The use of familiar analogy in the perceptual understanding of interactive multimedia environments

Paula Roberts
University of South Australia

The web-like nature of interactive multimedia formats differs significantly from linear environments, and the navigation of this new intellectual terrain relies heavily on abstract thinking which involves spatial ability. This case study examines the use of a familiar analogy (that is, the presentation of information in the fragmented but connected textual style of news-magazines) to assist computer novices in the conceptual understanding of hypertext and interactive multimedia. The outcomes of this study suggest familiar analogies may enhance students' perceptual understanding of non-linear computing formats. The study describes also undergraduates exploring the potential of these web-like environments for academic writing.

Introduction

Computing educators, who understandably are caught up in the excitement of the educative potential of hypertext and interactive multimedia formats, should not take for granted a student's easy passage from the old and familiar linear formats of reading and writing to these new, non-linear environments (Leader & Klein, 1996; Mayer, 1997; Mayer & Moreno, 1998).

The movement to the web-like, branching structures of hypertext and interactive multimedia formats requires a conceptual leap which involves spatial ability. This facet of human cognition is under-developed in many students (females in particular) due to differential socialization of the sexes. Hyde, Fennema & Lamon (1990), in a meta-analysis of studies in mathematics performance, have shown that the development of male spatial acuity may be attributed in large part to boys' early participation in ball games, as well as their greater mathematical experience. The meta-analysis also identified research which showed that spatial ability is a gender anomaly which disappears once girls participate in spatial activities.

This current paper describes how the use of a familiar analogy, (in this case, the presentation of information in popular news-magazines), has assisted students' conceptual transition from linear to non-linear learning environments. As well, the experience of constructing an academic essay in the non-linear news-magazine format has both improved student writing, and suggested the narrative potential of writing in interactive multimedia.

The use of analogy in the conceptual understanding of computer systems

Learning with computers often creates problems for students inexperienced in their use, and anxiety can develop into avoidance (Harrington, McElroy & Morrow, 1990; Chu & Spires, 1991; Farina, et al. 1991; Roberts, 1994; Roberts, 1997).

Familiar analogies have been introduced by computer designers to reduce anxiety and to assist conceptual understanding in users new to computing. For example, Apple’s (and now Windows') ‘drag and drop’, icon-based filing system for electronic documents uses familiar analogies, in which the user drags a ‘file’ to a ‘folder’ icon, or to a ‘trash’ (now recycle) bin, a file management system far easier to understand and use than the former PC method of creating directories and sub-directories.

Analogical reasoning has a long history in human cognition and scientific thought. Gentner & Jeziorski (1993) and Holyoak & Thagard, (1997) define the central idea of analogy as the mapping of knowledge from one domain (the base) into another (the target). However, in processing analogy, people implicitly focus on certain similarities and discard others (Gentner & Jeziorski, 1993; Gentner & Markman, 1997). Gentner & Jeziorski cite a bright student reading the analogy, ‘a cell is like a factory’, and suggest she is unlikely to see a cell as constructed of...
masonry and steel, but is more likely to consider the similarities of the processes of factories and cells, that is, the intake of resources to maintain operations and generate products.

The research literature reveals the effective use of familiar analogies in promoting the understanding of new concepts, especially for novices (Hesse & Klecha, 1990). Analogies act as ‘advance organizers’ which allow learners to relate the new to familiar material (Gentner & Markman, 1997), and are commonly used as instructional tools in a variety of subjects including mathematics, science, literacy, business policy, computer programming, and problem solving (Newby, Ertem & Stepich, 1995; Kolodner, 1997), although there is a danger that the particular quality of an analogy may bias how new material is understood (Zook & Maier, 1994), and the transferability of learning may also be impeded if the analogy is insufficiently transparent (Hesse & Klecha, 1990).

Russon, Josefowitz & Edmonds (1994) cite a small body of work relating to the use of analogies in computer education for novices. In their own study, Russon and colleagues report that changing one aspect of computer exposure, in this case, the way computer material is taught by the use of a familiar analogy, had beneficial effect on skill acquisition and the development of confidence.

While these various writers identify the value of analogies in assisting learners link new with familiar material, and fostering a sense of relevance and reducing anxiety, of particular value for this present study is Mayer & Sims (1994) work which investigated the role of the student’s spatial ability in learning from words and pictures about how a system works. These researchers concluded that high-spatial ability students were ‘more likely than low-spatial ability students to be able to build mental connections ... (and suggested that) researchers need to examine more fully the role that individual differences might play in multimedia learning’ (p. 400).

Of similar relevance for this study is the work of Newby, Ertem & Stepich (1995) who used analogies to assist the development of understanding of advanced concepts. In summarising their findings, these researchers suggest the need to:

- "examine how supplanted analogies are accepted and used by learners ...
- Qualitative studies examining how presented analogies are used by both successful and not-so-successful learners could reveal important information in this regard." (p. 16)

This current study is a contribution to this ongoing research.

"...as an environment for reading and writing, hypertext represents a compelling paradox..."

**Analogy and conceptual understanding of non-linear learning environments**

Douglas (1993) notes that, as an environment for reading and writing, hypertext represents a compelling paradox, for while its content looks like the printed word, its technological apparatus places the printed word in an environment almost free of the physical constraints and characteristics traditionally associated with printed text. A consideration of how this challenging notion involving hypertext and interactive multimedia might best be conveyed to computer novices suggests their need for a conceptual understanding of these non-traditional formats.

The genre of news-magazine writing presents itself as a powerful analogy (and conceptual tool) for understanding the complexities of these new writing environments, as well as their potential to revolutionise traditional notions of text. News-magazines represent a new form of electronic writing.Formatted with page layout software similar to that used by student writers, their structure and visual presentation allows easy analysis, and provides a sense of familiarity. It is a familiar notion to students that these magazines are composed and typeset centrally, and then transmitted electronically to regional areas of the world for the addition of local content. This is compatible with students' understanding of online communications and co-operative writing. But these magazines’ style of information presentation makes them an even more valuable analogy for students in their understanding of new ways of writing and reading electronically.

The news-magazine presents its information in fragmented but connected pieces, and departs from a text-only approach to communicate with various formats of text and graphics, created with the purpose of gaining and holding attention, and facilitating understanding. Designed to be read in trains and buses as much as in lounge rooms, the news-magazine allows readers different entry and exit points from its stories by segmenting them into main text and commentaries. And this, of course, is the nature of hypertext and interactive multimedia presentations of information, where the reader has similar choice.

In news-magazines, these commentaries (which exploit the facilities provided in page layout software), exist on a different level from the main text, thus creating an illusion of web-like..."
connections with the main story. As such, these 'layered' texts represent a powerful analogy for students, which aids their understanding of the electronic construction of hypertext and interactive multimedia environments, as well as the opportunities they present for the reader to depart from the traditional linear path of reading. These facets of news-magazines have been used as conceptual tools in the case study which is outlined below.

The case study

The case study describes Arts undergraduates in first year computing studies at the University of South Australia, who, in writing with page layout software, moved beyond mere page design to exploit this software's potential for the 'layering' of information. Using a news-magazine style of writing typified, for example, by Time and Newsweek magazines, the students took a word processed story and transformed it into a layered text which simulated a hypertext or interactive multimedia environment.

The news-magazine genre is familiar to most undergraduates who are avid consumers of those magazines which are representative of popular culture. Time and Newsweek magazines are known to students, if not as well used, and readily available in the university library for analysis of their unique features. For example, in a recent story on heart attacks, the Time magazine writers departed from their main theme of the incidence and cost to society of the prevalence of heart disease, to create various subthemes, (or layers), to the main story. One such subtheme was a list of recovery chances, based on the closeness to medical assistance at the onset of the attack. Another was a commentary on risk factors in the prevalence of heart disease related to personality-typed individuals, while another significant section was an interview with patients who had suffered a serious heart attack and then made an excellent recovery.

In Time magazine, through desktop publishing techniques, the themes in this article had been integrated on the same or adjoining pages, but were separated by textual and graphical means, such as the main columned text's weaving its way through 'islands' created by graphics and photographs, and by the separate, coloured and boxed panels of text which contained the subthemes. Here was choice for the reader, either to follow the main text through the pages to its conclusion, or to digress to the accompanying subthemes, and later, maybe, to once more resume the main story.

So, here in Time was a practical example, if in a contradictory and linear print form, of an electronically layered hypertext. That is, instead of the subthemes being hidden from view in electronic layers distant from the main text, the page layout of these articles provided a hypertextual, visual example on the one plane. As such, this journalistic writing model created a conceptual analogy of hypertext for students yet to undertake projects in interactive multimedia.

The writing task undertaken by the students involved transforming into a layered text van Gelder's article, The Strange Case of the Electronic Lover, which is reproduced in Dunlop & Kling (1991). Briefly, the story involves deception on the Internet. A male, New York psychiatrist masquerades as a disabled female, named Joan, and develops online, electronic relationships with a host of unsuspecting women. The motives of Alex (not his real name) for these several months of deception are uncertain. Whether Alex saw himself as an earlier Tootsie or Mrs Doubtfire and could argue some valid professional reason for his actions, or whether he sought only personal gain, remains a mystery. Certainly, Alex (in a complicated sub-plot) developed a sexual relationship with one of his new female, 'on-line' friends, and eventually was unmasked. An interesting outcome was the reaction of Alex's 'victims' to this disclosure. Most did not condemn him, but spoke only of the pleasure and benefit of their electronic interaction with Joan (Alex's female persona).

First the students analysed the story of the electronic lover, and its many facets became visible as layers, or stories within stories. As they set about planning the four pages allowed for their review essay, there was much interest both the male and female students, and their responses to Alex's deception were varied. Some were offended by the deception, while others were more tolerant, and these divergent opinions, interestingly, were represented not only in words but in the scanned photographs which they chose to represent Alex.

Some students created an ethical debate as the framework for their review, some highlighted gender issues, while others extended their review to the wider concerns of behaviour in global communication networks. Others still, followed the journalistic view that here was an interesting story whose nuances could best be highlighted by the interplay of banner headlines, subheads and pullquotes with text, typography and graphics, in page layout software which allowed these differing story lines to be

“...this journalistic writing model created a conceptual analogy of hypertext for students yet to undertake projects in interactive multimedia”
given individual emphasis in ways not available in the linear, wordprocessed, original version of van Gelder's article.

So, page layout software allowed the composition of diverse pages, each exploiting text and graphics to construct 'commentaries' on the main story. Importantly, the students created their own fragmented, but connected, textual format, which was a hypertext, but in a single plane.

There was a significant increase in student understanding of the meanings and issues contained in the story as they wrote with software which allowed the visual representation of the various facets of the story, and in the structural planning of their review essay. Before writing electronically, the students created pencilled drafts of the layout of each of their pages, much as an architect would make preliminary sketches of living or working spaces before proceeding to the formal plans of a building. Of importance here was the visual advantage of seeing discrete but connected pages of text, a view denied the writer working in the linear medium of wordprocessing. Of great significance was the students' planning, not for the purpose of page layout only, but as an integral part of their story-telling, an element so frequently missing from the work of word processing student writers.

After completing their publication, the students described how the story might have been enhanced further in an interactive multimedia format, for example, with the use of audio/visual interviews with Alex's so called 'victims', or with ethical debates, or street interviews which could act as straw polls of citizen opinion about deception in interaction on the Internet. There was an imaginative response from the students which demonstrated their conceptual understanding of how this might be accomplished as a hypertext or as an interactive multimedia piece. The student responses revealed also their enthusiasm for the potential of writing in these new formats.

Conclusion

The use of a presented analogy in conceptual learning

Hypertext and interactive multimedia environments present advantages and disadvantages for readers and writers. Theoretical arguments insist these systems, which offer an absence of direction, and where textual meaning can be suspended on an immediate level, allow readers to compile their own experience of the text as a whole. Such is the case with the fragmented but connected texts of the news-magazine writing genre which allow discontinuous reading without loss of meaning. However, users of these new media need a conceptual, navigational map so that information might be juxtaposed without loss of meaning, in an environment of transparent windows, paths and links, and which lacks the traditional structures of chapters and closure. The students in this study demonstrated their use of a presented analogy (the news-magazine) as a pathway to the conceptual understanding of the structure of interactive multimedia and hypertext environments.

The cognitive needs of students' writing with computers

Research over two decades has shown minimal benefit of the use of word processors in student writing, particularly in aiding the cognitive processes of planning and revision (Haas, 1989; Eklundh, 1990; Sharples & van der Geest, 1996). When composing text on a computer, the vision of the writing is limited to the current screen view, and preceding passages are obscured. Thus the writer has little chance of developing a conceptual map of the whole piece, leading to what Haas (1989) describes as a 'text sense' problem; a difficulty in 'knowing' or recalling the text which is essential for its structural reform. These difficulties cause many students to spurn the use of computers as writing tools, and persist in writing first and subsequent drafts by hand, then use a word processor only to produce a final version. The revision of drafts thus remains a cosmetic process, without structural alterations, despite the usefulness of the word processor's 'cut and paste' facilities.

In this study, writing in a news-magazine format with page layout software allowed the construction of separate pages of text and graphics which were easily

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viewed and revisited by clicking a page icon. This permitted the students to maintain the global sense of their text which is missing when writing with a word processor (Eklundh, 1990). Structural planning and revision was thus encouraged by the ease of vision of the whole piece of writing.

The students displayed their enthusiasm for writing in this format. Novice academic writers seemed better able to cope with writing smaller, but related pieces of text, and they made obvious their enjoyment in being able to communicate with graphics as well as text.

**Outcomes of the study**

The study’s outcomes suggest the potential of page layout and hypertext formats for writers and readers to interact more fully with the layers of information in a text. The study’s subjects showed a significant increase in understanding of the meanings and issues contained in the story as they used software which allowed them to create the visual representation of these layers. Similar claims are made for information presentation in hypertext and multimedia, but increasingly researchers are identifying conceptual difficulties and differences in users of the new media (Mayer, 1997).

The news-magazine style of presenting information provides an analogy of a hypertext or piece of interactive multimedia. When novice computer users write in this genre using page layout software, they appear to accept a presented analogy, then adapt it for their own conceptual purposes.

**REFERENCES**


