader, which promises approximately six hours of battery life, 1024 x 600 resolution, and a 5.6-inch full-color panel, is scheduled for a November 2006 release to the Japanese Market (Ricker, 2006).

3 E Ink's electronic paper is currently being used as part of the Sony Reader, as the display screen for the Weather Wizard and as a display for train information in Berlin.

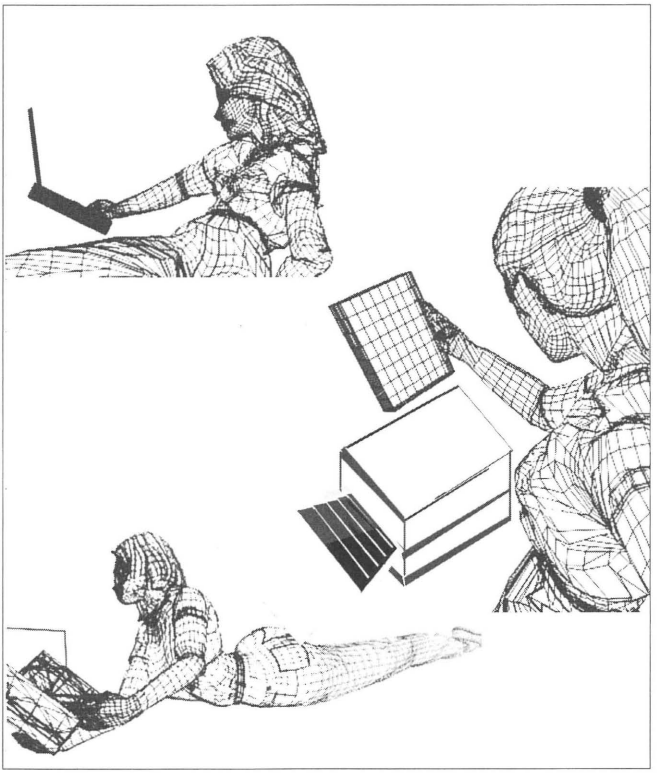


Figure 2. The Bi Sheng in use. The reader downloads content to her laptop, where she formats it, then sends it to the book printer. Once the book is ready, she removes it from the printer, then reads it as she would any standard book.

REFERENCES

Anuradha, K.T. and H.S. Usha. 2006. Use of e-books in an academic and research environment: A case study from the Indian Institute of Science. *Program: electronic library and information systems,* 40:1, 48-62.

Back, Maribeth, Jonathan Cohen, Rich Gold, Steve Harrison, and Scott Minneman. 2001. Listen reader: an electronically augmented paper-based book. *Proceedings of the SIGCHI conference on Human factors in computing systems.* ACM Press, March.

Bradbury, Danny. 2006. E-books turning over a new leaf: Danny Bradbury asks if the story of the technology will result in a happy ending. *Financial Times.* Apr 12, n.p.

Clyde, Laurel A. 2005. Electronic books. *Teacher Librarian.* 32:5, 45-48.

Dillon, Andrew. 2004. *Designing Usable Electronic Text.* New York: Taylor & Francis.

Dillon, Andrew. 2001. Beyond Usability: Process, Outcome, and Affect in Human Computer Interactions. *Canadian Journal of Information & Library Sciences,* 26:4, 57-69.

Dillon, Andrew. 1992. Reading from paper versus screens: a critical review of the empirical literature. *Ergonomics,* 35:10, 1297-1326.

Dvorak, Phred. 2004. Electronic Readers, Now on Sale in Japan, Still Don't Beat Paper. *Wall Street Journal.* (Eastern edition). New York, N.Y.: Jul 15, p. B.1.

E Ink. <http://eink.com> Accessed September 23, 2006.

Gall. James E. 2005. Dispelling five myths about e-books. *Information Technology and Libraries*, 24:1, 25-32.

Harrison, B.L. 2000. E-books and the future of reading. *Computer Graphics and Applications,* 20:3, 32-39.

Kozak, G.L. and G.A. Keolelan, G.A. 2003. Printed scholarly books and e-book reading devices: a comparative life cycle assessment of two book options. International Symposium on Electronics and the Environment, May 19-22, 291-296.

Lewis, Peter. 2004. Prose and Cons: Sony's New E-Book. *Fortune,* 150:5, 62-64.

Lillington, Karlin. 2001. The Writing's on the Screen. *New Scientist,* October, 37.

Max, D.T. 2000. The Electronic Book. *American Scholar,* 69:3, 17-28.

McCrum, Robert. 2006. E-read all about it. *The Observer,* Online. January 15. <http://www.guardian.co.uk> Accessed October 18, 2006.

Paiano, R. and A. Pandurino. 2004. EB2000: a structured approach to the creation of e-books. Sixth International Symposium on Multimedia Software Engineering Proceedings. 13-15 December, 443-449.

Project Gutenberg. Online. <http://www.gutenberg.org/wiki/Main_Page> Accessed October 17, 2006.

Plastic Logic. Online. <http://www.plasticlogic.com/flexible_displays.php> Accessed September 23, 2006.

Pogue, David. 2006. Trying Again to Make Books Obsolete. *New York Times,* October 12.

Richmond, Riva. 2006. Google offers Book Downloads. *Wall Street Journal.* (Eastern edition). Aug 31, D.2.

Ricker, Thomas. 2006. Panasonic's Words Gear color e-book reader. Engadget. Online. <http://www.engadget.com/2006/09/26/panasonics-words-gear-color-e-book-reader> September 26. Accessed October 17, 2006.

Ruecker, Stan. 2006. The Sensual Pleasures of Books. *The Senses and Society.* 1:1, 109-111.

Sony. 2006. Sony® Portable Reader Systemspacer PRS-500. Online <http://Sonystyle.com> Accessed October 18, 2006.

Striphas, Ted. 2006. Disowning Commodities: EBooks, Capitalism, and Intellectual Property. *Law Television & New Media,* 7:3, 231-260.

Sun, Yixing, David J. Harper, and Stuart N. K. Watt. 2004. Design of an e-book user interface and visualizations to support reading for comprehension. *Proceedings of the 27th annual international ACM SIGIR conference on Research and development in information.*

Wershler-Henry, Darren. 2006. Writers of the world, un-clench: digital technology is making it impossible to control the spread of intellectual property. So, how are artists supposed to make a living from their work? Give it away. This Magazine. Online. <http://www.thismagazine.ca/issues/2003/09/writersoftheworld.php> Accessed September 23.

Wicht, Heather. 2006. Buying Ebooks. *Library Journal,* 131, 15-18.

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ALPHABET *ante portas:* **HOW ENGLISH** TEXT INVADES **JAPANESE** PUBLIC SPACE

PETER BACKHAUS

ABSTRACT

This paper examines the prominence of written English on shop signs in Japan. Based on data from a larger empirical study into multilingual signs in Tokyo, the most common ways of using English and the roman alphabet on Japanese shops signs are identified. It is argued that the ambivalent nature of English loan words plays a key role in the ever growing visibility of English in Japanese public spaces. Focusing on one special type of sign – price lists outside hairdressers' – I will show how the use of English loan words entails the general use of English and the Roman alphabet, which in the long run results in signs completely functioning in English.

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INTRODUCTION

About twenty years ago, Saint-Jacques (1987) in this journal published a paper that was titled "Bilingualism in Daily Life: The Roman Alphabet in the Japanese Writing System." Motivated in part by a discussion on the use of the roman alphabet published two years earlier in a special issue of the Japanese journal *Gekkan Gengo* (1985), Saint-Jacques observed a relatively sudden increase in the use of roman letters in Japan, the beginning of which he dates back to the early 1980s. One of the main points he makes is that 'the alphabet is in,' especially in the domain of commercial language usage (Saint-Jacques, 1987, 90, 97).

The aim of this paper is to follow up on Saint-Jacques' observations and see how things have developed since. On the basis of empirical data, I will discuss how the roman alphabet and the language that it most commonly represents, English, are integrated into Japanese text and context. In this respect, it is necessary to know that written Japanese is a combination of four scripts: 1) *kanji,* the Japanese adaptations of Chinese characters; 2) *hiragana* and 3) *katakana,* the two indigenously developed syllabary scripts also referred to as *kana;* and 4) the twenty-six letters of the English variety of the roman alphabet, called *rōmaji* in Japanese. The roman alphabet has traditionally been used for transliterating Japanese terms, usually place

and person names or other proper nouns, and in internationally known abbreviations, acronyms, measurement units, etc. However, already Saint-Jacques observed a growing use of 'the alphabet'[1] for the representation of loan words from Western languages. This second type of usage is of major interest in this paper, which focuses on language use on public signs.

The study of language on signs is now commonly referred to as linguistic landscape research (Landry & Bourhis, 1997; Gorter, 2006), but the topic already attracted scientific interest in Japan long before the term gained wider currency. An early survey was conducted by Masai (1972, 153-158), who in 1962 examined shop signs in the Shinjuku area of central Tokyo. His methodology was revived by Lim (1996) some three decades later. Comparing the findings of her survey to Masai's data, Lim observed a strong increase in the use of the alphabet. Similar studies into language on shop signs in Japan have been conducted by Miyazima (1995, 14-19), Ōura (1997, 27-28), Inoue (2000, 16-20), Someya (2002, 2007), MacGregor (2003) and Satō (2003). The general tenor of these publications is that English and the alphabet are characteristic features of shop signs in Japan. They further emphasize that the use of English in the majority of cases serves a Japanese rather than a foreign target group.

The survey on which the observations in the present paper are based was conducted in Tokyo in spring 2003 (Backhaus, 2007). A total of 2444 multilingual signs were collected in twenty-eight survey areas in the center of the city. Employing this data, I will identify four common ways of using English and the alphabet on Japanese signs. I will argue that the ambivalent nature of English loan words plays a key role in the ever growing visibility of English in Japanese public spaces. Discussing in detail four signs found outside hairdressers, I will show how the use of English loan words entails the general use of English and the alphabet, and how in the long run, this results in signs completely functioning in English.

THE LOGIC OF KATAKANA

The orthodox way of graphically integrating foreign terms into Japanese text has been to make use of the *katakana* script. Consequently, loans written in *katakana* are an indispensable component in Japan's linguistic landscape. The streets of Tokyo are overflowing with terms like *kōhī hausu* (coffee house),[2] *kopī sābisu* (copy service), *kurīningu* (cleaning, i.e., laundry), *gyararī* (gallery), or *fasshon saron* (fashion salon), to quote just a few examples from shop signs in Komagome, a survey area in the north of central Tokyo.

A rather special use of *katakana* is the transliteration of English-based alphabet acronyms. One example from the Komagome area is *jei emu ei,* the Japanese version of the acronym JMA, which stands for 'Japanese Marriage Association.' Despite the high degree of complexity involved in deriving a *katakana* rendition from the sound value of an alphabet acronym of an English term, this type of *katakana* use is a common practice. The fact that the *katakana* version is always modeled after the English reading of the alphabet letters – even in cases where an acronym is not based on an English term (e.g., NHK, BMW) – is indicative of the strong association of the alphabet with English in Japan (see also Coulmas, 1999, 15).
A look at the signs in Komagome also reveals some characteristic features concerning the morphological integration of English loans into Japanese text. Where longer phrases are concerned, a frequent practice is retaining morphological complements of the donor language by directly transliterating them into *katakana.* Some examples are *redisu fasshon* (lady's fashion) *menzu katto* (men's cut), or *raionzu manshon* (Lion's Mansion), where the genitive 's' of the original phrase is molded into the Japanese version in accordance with English phonological rules as either *su* (voiceless) or *zu* (voiced).

English loans in *katakana* transliteration can be combined almost unrestrictedly with Japanese terms in *kanji* or *kana*. The signs in the survey area in Komagome among others contain the following phrases (*katakana* term underlined): *petto yōhin* (pet supplies), *supīdo shiage* (speed finishing), *kasabukuro sābisu ki* (umbrella-bag service machine), *matsuge kāru* (eyelash curls) and *puropōshon dukuri* (proportion building). Noteworthy about the last example is the application of Japanese morphophonemic compounding rules according to which initial voiceless consonants of attached constituents become voiced. Thus, *tukuri* (produce) is altered into *dukuri*,[3] regardless of whether or not the preceding part of the compound is an English loan (see Tsujimura, 1996, 54-63). The terms discussed so far are given in Table I.

Table I. English terms in katakana

Term as given on sign	Transliteration	English gloss
コーヒーハウス	*kōhī hausu*	coffee house
コピーサービス	*kopī sābisu*	copy service
クリーニング	*kurīningu*	cleaning (= laundry)
ギャラリー	*gyararī*	gallery
ファッションサロン	*fasshon saron*	fashion salon
ジェイ・エム・エイ	*jei emu ei*	JMA (Japan Marriage Association)
レディスファッション	*redisu fasshon*	lady's fashion
メンズカット	*menzu katto*	men's cut
ライオンズマンション	*raionzu manshon*	Lion's Mansion
ペット用品	*petto yōhin*	pet supplies
スピード仕上げ	*supīdo shiage*	speed finishing
傘袋サービス機	*kasabukuro sābisu ki*	umbrella-bag service machine
まつ毛カール	*matsuge kāru*	eyelash curls
プロポーションづくり	*puropōshon dukuri*	proportion building

'BEAUTY MENU'

Previous research has shown that the use of foreign language elements in Japan's linguistic landscape is more striking in some commercial domains than in others (Masai, 1972; Lim, 1996; Someya, 2002; Satō, 2003). English loan words are particularly widespread in business types like hairdressers' or Western-style restaurants and cafés, where a sign in extreme cases may be completely *katakana*-dominated. An example is the 'Beauty Menu' in Figure 1, which was displayed outside a hairdresser's in the survey area in Tabata. The sign is a price list consisting of three columns. The left column gives the names of the services, the two columns to the right the prices of each service for short (middle column) and long hair (right column), respectively.

Figure 1. Hairdresser's sign in Tabata

Of all available services only those in the last three lines are not, or only partially, given in *katakana: shukumō kyōsei* (hair straightening) and *kitsuke* (dressing) are written in *kanji, tokushu kōtingu* (special coating) in *kanji* and *katakana*. The other twelve items are English-based expressions exclusively written in *katakana: pāma* (perm), *dezain pāma* (design perm), *sutorēto pāma* (straight perm), *katto & burō* (cut & blow), *sukūru katto* (school cut), *chairudo katto* (child cut), *burō* (blow, i.e., dry), *karāringu* (coloring), *heāmanikyua* (hair manicure), *shanpū* (shampoo), *setto* (set) and *heā torītomento* (hair treatment). Two other *katakana* items, given in the headline of the middle and the right column, are *shōto* (short) and *rongu* (long).

The 'Beauty Menu' demonstrates that terms of English origin are not only used to fill lexical gaps for terms like 'perm' or 'shampoo,' but also replace such rather unspectacular concepts like 'long' and 'short,' 'hair' and even 'school' and 'child.' Transliterating these terms into *katakana* rather than using common Japanese vocabulary thus can hardly be accounted for from a purely instrumental point of view (see also Takashi, 1992). It is the interaction of language and writing that is at the heart of the matter here, because the *katakana*-dominated linguistic environment of the sign works like a chain reaction that affects all parts of the vocabulary in use.

'PARM, CUT, BROW'

Though *katakana* has been the default choice when using terms of English origin in Japanese text, it is not the only option. As Saint-Jacques observed two decades ago, there has been a strong tendency to use the roman alphabet for these types of expressions. Examples can be found on the sign of a hairdresser's in the survey area in Meguro. As can be seen in Figure 2, the sign lists four services and their respective prices for member and non-member customers, respectively. The four services are given in the alphabet, each accompanied by a smaller *katakana* version attached below. The function of the *katakana* glosses is to assure that the sign remains comprehensible to people less familiar with roman letters. However, not all English terms have been equipped with transliterations. Not accompanied by *katakana* glosses is 'PHONE,' given in the right part of the sign, as well as the name of the business at the bottom, 'Beauty Salon Claude MONET.' Compared to the 'Beauty Menu' in Tabata *(figure 1)*, the roman alphabet terms here make up a quite substantial part of the text.

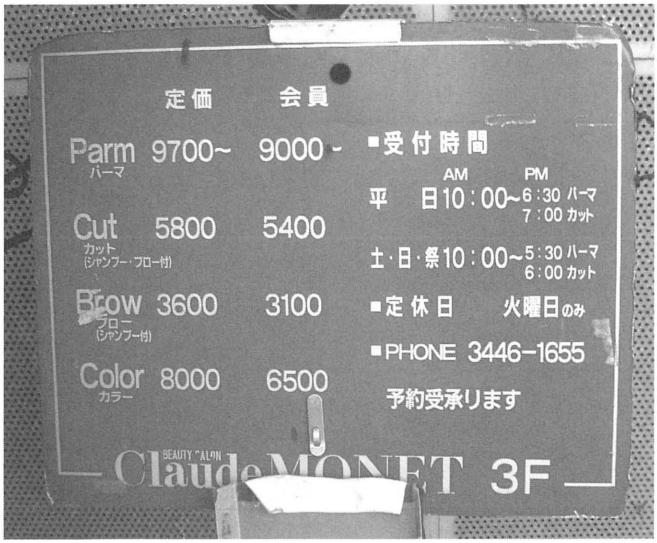

Figure 2. Hairdresser's sign in Meguro

Interesting aspects of the sign are the two lexical items 'Parm' and 'Brow,' which are supposed to stand for 'perm' and 'blow' (i.e., to blow-dry), respectively. Regarding the fact that the two terms lead a second life as well-established loan words in the Japanese lexicon, the orthographic idiosyncrasies can be identified as interferences between the two linguistic systems and between language and script. As exemplified with 'perm' in Table II, the orthographic output <parm> is generated by the term's graphical representation in Japanese as *pāma*, which in turn results from its phonetic representation /pa:ma/ (or the other way round). Similar types of interferences on the spelling of re-romanized loan words are listed in Table III.

Table II. Representations of "perm" on different linguistic levels

Lexical input	"perm"
Phonetic representation	/pa:ma/
Graphical representation	パーマ
Roman transliteration	*pāma*
Orthographic output	<parm>

Table III. Examples of orthographic interference

Original English term	Japanese loan	Japanese loan (Transliteration)	Spelling on sign
blow	ブロー	*burō*	brow
alcohol	アルコール	*arukōru*	alcohl
side order	サイドオーダー	*saido ōdā*	side ordar
chicken	チキン	*chikin*	chickin
Chinese	チャイニーズ	*chainīzu*	Chainese
strawberry	ストローベリー	*sutorōberī*	storawberry
cocktails	カクテル	*kakuteru*	cacktails
import	インポート	*inpōto*	inport

'SIMPLE IDEA'

As terms like 'PHONE' and 'Beauty Salon Claude MONET' on the hairdresser's sign in Figure 2 demonstrate, the alphabet in some cases is considered the only option for graphically representing terms of English origin. More examples are given in Figure 3, the price list of a hairdresser's named 'Simple idea' that was found in the survey area in Ebisu. As can be seen, eight of the nine services are announced in the roman alphabet, unaccompanied by *katakana* glosses. Were it not for the four *kanji* characters in the bottom line of the list, the sign at first sight would hardly be identifiable as a Japanese hairdresser's sign in a Japanese city at all.

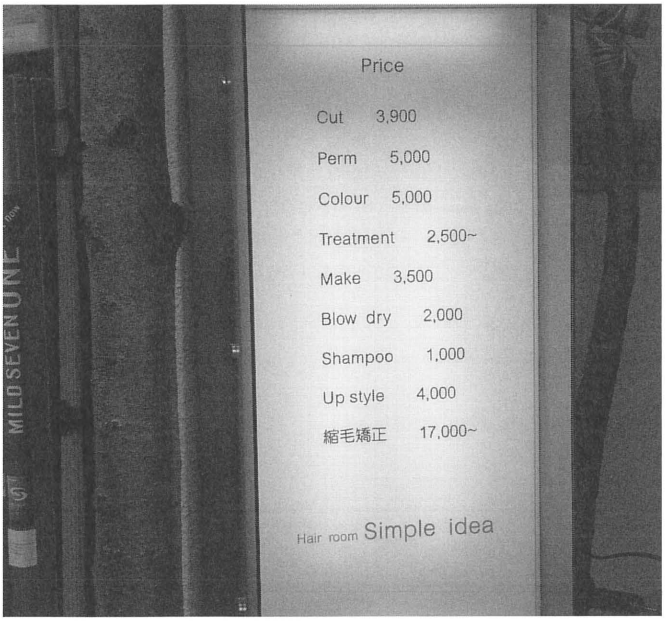

Figure 3. Hairdresser's sign in Ebisu

However, this sign, too, contains some noteworthy idiosyncrasies which betray its linguistic background. While terms like 'Cut,' 'Perm,' 'Color' and 'Treatment' would appear in a similar way on signs of hairdressers' elsewhere, the term 'Make' in the sense of 'makeup' is Japan-specific and clearly distinct from common English usage. What makes this well-established English loan appear idiosyncratic in this context is its alphabet representation based on English spelling rules. This suggests that we are dealing with an English term rather than with a well-established Japanese term that happens to be of English origin. When given in *katakana,* the term would be clearly identifiable as Japanese and appear much less odd.

The same holds true for a couple of other apparent lexical misfits in English-looking expressions. The 'Beauty Menu' in Figure 1 is a good example in this respect. While the term 'menu' in English is usually restricted to the domain of eating and drinking, its Japanese offspring *menyū* has a broader scope including selections of products and services well beyond this domain. A similar case was found in the survey area in Gotanda on a sign of a business named 'PUB&SNACK PEARL.' The semantic mismatch of the terms 'pub' and 'snack' is only in English, whereas the loan *sunakku* in Japanese designates a bar or night club, which goes together well with 'pub.' Table IV gives a list of the terms discussed.

Table IV. Examples of lexical interference

Term as given on sign	Japanese loan	Transliteration	English gloss
Make	メーク	*mēku*	makeup
Beauty Menu	メニュー	*menyū*	list of services and prices
PUB&SNACK	スナック	*sunakku*	night club, bar

'HAIR & MAKE'

As the examples in Table IV show, one frequently comes across apparently English expressions that only make sense when read as Japanese. It is hard to clearly allocate these terms to one language. From a formal point of view (script and spelling) they look English, but from a functional point of view (usage) they had better be considered Japanese. This type of loan word re-imported into alphabet and English spelling has been referred to by Honna (1995, 54; see also Loveday, 1996, 152) as 'rewriting.' It is a common practice that is usually preferred over a faithful transliteration of the *katakana* version of a term, which would have resulted in 'Mēku,' 'Menyū' and 'Sunakku' in the cases just discussed.

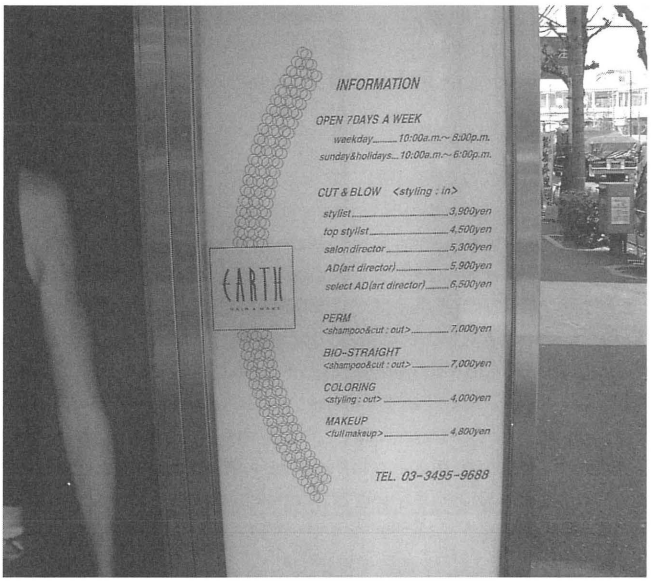

Figure 4. Hairdresser's sign in Osaki

Increasing use of graphically unaltered English loans has contributed to an ever growing familiarity with roman letters and English spelling rules for sign readers in Japan. As a result, it is no longer exceptional to find shop signs now completely functioning in English. The example in Figure 4, a sign of a hairdresser's chain called 'EARTH – HAIR & Make' is such a case. It was found in the survey area in Ōsaki and contains not a single term visibly discernible as Japanese. All information that is available is exclusively in English. In contrast to the sign in Figure 3, this includes not only the services, but longer and more complex contents about the opening hours ('OPEN 7DAYS A WEEK') and the staff ('stylist,' 'top stylist,' etc.) as well. Even the currency is spelt out as 'yen,' which, as a look at the three former examples shows, is quite unusual.

That this is the sign of an ordinary Japanese hairdresser's can be inferred only from a few remaining idiosyncrasies such as frequent lack of space between words and missing plural endings in 'weekday' and 'sunday&holidays.' However, the language of the sign can be clearly identified as English. The shift from Japanese to English has been completed – at least as far as visible language is concerned.[4]

FROM KATAKANA TO ENGLISH

The examples discussed in this paper suggest that there is an overall trend from including some *katakana* elements on a sign to producing signs completely functioning in English. A key factor in this development is the use of English loan words, which appear on commercial signs in basically three ways. The unmarked way of integrating an English term into Japanese text is using the *katakana* script. As we have seen, such *katakana* renditions can be almost unrestrictedly combined with domestic terms written in *kanji* or *hiragana*. However, as the sign in Figure 1 exemplifies, the use of *katakana* may bring about a sort of graphical chain reaction, with the effect that a sign becomes completely *katakana*-dominated.

Another way English loans are used on commercial signs is without any graphical adaptation, that is, in roman alphabet and according to English spelling rules. The propensity to use this strategy is particularly strong with terms whose *katakana* renditions have become well-established parts of the Japanese lexicon. From a diachronic point of view, it can be assumed that the *katakana* version of a term

precedes its representation in the roman alphabet. Thus, Someya (2002, 227) has pointed out that *hea* and *katto* open up the door for 'Hair' and 'Cut.' Disguised in *katakana,* these terms function like Trojan horses waiting to be re-converted into their original script and spelling.

An intermediate stage in this process is the co-occurrence of a term spelled simultaneously in alphabet and *katakana,* as has been the case for the sign in Figure 2. This way of usage is motivated by the desire to have alphabet elements on a sign while also making sure that their meaning is properly understood. Though some characteristic misspellings of English loan words testify to the *katakana* background of a term, a direct transliteration based on the *katakana* spelling is never considered an option. The absence of terms like 'Heā' or 'Katto' on signs in Tokyo demonstrates that use of the alphabet automatically entails the (more or less successful) application of English spelling rules. The occurrence of such terms within Japanese texts makes them linguistic hybrids impossible to clearly assign to either Japanese or English.

Use of the alphabet on commercial signs may involve similar graphical chain reactions as in the case of *katakana.* In this respect, Someya (2002, 224) has observed an 'eliminative nature of roman letters.' A similar point has been made by Satō (2003, 6,8). This brings us to the third way English is used on shop signs in Tokyo. As the example in Figure 3 has shown, there are cases in which a sign is completely alphabet-dominated. The few native (*kanji* or *kana*) elements that remain are not used for the sake of intelligibility of the English terms, but represent concepts for which no handy English vocabulary exists.

The last step in this development is the occurrence of completely monolingual English signs, as the example in Figure 4. Except for the currency ('yen') and a few linguistic idiosyncrasies that remain, the sign contains no hint about its Japanese background. Examples like these refute the frequently made claim that English in Japan was used for the sake of decoration only. English is not a decoration here but conveys substantial linguistic contents. The same point has been made by Stanlaw (2004, 31), who in interviews with executives of Japanese advertisement companies found that intelligibility of an English message to potential customers was considered to be of crucial importance.

The different degrees to which English is integrated into Japanese text can be interpreted as reflecting different chronological stages (Backhaus, 2005). Point of departure is the need to fill a lexical gap (e.g., 'perm') or simply the desire to replace an ordinary Japanese term by an English one (e.g., 'short' and 'long'). Stage one is the import of the term by using the *katakana* script. This is the orthodox way of making native foreign vocabulary, but it is not the only one. A more recent strategy, which may be referred to as stage two, is integrating an English loan word into Japanese text by retaining its original script and spelling. English loans are no longer written in *katakana*, but simply left as they are. The use of graphically non-adapted English terms at the same time involves a trend to progressively replace Japanese expressions – borrowed or other – by English ones. This paves the way for stages three and four, the appearance of signs mainly or completely functioning in English. The development is sketched in Table V.

Table V. Integration of English and roman alphabet: diachronic development

Stage	Script for English term	Language	Example
(1)	Katakana	Japanese/ English	Figure 1
(2)	Katakana, alphabet	Japanese/ English	Figure 2
(3)	Alphabet	Japanese/ English	Figure 3
(4)	Alphabet	English	Figure 4

CONCLUSION

Coming back to Saint-Jacques' paper of 1987, it can be said that the alphabet is still in, and far more even than it used to be twenty years ago. A look at Tokyo's linguistic landscape shows that Saint-Jacques' observations about the prominence of the roman alphabet were no temporary phenomenon of the 1980s, but one that has considerably progressed ever since. What Saint-Jacques does not discuss – most likely because the phenomenon was not observable to any substantial degree at the time – is the prominence of signs whose main or only language is English rather than Japanese. This is a new development that deserves special attention. It is interesting not only because it testifies to the unabated popularity of English in Japan, but also because it shows that this process cannot be properly understood without taking into account the dynamics of visible language.

ENDNOTES

1 In a wider sense, the term 'alphabet' refers to any writing system "characterized by a systematic mapping relation between its signs (graphemes) and the minimal units of speech (phonemes)" (Coulmas, 1996, 9). However, the term is used here as synonymous with 'roman alphabet.'

2 Italics are used throughout this article to indicate transliterations from terms originally written in *kanji* and/or *kana*.

3 Transliteration of Japanese terms in this paper follows the rules of the Hepburn system. Nippon transliteration (*tukuri* and *dukuri* rather than *tsukuri* and *zukuri*) is exceptionally used in this example to illustrate the morphophonemic processes at work.

4 My impression from a few spot checks conducted during data collection was that the visibility of English on signs outside usually could not be read to be indicative of the availability of English-speaking staff inside. In this respect, Loveday (1996, 157) has emphasized that "intensive Anglicization is a predominantly orthographic phenomenon associated with the public spheres of marketing and media and does not extend to ordinary interaction in the speech community."

REFERENCES

Backhaus, Peter. 2005. Signs of Multilingualism in Tokyo: A Diachronic Look at the Linguistic Landscape. *International Journal of the Sociology of Language,* 175/176, 103-121.

Backhaus, Peter. 2007. *Linguistic Landscapes: A Comparative Study of Urban Multilingualism in Tokyo.* Clevedon: Multilingual Matters.

Coulmas, Florian. 1996. *The Blackwell Encyclopedia of Writing Systems.* Oxford and Cambridge, MA: Blackwell.

Coulmas, Florian. 1999. Metaschrift. In Wertheimer, J. & S. Gööe, editors. *Zeichen lesen – Lese-Zeichen,* 31-54. Tübingen: Stauffenburg.

Gekkan, Gengo. 1985. *Tokushū: Yokomojigo sōtenken [Special issue: Roman alphabet words, general inspection]* (Vol. 9). Tokyo: Taishūkan.

Gorter, Durk, editor. 2006. *Linguistic Landscape: A New Approach to Multilingualism.* Clevedon: Multilingual Matters.

Honna, Nobuyuki. 1995. English in Japanese Society: Language within Language. *Journal of Multilingual and Multicultural Development,* 16, 45-62.

Inoue, Fumio. 2000. *Nihongo no nedan [The Price of Japanese].* Tokyo: Taishūkan.

Landry, Rodrigue and Richard Y. Bourhis. 1997. Linguistic Landscape and Ethnolinguistic Vitality. *Journal of Language and Social Psychology,* 16.1, 23-49.

Lim, Young-Hee. 1996. Kan nichi tagengo hyōki no kenkyū [Research on Korean and Japanese multilingual writing]. Unpublished graduation thesis, Tokyo University of Foreign Studies.

Loveday, Leo. 1996. *Language Contact in Japan: A Sociolinguistic History.* Oxford: Clarendon Press.

MacGregor, Laura. 2003. The Language of Shop Signs in Tokyo. *English Today,* 19.1, 18-23.

Masai, Yasuo. 1972. *Tōkyō no seikatsu chizu [Living Map of Tokyo].* Tokyo: Jiji Tsūshinsha.

Miyazima, Tatuo. 1995. *Tagengo shakai e no taiō: Ōsaka 1994 nen [Adapting to a multilingual society: Osaka 1994].* Handai Nihongo Kenkyū, 7, 1-21.

Ōura, Junichi. 1997. Nihon no gengo sābisu [Japan's language services]. Unpublished graduation thesis, Tokyo University of Foreign Studies.

Saint-Jacques, Bernard. 1987. Bilingualism in Daily Life: The Roman Alphabet in the Japanese Writing System. *Visible Language,* 21.1, 88-105.

Satō Keiko. 2003. *Kanban no moji [The letters on signs].* Yamagata Hōgen, 35, 1-21.

Someya, Hiroko. 2002. Kanban no moji hyōki [Letter writing on signs]. In Tobita, Y. and T. Satō, editors. *Gendai nihongo kōza [Modern Japanese course]* (Vol. 6), 221-243. Tokyo: Meiji Shoin.

Someya, Hiroko. 2007. Gengo keikan no naka no kanban hyōki to sono chiikisa [Shop signs and their regional differences in the linguistic landscape]. In Backhaus, P., F. Coulmas and H. Shōji, editors. *Nihon no gengo keikan [Japan's linguistic landscape].* Tokyo: Sangensha (In preparation).

Stanlaw, James. 2004. *Japanese English: Language and Culture Contact.* Hong Kong: Hong Kong University Press.

Takashi, Kyōko. 1992. Language and desired identity in contemporary Japan. *Journal of Asian Pacific Communication,* 3.1, 133-144.

Tsujimura, Natsuko. 1996. *An Introduction to Japanese Linguistics.* Oxford: Blackwell.

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BOOKREVIEW

JANET ABRAHMS AND **PETER HALL**, EDITORS

ELSE/WHERE: MAPPING
NEW CARTOGRAPHIES OF NETWORKS AND TERRITORIES

Minneapolis: University of Minnesota Press, 2006
ISBN 0-9729696-2-4, 320 pages,
softbound, full color illustrations

The information context in which we live serves as the problematic for this book. We know the situation all too well, too much information to process, much redundancy and distraction, isolated information chunks that we suspect are related, multiple viewpoints that escape easy comparison and over reliance on text. Divided into four sections — mapping networks, mapping conversations, mapping territories and mapping mapping — *Else/Where* explores the edge between our vast ability to gather and analyze data and how we might effectively represent information as an outcome or for further exploration. In this context the book moves beyond representations of physical space and scientific visualization and into the possibilities of social and technical realms that were formerly invisible. Many of the images characterize a visual flow with changing boundaries, referred to as information cartography. Understanding more complex relationships can now bring to light new information that can influence understanding and decision making and even support collaboration.

Most of the material is very current, but there are a few references to historical representations that have proven seminal, the London Underground or Napoleon's ill-fated winter march on Russia, for example. Behind the technical expertise, that puts information before us, are the social and political implications of intrusive information tracking that violate privacy through active surveillance or seemingly passive capture of our digital actions. In large part the book avoids these issues, taking instead an enthusiastic positive position that focuses on instrumentality. And this instrumentality is important as it lets us observe more intricate interconnections between events and subsequent actions, helping us to actively learn from the past. Knowledge management is not only about database creation or research planning, it is also about finding and visualizing new patterns of useful information.

While practical, the book format can only provide snapshots of informational situations—we cannot see the build up or take down of map layers, instructional animations or dynamically changing viewpoints in this format. Nevertheless, the many illustrations convey a rich compendium of visual structure and the brief articles are provocative. Small images within an article serve as reference to larger more full-bodied representations that follow. URLs are pulled from the text and printed in color, but the small size (maybe 4 point) and the light blue color make reading difficult. URLs themselves are unreliable as they frequently have disappeared by the time the reader tries to access them. Such information needs a use-by date. The book is a bit too self-conscious in its design as a mediator between dynamic visualization and the traditional book form. The large images, however, do invite study but some of the typography does not invite reading.

One can take an analytical eye to the visual variables that are used or abused, and also speculate on the possible interaction principles at play (zoom, query, viewpoint change, etc.) in the representations. A serious limitation that cannot be overcome is time; this is both a content and structural variable that the digital world on screen puts at our fingertips. This is a new dimension to information use and it is missing in this choice of publication. Acceleration of growth or decay or the meaning of silence, can only be poorly represented without envisioning the speed of movement or weight of silence. Increasing the variables under our digital command can increase the impact of mapping or visual representation, moving it from a realm of high visual abstraction and into a more sensory realm that uses sound and time.

Despite some critical comments, the book is beautifully produced and well worth having as a reference and sometime inspiration.

Reviewed by Sharon Poggenpohl

BOOK REVIEW

JOHN MAEDA

THE LAWS OF SIMPLICITY
DESIGN, TECHNOLOGY, BUSINESS, LIFE

Cambridge, MA: MIT Press, 2006
ISBN 0-262-13472-1
108 pages, hardbound, $20.00

Everyone has technology tales — some devastating and some miraculous — it is a common thread through our lives. John Maeda, a member of MIT's Media Lab writes this small book as a technologist, user and father. I review this book as a long-time user from the punch cards and computer lab mystics of the early 70's, to the purchase of a used Apple II in the late 70's, to the digital revolution of the mid- to late-80s and its energetic and pervasive continuation.

As the digital world becomes more ubiquitous — interpreting our actions and preferences — it provides unsolicited information, forming the unavoidable platform for our work, memories and even sense of identity. We endure micro-anxieties in relation to technology when we anticipate that something can go wrong and then when it does, the time we take from other activities (whether pleasurable or essential) to seek repair or resolution of the breakdown. Our digital dependency spawns micro-anxieties and life seems simultaneously more efficient yet more complex. This goes beyond feature creep in technological devices or planned obsolescence as marketing or economic ploys respectively, as it is about our life in relation to the digital objects we use.

Maeda is thinking about a remedy that is the title and substance of the book, *The Laws of Simplicity*. He admits that he hurried to get the book out as it is more than timely and he admits that not all the 'laws' are reliable or well worked out. He is honest about his sense of where his thinking resides and the book is really for the reader to

think with and it communicates this character well. Consequently I will not reduce the message or give away much of the content. An example of his honesty is law 9 that criticizes the process of developing the previous laws, thereby undercutting them and presenting them as still under consideration.

Readers will no doubt respond to this book in terms of their own experience and preference for simplicity and complexity as we all differ in our sense of being well located, somewhat adrift or very lost, or for desiring either rules or soft guidelines. The book resonates for me as it stresses the importance of quality, is proactive about feeling and emotion and even reminds us of gestalt principles like closure. His examples are clear and well chosen and the writing itself is direct and simply stated.

Not surprisingly, the author has a website www.lawsofsimplicity.com with media connections. Here I am reminded of Philips 'Sense and Simplicity' a corporate mission to look again at objects and technology and their role in our lives. *The New Everyday* (2003) would be a good companion text to explore in relation to Maeda's *The Laws of Simplicity*.

Book mentioned in this review:

Aarts, Emile and Stefano Marzano. 2003. *The New Everyday, Views on Ambient Intelligence.* Rotterdam: 010 Publishers.

Reviewed by Sharon Poggenpohl

BOOKREVIEW

JONAS LOWGREN AND **ERIK STOLTERMAN**

THOUGHTFUL INTERACTION DESIGN
A DESIGN PERSPECTIVE ON INFORMATION TECHNOLOGY

MIT Press, 2004
ISBN 0-262-12271-5, 198 pages,
hardbound, black and white illustrations, $35.00

When I picked up this book, I thought I'd give it a quick browse. The early pages confirmed this approach as it identified its goal as representing design to information technology (IT). However by the end of the first chapter I knew I needed to read it thoroughly.

The authors are in the Scandinavian human-centered tradition that emphasizes development of the human side of technology use. As designers in search of digital solutions, they traverse design processes, understanding people and technology in use and development. This book is important because designers increasingly work with information technologists and epistemologically their worlds are quite different. What is important, what constitutes evidence for a solution, how a process unfolds and what is the goal are all somewhat different between these disciplines. Many designers lack basic understanding of science or logic and find interdisciplinary work difficult or even troubling. This book serves to provide a bridge from design to IT. Another book is needed for traffic going in the other direction, from IT to design.

In an early chapter the authors develop terms for the design process in order to speak clearly about it; the terms are vision, a largely intuitive first organizing principle for what will unfold; operative image, the externalization of the vision that bridges the abstract and the concrete; and specification, the transition from an operative image into a specific something to be built. The way a designer works, holistically, fluidly and in a search for the character of an emergent whole, is significantly different from that of an engineer. The authors enumerate design ability with the following (p. 45):

- Creating and shaping demands creative and analytical ability
- Deciding demands critical judgment
- Working with a client demands rationality and ability to communicate
- Design of structural qualities demands knowledge of technology and material
- Design of functional qualities demands knowledge of technology use

- Design of ethical qualities demands knowledge of relevant values and ideals
- Design of aesthetic qualities demands an ability to appreciate and compose

After establishing design fundamentals, a chapter explores design methods and techniques. If interdisciplinary work is to be done with all participants contributing to decision making, then negotiating a working process becomes essential and some shared knowledge of method and technique is needed to smooth the way. Later in the book, eighteen use qualities are mapped. Some of these may seem odd to an engineer, surprise for example, but surprise and confusion signal learning or its opportunity, and we know from information theory that surprise is the feedback that results from an encounter with real (new, unique) information delivery.

For the most part the authors resist making comparisons between design and engineering approaches to the digital world. One exception is a tacit comparison between usability engineering and contextual inquiry. This is where an obvious epistemological difference emerges. Usability engineering often happens very late in the development process and seeks quantitative measurement of performance in laboratory situations. In contrast, contextual inquiry is based on ethnographic techniques and yields qualitative results at various stages in a project from the earliest investigation of people's needs and context of use through prototyping. The believability of the results and their usefulness are what is at issue, depending on your perspective as a designer or software engineer.

Working across disciplines is difficult and requires open-mindedness and negotiation. *Thoughtful Interaction Design,* as mentioned earlier, is an explanatory bridge in one direction, from design to engineering. It is 'thoughtful' in trying to make plain what design can do and how it can do it; stereotypes are avoided. We now need 'The Logic of Software Engineering' as the complement, bridging the engineering perspective to design.

Reviewed by Sharon Poggenpohl

BOOKREVIEW

JAY DAVID BOLTER AND **DIANE GROMALA**

WINDOWS AND MIRRORS
INTERACTION DESIGN, DIGITAL ART AND THE MYTH OF TRANSPARENCY

Cambridge, MA: MIT Press, 2003
ISBN 0-262-02545-0, 182 pages,
softbound, black and white illustrations, $17.95

Buzz surrounding new concepts, techniques and computer applications is hard to escape. Making sense of it requires some time to elapse so that a perspective is possible. Bolter and Gromala have a perspective and they share it in *Windows and Mirrors,* a book that is part polemic and part history of dichotomous positions regarding digital development.

First, let's look at the polemics. Using Siggraph's 2000 digital art show as a device with which to illustrate positions and developments, the authors focus primarily on the myth of transparency. A favorite theme of structuralists, who rationally organize interface, navigation and interaction so these elements fade into the background leaving only engagement with the user's task at hand, Bolter and Gromala expose transparency as a myth belonging to a long line of reductive approaches to communication and design. "Text Rain," an interactive physical interface, is the Siggraph exemplar for the counter position in which awareness of and interaction with digital mechanics as pleasurable and essential to the experience.

In similar fashion, artificial intelligence (AI) is put into perspective as a big idea that has not delivered on its promises despite its continued exploration in computer science and science fiction cinema. Virtual reality (VR) is also challenged as the supreme focus of the developmental future as Western culture repairs its mind-body split (see Lakoff and Johnson's *Philosophy in the Flesh* for more on this). Interestingly, Eastern culture never suffered this fragmentation in the first place (see Nisbett's *Geography of Thought).* VR's role in simulation (for pilots or surgeons for example) is acknowledged, but its potential role in daily life is questionable. Augmented reality (AR) is understood as a more useful mediation between physical or psychological reality with focused feedback based on sensors and sensory stimulation. The exemplar for (AR) is Gromala's own "Meditation Chamber" that provides real-time feedback based on bodily signals (respiration, galvanic skin response, etc.).

Second, the other structural element of the book is history. This is woven through the pages to put the various digital developmental perspectives into context. The history is interesting in terms of the growth of scientific knowledge regarding human cognition and the technological developments that drive change. Not a detailed rendering, the history is an encapsulation of some key events and the

ideas that developed from them. Technology is covered more than human cognition and the informed reader will recognize the technological developments. In a sense, the history, while informative, is a foil for the polemics.

The authors favor ubiquitous or embedded computing rather than VR. This reprises Bolter's position in *Remediation* in which he carefully detailed the difference between these two positions. Use of the Siggraph Art Show expands on the Art and Technology focus of the 1970s. Art is presented as an experimental mediation in a technological realm. Some art transcends the technical and is art; some fails to do so. That the art in question dates from 2000 should not discourage the potential reader as it is forward thinking even six years later as it demonstrates various digital world perspectives.

The book holds together well until chapters 8, 9 and the colophon. The colophon explores writing as a reflective interface with Gromala's own typeface "Excretia" that responds to the writer's physical state in real time. Used internally as chapter heads in a controlled or clinical way, this is an experiment to merge visible language with emotional state through autonomic response. The results are bizarre and unpoetic, rather like a psycho-physical revelation of bodily humors rather than an expression of emotion or feeling. Yes, there is a relation between bodily change in relation to emotion (see Antonio Damasio's book *The Feeling of What Happens* for more on this) but the expression of emotion takes cultural form.

Whether the authors set out to write a polemic is unknown, but the book does serve to sort out perspectives. It is a bit edgy, but one would expect that from a polemic. Whether one agrees with the perspectives presented or not is inconsequential; the book identifies alternative paths for future development.

Other books mentioned in this review:

Damasio, Antonio. 1999. *The Feeling of What Happens, Body and Emotion in the Making of Consciousness.* New York: Harcourt Brace.

Bolter, Jay David and Richard Grusin. 2000. *Remediation, Understanding New Media.* Cambridge: MIT Press.

Lakeoff, George and Mark Johnson. 1999. *Philosophy in the Flesh, The Embodied Mind and Its Challenge to Western Thought.* New York: Basic Books.

Reviewed by Sharon Poggenpohl

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