1991

The effects of hypermedia structure and its visibility on the effectiveness of computer assisted instruction

Katherine J. Fugitt
San Jose State University

Order Number 1345799

The effects of hypermedia structure and its visibility on the effectiveness of computer assisted instruction

Fugitt, Katherine June, M.A.

San Jose State University, 1991

U·M·I
300 N. Zeeb Rd.
Ann Arbor, MI 48106

THE EFFECTS OF HYPERMEDIA STRUCTURE AND ITS VISIBILITY ON THE EFFECTIVENESS OF COMPUTER ASSISTED INSTRUCTION

A Thesis

Presented to

the Faculty of the Department of Psychology

San Jose State University

In Partial Fulfillment

of the Requirements for the Degree

Master of Arts

by

Katherine J. Fugitt

August, 1991

APPROVED FOR THE DEPARTMENT OF PSYCHOLOGY

Robert G. Cooper Jr.

Robert Cooper, Ph.D. (Chair)

Kevin Jordan

Kevin Jordan, Ph.D.

Robert Fox

Robert Fox, Ph.D.

APPROVED FOR THE UNIVERSITY

M. Lou Lewandowski

ABSTRACT

THE EFFECTS OF HYPERMEDIA STRUCTURE AND ITS VISIBILITY ON THE EFFECTIVENESS OF COMPUTER ASSISTED INSTRUCTION

by Katherine J. Fugitt

Following associative hypermedia links may be analogous to following memory traces, and if so, could facilitate meaningful learning in computer assisted instruction (CAI) applications. This research tested hypotheses that hypermedia CAI, semantic network representations of the knowledge visible during study, and semantic network representations of the knowledge as hypermedia navigational aids would all facilitate learning. Variables of internal structure (linear vs. network) and knowledge structure visibility (map vs. no map) were tested with four versions of a CAI tutorial using 32 students from cognition and learning courses. Learning was measured with immediate and delayed post-tests. A significant effect for structure was found, though it favored linear presentation rather than network, and a marginally significant interaction was found. Explanations discussed are unfamiliarity of hypermedia presentation and relevancy of hypermedia for learning basic materials versus advanced learning where structures and associations are more important.

ACKNOWLEDGEMENTS

I would like to thank Dr. Jakob Nielsen for his kind permission to adapt the graphical interface and related coding from his HyperCard stack *Hypertext '87* for my tutorials. I would also like to thank Dr. Robert Cooper for his permission to use portions of the text from *Child Development* (Sroufe & Cooper, 1989) as the primary content of the tutorials.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

The Effects of Hypermedia Structure and its Visibility on the Effectiveness of Computer Assisted Instruction

Katherine J. Fugitt
San Jose State University

Running Head: HYPERMEDIA STRUCTURE AND VISIBILITY

Footnotes

Requests for reprints should be sent to: Katherine Fugitt, Department of Psychology, San Jose State University, San Jose, California 95192.

Abstract

Following associative hypermedia links may be analogous to following memory traces, and if so, could facilitate meaningful learning in computer assisted instruction (CAI) applications. This research tested hypotheses that hypermedia CAI, semantic network representations of the knowledge visible during study, and semantic network representations of the knowledge as hypermedia navigational aids would all facilitate learning. Variables of internal structure (linear vs. network) and knowledge structure visibility (map vs. no map) were tested with four versions of a CAI tutorial using 32 students from cognition and learning courses. Learning was measured with immediate and delayed post-tests. A significant effect for structure was found, though it favored linear presentation rather than network, and a marginally significant interaction was found. Explanations discussed are unfamiliarity of hypermedia presentation and relevancy of hypermedia for learning basic materials versus advanced learning where structures and associations are more important.

The Effects of Hypermedia Structure and its Visibility on the Effectiveness of Computer Assisted Instruction

Hypermedia or hypertext is a computer framework for the representation of text, graphics, video, sound, software code, etc. in a non-linear manner as a collection of nodes and links. More than just a relational database, hypermedia also adds a new dimension to user interfaces and the presentation of information. The hypermedia concept actually dates back to 1945 (see Conklin, 1987, for a description of Vannevar Bush's "Memex"). It is only recently, with the availability of relatively inexpensive fast computers and high-resolution graphics displays needed to properly implement it, that hypermedia has received much attention.

Hypermedia is often described as unstructured, but it actually can be structured in nearly any form the designer chooses. There are significant differences in features and applicability between static or structured hypermedia and the more commonly described dynamic or unstructured form. There are claims that, properly structured, hypermedia is one of the most potentially "mind-expanding" technologies available (Jonassen, 1988b). It was the intent of this research to test some of those claims.

Many cognitive theories of memory and learning hypothesize that knowledge is stored in semantic, or propositional networks of connections and categorizations among the concepts and facts in memory. Related theories hypothesize that learning new information is affected by previously stored information which may in turn be modified and reorganized by the new knowledge (J. R. Anderson, 1985; T. Anderson, 1988; Jonassen, 1988a). Semantic networks may be represented graphically by a network of nodes (representing concepts) and links (representing relationships). Cognitive psychology, artificial intelligence, education, information science, and hypermedia use variations of this method to represent the structure of information for people to use, acquire, develop, teach, learn, retrieve, model, automate, and memorize information (Churcher, 1990). This ability to represent the structure of information is a major basis for the claims that hypermedia is ideal for application in computer assisted instruction (CAI).

Computers may aid human learning in a number of ways. They support human working memory by allowing the human to be selective with attention without worrying about losing important information. Computers can be used to represent ideas in different media, allow learners to self-pace their work, quickly execute complicated algorithms to solve standardized problems, and prompt learners to structure, integrate, and interconnect new ideas with old ones by providing relevant older information simultaneously with new information (Dede, 1987; Kozma, 1987). Following associative links in a hypermedia database may be analogous to following memory traces, and if so, could facilitate meaningful learning. The associative ability of hypermedia has attracted attention from computer scientists, educators, psychologists, and others interested in CAI, a field which has not yet achieved large significant gains in effectiveness over traditional teaching methods (Dede, 1986). In part, this lack of effectiveness may be due to presenting information in a rigid computerized format that loses some of the benefits of physical books such as knowing where you are and how far you have left to go, being able to add highlighting and marginalia, being able to mark your place briefly with a finger or longer with a bookmark, and happening upon interesting information by chance (Oren, 1987). In addition, traditional linear "page turning" CAI programs generally make no effort to reveal the structure of the tutorial or information within it (Bourne et al., 1989).

Many of these problems can be overcome with proper user interface programming (Marchionini & Shneiderman, 1988). More importantly, hypermedia CAI may support metacognitive skills by focusing on relationships between ideas rather than isolated facts (Hooper, 1988; Kearsley, 1988). Teaching the structure of knowledge is important because it simplifies and organizes the information for easier integration into memory (Shulman & Ringstaff, 1986). Knowledge about the structure of a subject enhances retention, facilitates problem solving, assists transfer, excites intellectual curiosity, and develops learning aptitudes (Churcher, 1990). Hypermedia's flexible organizational structure allows it to represent the cognitive structure of the concepts and associations of the knowledge in the framework (Dede, 1987; Jonassen, 1988a; Smith & Weiss, 1988). "Concepts can be indexed by their semantic content and their relations to other concepts. Because of its resemblance to semantic network, hypertext may be used to convey knowledge instead of just information" (Tsai, 1988, p. 7).

Even structured hypermedia by itself may have problems as a learning environment. Hypermedia's non-linearity can make it difficult for users to create a "mental model" of the information and increase the possibility of distraction and disorientation ("lost in hyperspace") (Marchionini, 1988; McKnight, Dillon, & Richardson, 1989). Systems without location cues put the entire burden of placekeeping on human memory (Oren, 1987). Visualization is one method of reducing the difficulty of understanding complex structures. Navigation tools and metaphors, such as maps, are a visual representation of the knowledge space. These tools can help users develop mental models of the information they are studying and keep track of their progress within it (Nielsen, 1990; Tsai, 1988; Waterworth & Chignell, 1990). They also help to regain some of the benefits of printed media by providing cues for location and completion (Oren, 1987).

The Institute for Research in Information and Scholarship (IRIS) at Brown University has developed a hypermedia system called Intermedia to help with two major educational difficulties: the associations of information and the visualization of concepts. Materials can be linked and annotated to form a "semantic web" or "trail of meaning." Intermedia materials contain "concept maps" to graphically represent relationships between concepts (Beeman et al., 1987). The use of Intermedia focuses on teaching "critical thinking" which "centers on the notion that an educated intelligence perceives any particular phenomenon, any particular fact or event, as potentially multi-determined or subject to multiple causation" (Yankelovich, Landow, & Heywood, 1987, p. 2). In the opinion of an assessment team of social scientist observers, students using Intermedia in a cell biology course and an English literature course had a better integrated understanding of the subject in comparison to students who had taken the course before the Intermedia materials were implemented. Instructors noticed an increased use of critical thinking skills by the students in both courses.

Is CAI using hypermedia's semantic network structure superior to a more traditional linear structure in terms of learning facts, forming better conceptual models, understanding relationships between concepts, and making inferences about the information? Substantial changes in teaching materials and procedures will require the demonstration of hypermedia's superiority over traditional methods (Hooper, 1988). In an attempt to verify hypertext's superiority over linear text, Talbert (1988) reported a positive effect for the network hypertext structure over a purely linear structure on the assimilation of material into learners' knowledge network with subjective measures, but the results of his objective measures were inconclusive. Numerous hypermedia projects are in development, but few reports of controlled evaluations have been published. Because empirical verification is scarce, many assumptions about hypermedia's abilities remain conjecture. Data are needed to guide future development and avoid haphazard and redundant implementations. This experiment evaluates three hypotheses: (a) students who use CAI with a hypermedia network structure will score higher on tests of knowledge learned than those who use CAI with a linear structure, (b) students who have a semantic network representation of the knowledge visible during study will score higher on tests of knowledge learned than those who do not, and (c) students who have a visible semantic network representation of the knowledge available as a navigational aid while using CAI with a hypermedia network structure will score higher on tests of knowledge learned than those who use CAI with a hypermedia network structure without the navigational aid available or those who use CAI with a linear structure with or without the visible semantic network.

Method

Subjects

Thirty-two volunteer participants from either an undergraduate cognition course or learning course at San Jose State University during the fall 1990 semester were randomly divided into four groups. Students in the cognition course were responsible for learning the content of the tutorial as part of their course grade, but other materials were available if they declined to participate in the experiment. Students from the learning course received extra credit for participating.

Materials

The two variables of internal presentation structure (linear vs. hypermedia network) and knowledge structure visibility (map vs. no map) were tested with four versions of a CAI tutorial. The tutorial content compared cognitive development theories (focusing on Piaget). Text and graphics for each version were taken from a developmental psychology textbook (Sroufe & Cooper, 1989). The material was the same for all experimental conditions, with substantial variations between conditions limited to the presence or absence of hypermedia links and the map (see Figures 1-4 for sample screens). The four conditions were (a) network hypermedia with map, (b) network hypermedia without map, (c) linear with map, and (d) linear without map. The tutorial was written in HyperCard for use on Apple Macintosh computers. Six Macintoshes in Clark Library's microlab on the SJSU campus were reserved for a block of time for one week to conduct the experiment.

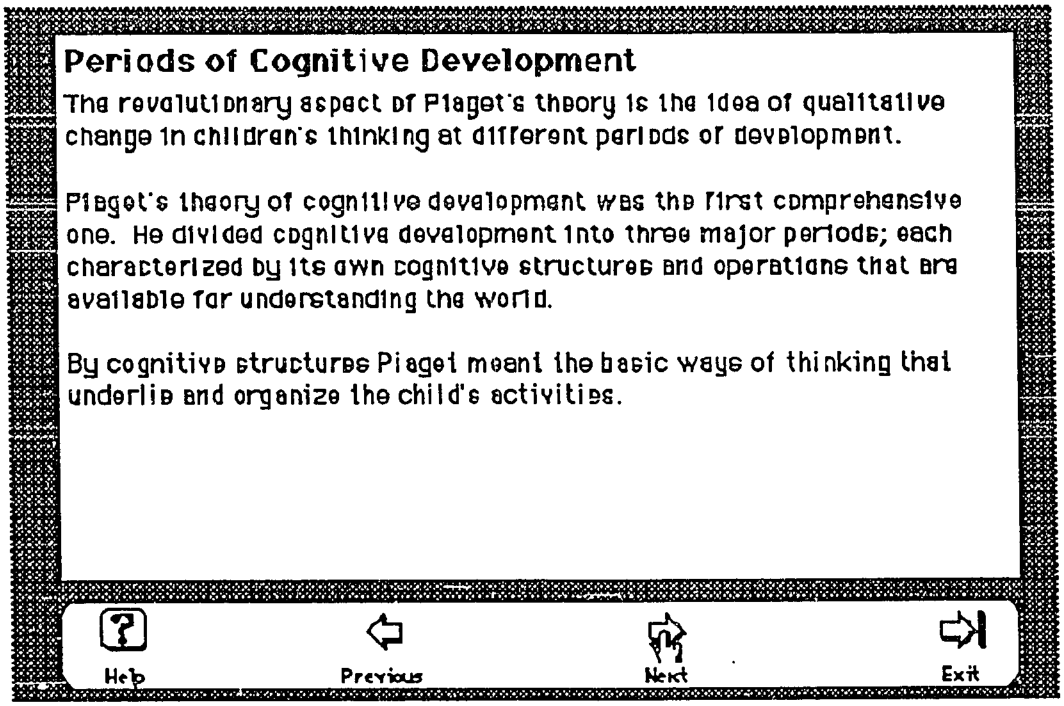

Figure 1. Sample screen for linear tutorial.

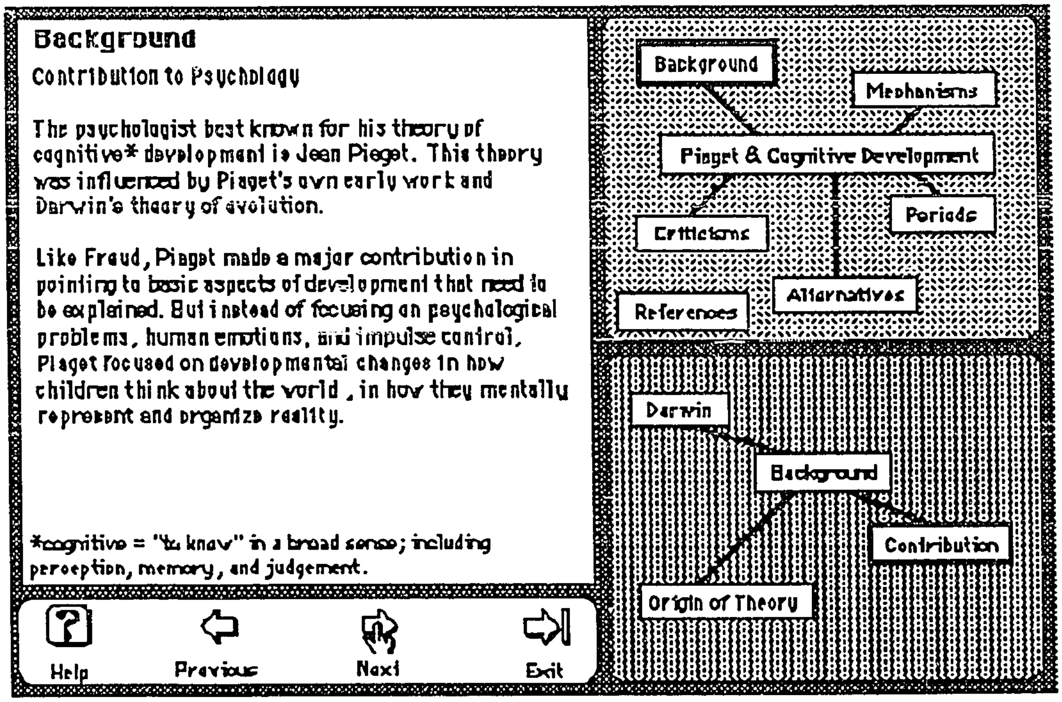

Figure 2. Sample screen for linear tutorial with map.

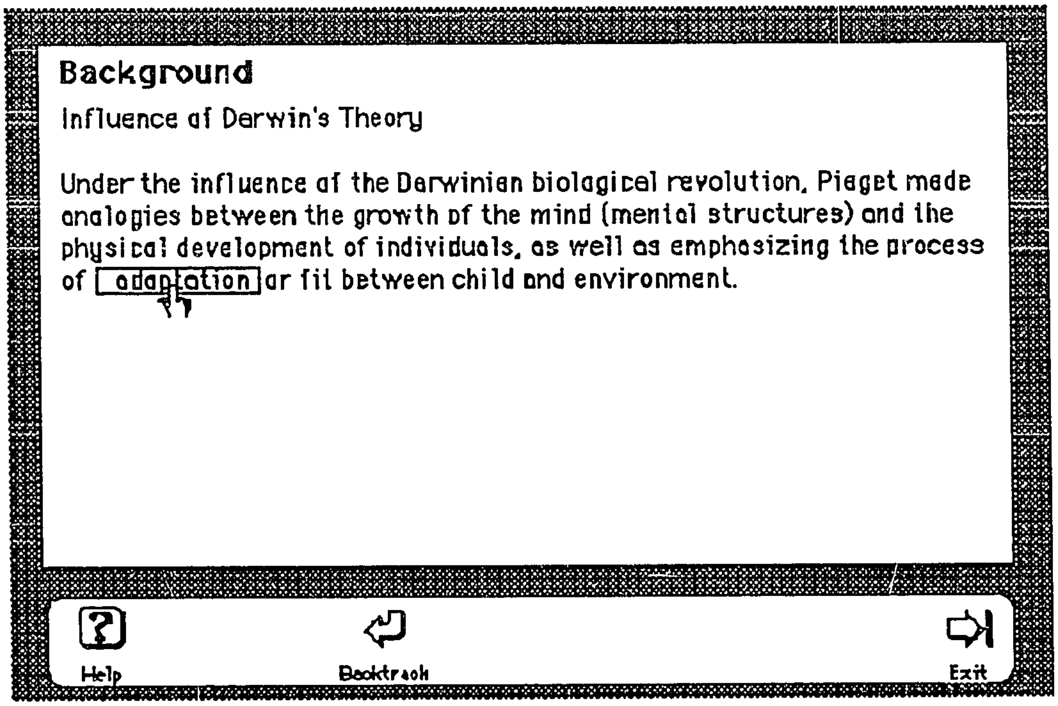

Figure 3. Sample screen for network tutorial.

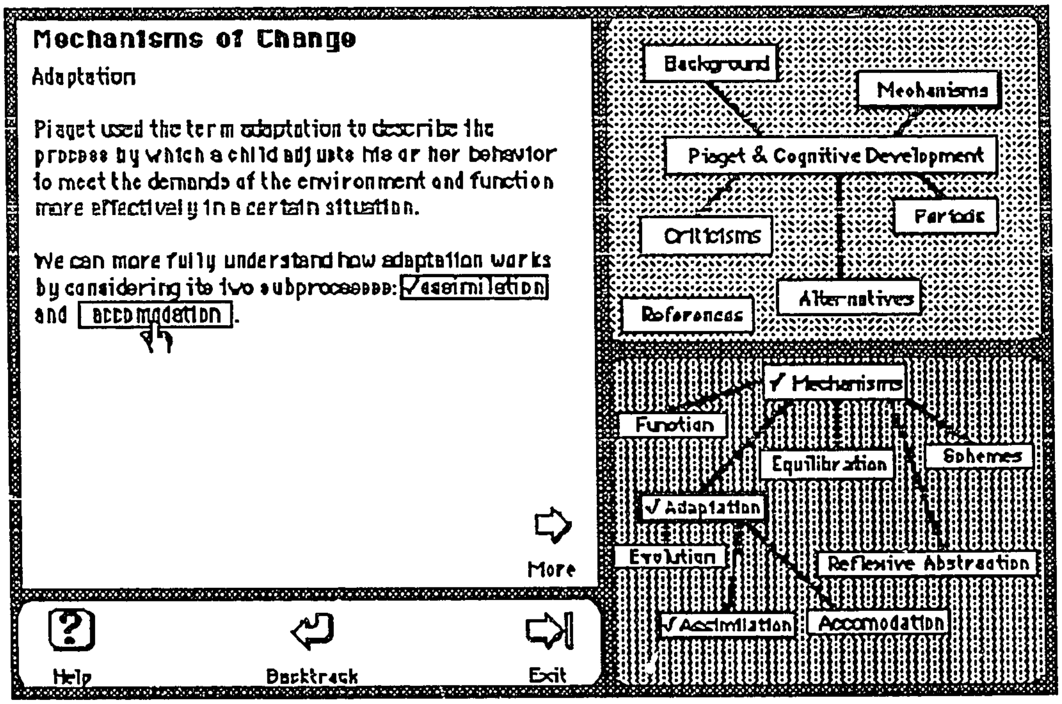

Figure 4. Sample screen for network tutorial with map.

Design and Procedure

Each student was randomly assigned to one of the four versions of the tutorial. Immediately after finishing the tutorial they were given a short post-test. Two to three weeks after completing the learning assignment they were given an in-class secondary post-test. There were two tests, with half of the students (randomly assigned) taking one as the immediate post-test and the second as the delayed post-test and the other half of the students taking them in the opposite order. Both tests consisted of six multiple choice and five short answer questions. After the experiment, students from the cognition course were given a printed copy of the linear tutorial to study before the in-class graded exam was given.

Results

Mean quiz scores for the four tutorial conditions are shown in Table 1 and Figure 5. A 2 (Structure) x 2 (Map) x 2 (Quiz Time) ANOVA was conducted, but because of the relatively small sample and because five students did not take the delayed post-test, the power of this analysis was sub-optimal. A main effect for Quiz Time was significant, $F\ (1, 23) = 28.48$, $p < .001$, in the expected direction of poorer performance on the delayed post-test, probably due to forgetting. The Structure x Quiz Time interaction was also significant (see Figure 5), $F\ (1, 23) = 5.33$, $p = .03$. All other effects tested non-significant. Because of the lower power of the first unequal n analysis, a separate 2 (Structure) x 2 (Map) between subjects ANOVA was calculated using the scores from the first quiz only ($N = 32$). A significant effect was found for Structure, $F\ (1, 28) = 4.8$, $p = .05$, and a marginally significant interaction was found, $F\ (1, 28) = 2.99$, $p = .09$. Planned

Table 1

Quiz Score Means and Ranges, and Number of Students for each Tutorial Condition

Tutorial	Quiz 1	Quiz 2
Linear		
Mean (SD)	4.75 (2.36)	2.50 (1.61)
Range (low/high)	0/7.0	0/4.0
n	8	7
Linear with Map		
Mean (SD)	7.13 (1.83)	3.33 (0.98)
Range (low/high)	3.5/9.0	2.0/4.5
n	8	6
Network		
Mean (SD)	4.50 (2.12)	3.33 (1.33)
Range (low/high)	1.0/7.0	1.5/5.0
n	8	8
Network with Map		
Mean (SD)	4.31 (2.03)	3.67 (2.50)
Range (low/high)	2.0/7.5	1.0/7.0
n	8	6

Note. Maximum possible score on each quiz = 11.

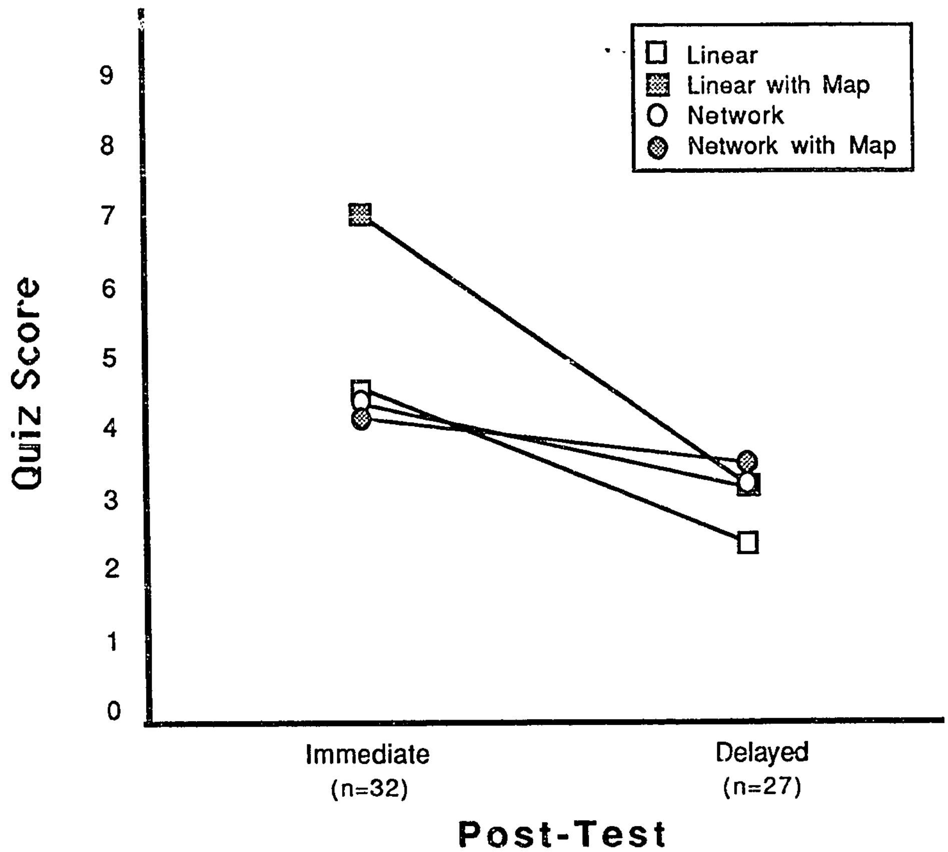

Figure 5 Mean quiz scores for students in each tutorial condition.

comparisons of the Linear with Map group to the other three groups showed significant differences in all cases: t (29) = -2.3, p = .03 (Linear with Map > Linear), t (29) = 2.5, p = .02 (Linear with Map > Network), and t (29) = 2.7, p = .01 (Linear with Map > Network with Map).

Informal subject comments and experimenter observations indicated that the Network version (without Map) was by far the most difficult to use. Subjects often found themselves lost, searching blindly for new information.

The path data collected by the computer program showed that some topics, such as those with fewer links from other topics, were missed completely by several subjects in this group.

Discussion

These results clearly do not support the first hypothesis that semantic network structured learning materials are superior to linear ones. They may indicate that, at least for initial exposure, learners do better if structure and guidance is provided for them. There were no main effects for Map to support the second two hypotheses regarding the superiority of a semantic network visible during study or being used as a navigational aid.

A near-floor effect for the delayed post-test may have contributed to the Structure x Quiz Time interaction and the non-significant main effects on the first analysis. A shorter interval between the post-tests may have yielded more informative results.

The most obvious factor which may have contributed to the superiority of the linear condition is experience. Students have years of experience learning from linear presentations and may need a new type of literacy or special guidance to benefit from hypermedia's different learning opportunities (Marchionini, 1990). In addition, the textual and graphical material used in the tutorials was adapted from a traditional linear format which could possibly have affected presentation.

The semantic network structure may impose extra cognitive requirements on the student (e.g., "Have I seen this already?", "What should I look at next?", or "How does this fit with what I already know?"). Whether this extra effort is enough to offset the potential benefits of hypermedia instruction is not yet clear. Does learner control detract from the tasks of understanding and remembering? Or is the process of looking for new viewpoints, connections, and alternatives the basis of gaining understanding? (Mayes, Kibby, & Anderson, 1990a). Learning to use a hypermedia system has been shown in at least one other case to interfere with learning the information contained within it. "Subjects either learn to navigate or they learn the material, but, at least during the initial stages of use [of a hypertext], they cannot do both together" (Mayes, Kibby, & Anderson, 1990a, p. 243).

It may be the case that when students become more comfortable with these new presentation methods, the potential benefits of hypermedia instruction will be realized. It is important for instructors who use hypermedia materials to give assignments which show students the advantages of connectivity and give them experience with the medium. The goals and methods of education may well need to be reconsidered (Landow, 1990). Teachers, learners, and designers of instructional materials must internalize the concept of information connectionism in order to take advantage of electronic information systems in general and hypermedia in particular (Marchionini, 1990). Because widespread substantial changes will not be made without clear benefits, teachers who believe in hypermedia's potential must persist in the development of hypermedia instruction in order to establish the requisite experience base.

If experience is such a critical factor and the potential hypermedia benefits are not as strong as expected, it seems unlikely there will ever be a clear experimental advantage of hypermedia instruction over traditional linear methods until students have years of experience using hypermedia as well. Users have not yet developed schema for using hypermedia and are not yet used to its different cognitive processing requirements (Jonassen & Grabinger, 1990). However, if the benefits are strong, moderate experience may build enough of a "hypermedia-use-schema" to show an experimental advantage. To test this, students would need sufficient training in the use of hypermedia materials to become comfortable with their use. Then they could use a different set of materials with linear or network structures to test the hypothesis.

Another possible factor is that hypermedia is better at "creative, open-ended learning situations that aim to develop an understanding of the structure of a domain of knowledge.... [and is] less relevant to learning of basic concepts, facts, procedures, and other routine subject matter. This would seem to be the domain of direct instruction, programmed instruction, or the more conventional forms of CAI" (Romiszowski, 1990, p. 335-6). As learning becomes more advanced and subject matter more complicated, the goals of learning shift from knowledge reproduction and gaining familiarity with facts and concepts to knowledge use and conceptual relationships. Hypermedia instruction may be best suited for "advanced learning, for transfer/application learning goals requiring cognitive flexibility, in complex and ill-structured domains—rather than introductory learning, for memory tests in simpler domains" (Spiro & Jehng, 1990, p. 167). If this is the case, then *both* types of materials (conventional and hypermedia) should be used in educational settings; conventional materials for learning basic facts and concepts and supplementary hypermedia to teach advanced concepts and associations. This is testable in at least two ways; one could allow students to learn introductory material in the conventional manner, then compare advanced learning with linear and network presentations. Or expanded even more, one could use phase of learning (basic vs. advanced) in four conditions where students use materials of the same or different structures (linear or network) for a 2 x 2 x 2 mixed design.

References

Anderson, J. R. (1985). *Cognitive psychology and its implications* (2nd ed.). New York: W. H. Freeman.

Anderson, T. (1988). Beyond Einstein. In S. Ambron & K. Hooper (Eds.), *Interactive multimedia* (pp. 193-213). Redmond, WA: Microsoft Press.

Beeman, W. O., Anderson, K. T., Bader, G., Larkin, J., McClard, A. P., McQuillan, P., & Shields, M. (1987). Hypertext and pluralism: From lineal to non-lineal thinking. *Hypertext '87 Papers* (pp. 67-86). Chapel Hill: University of North Carolina.

Bourne, J. R., Cantwell, J., Brodersen, A. J., Antau, B., Koussis, A., & Huang, Y-C. (1989, September). Intelligent hypertoutoring in engineering. *Academic Computing,* pp. 18-20, 36, 42-48.

Churcher, P. R. (1990). A common notation for knowledge representation, cognitive models, learning, and hypertext. *Hypermedia, 1,* 235-254.

Conklin, J. (1987, September). Hypertext: an introduction and survey. *IEEE Computer.* pp. 17-41.

Dede, C. J. (1986). A review and synthesis of recent research in intelligent computer-assisted instruction. *International Journal of Man-Machine Studies, 24,* 329-353.

Dede, C. J. (1987). Empowering environments, hypermedia and microworlds. *Computing Teacher, 15*(11), 20-24, 61.

Duchastel, P. C. (1990). Discussion: Formal and informal learning with hypermedia. In D. H. Jonassen & H. Mandl (Eds.), *Designing hypermedia for learning* (pp. 135-143). New York: Springer Verlag.

Duffy, T. M. & Knuth, R. A. (1990). Hypermedia and instruction: Where is the match? In D. H. Jonassen & H. Mandl (Eds.), *Designing hypermedia for learning* (pp. 199-225). New York: Springer Verlag.

Hammond, N. & Allinson, L. (1988). Travels around a learning support environment: Rambling, orienteering, or touring? *Proceedings of CHI '88* (pp. 269-273). New York: Association for Computing Machinery.

Hooper, K. (1988). Multimedia in education. In S. Ambron & K. Hooper (Eds.), *Interactive multimedia* (pp. 315-330). Redmond, WA: Microsoft Press.

Jonassen, D. H. (1988a). Designing structured hypertext and structuring access to hypertext. *Educational Technology, 28*(11), 13-16.

Jonassen, D. H. (1988b). Mindtools: Potential new liberating intellectual forces. *Educational Technology, 28*(12), 33-34.

Jonassen, D. H. & Grabinger, R. S. (1990). Problems and issues in designing hypertext/hypermedia for learning. In D. H. Jonassen & H. Mandl (Eds.), *Designing hypermedia for learning* (pp. 3-25). New York: Springer Verlag.

Kearsley, G. (1988). Authoring considerations of hypertext. *Educational Technology, 28*(11), 21-24.

Kozma, R. B. (1987). The implications of cognitive psychology for computer-based learning tools. *Educational Technology, 27*(11), 20-25.

Landow, G. P. (1990). Popular fallacies about hypertext. In D. H. Jonassen & H. Mandl (Eds.), *Designing hypermedia for learning* (pp. 39-59). New York: Springer Verlag.

Marchionini, G. (1990). Evaluating hypermedia-based learning. In D. H. Jonassen & H. Mandl (Eds.), *Designing hypermedia for learning* (pp. 355-373). New York: Springer Verlag.

Marchionini, G. (1988). Hypermedia and learning: Freedom and chaos. *Educational Technology, 28*(11), 8-12.

Marchionini, G. & Shneiderman, B. (1988, January). Finding facts vs. browsing knowledge in hypertext systems. *IEEE Computer.* pp. 70-80.

Mayes, T., Kibby, M., & Anderson, T. (1990a). Learning about learning from hypertext. In D. H. Jonassen & H. Mandl (Eds.), *Designing hypermedia for learning* (pp. 227-250). New York: Springer Verlag.

Mayes, T., Kibby, M., & Anderson, T. (1990b). Signposts for conceptual orientation: Some requirements for learning from hypertext. In R. McAleese & C. Green (Eds.), *Hypertext: State of the art* (pp. 121-129). Norwood, NJ: Ablex.

McAleese, R. (1990). Concepts as hypermedia nodes: The ability to learn while navigating through hypertext nets. In D. H. Jonassen & H. Mandl (Eds.), *Designing hypermedia for learning* (pp. 97-115). New York: Springer Verlag.

McKnight, C., Dillon, A., & Richardson, J. (1989). Problems in hyperland? A human factors perspective. *Hypermedia, 1*, 167-178.

Nielsen, J. (1990). *Hypertext and hypermedia.* San Diego, CA: Academic Press.

Oren, T. (1987). The architecture of static hypertexts. *Hypertext '87 Papers* (pp. 291-306). Chapel Hill: University of North Carolina.

Romiszowski, A. J. (1990). The hypertext/hypermedia solution—But what exactly is the problem? In D. H. Jonassen & H. Mandl (Eds.), *Designing hypermedia for learning* (pp. 321-354). New York: Springer Verlag.

Shulman, L. S. & Ringstaff, C. (1986). Current research in the psychology of learning and teaching. In H. Weinstock & A. Bork (Eds.), *Designing computer-based learning materials* (pp. 1-31). New York: Springer-Verlag.

Smith, J. B. & Weiss, S. F. (1988). Hypertext. *Communications of the ACM, 31,* 816-819.

Spiro, R. J. & Jehng, J-C. (1990). Cognitive flexibility and hypertext: theory and technology for the nonlinear and multidimensional traversal of complex subject matter. In D. Nix & R. Spiro (Eds.), *Cognition, education, and multimedia* (pp. 163-205). Hillsdale, NJ: Lawrence Erlbaum.

Sroufe, L. & Cooper, R. G. (1989). *Child development* . New York: Knopf.

Stanton, N. A. & Stammers, R. B. (1990). Learning styles in a non-linear training environment. In R. McAleese & C. Green (Eds.), *Hypertext: State of the art* (pp. 114-120). Norwood, NJ: Ablex.

Talbert, M. L. (1988). *Object-oriented approach to the development of computer-assisted instructional material using hypertext.* Unpublished Master's Thesis. Air Force Institute of Technology, Wright-Patterson AFB, Ohio.

Tsai, C. (1988). Hypertext: Technology, applications, and research issues. *Journal of Educational Technology Systems, 17,* 3-14.

Waterworth, J. A. & Chignell, M. H. (1990). A manifesto for hypermedia usability research. *Hypermedia, 1,* 205-234.

Whalley, P. (1990). Models of hypertext structure and learning. In D. H. Jonassen & H. Mandl (Eds.), *Designing hypermedia for learning* (pp. 61-67). New York: Springer Verlag.

Yankelovich, N., Landow, G. P., & Heywood, P. (1987). Designing hypermedia "ideabases"—The intermedia experience. *IRIS Technical Report*. Providence, RI: Brown University.

SAN JOSE STATE UNIVERSITY

A campus of The California State University

Office of the Academic Vice President • Associate Academic Vice President • Graduate Studies and Research
One Washington Square • San Jose, California 95192-0025 • 408/924-2480

To: Katherine J. Fugitt, Psychology
3812 Ashridge Lane
San Jose, CA 95121-1401

From: Charles R. Bolz
Office of Graduate Studies and Research

Date: October 17, 1990

The Human Subjects Institutional Review Board has approved your request to use human subjects in the study entitled:

"The Effects of Hypermedia Structure and its Visibility on the Effectiveness of Computer Assisted Instruction"

This approval is contingent upon the subjects participating in your research project being appropriately protected from risk. This includes the protection of the anonymity of the subjects' identity when they participate in your research project, and with regard to any and all data that may be collected from the subjects. The Board's approval includes continued monitoring of your research by the Board to assure that the subjects are being adequately and properly protected from such risks. If at any time a subject becomes injured or complains of injury, you must notify Dr. Serena Stanford immediately. Injury includes but is not limited to bodily harm, psychological trauma and release of potentially damaging personal information.

Please also be advised that each subject needs to be fully informed and aware that their participation in your research project is voluntary, and that he or she may withdraw from the project at any time. Further, a subject's participation, refusal to participate or withdrawal will not affect any services the subject is receiving or will receive at the institution in which the research is being conducted.

If you have any questions, please contact Dr. Stanford or me at (408) 924-2480.

cc: Robert Cooper, Ph.D.

October 24, 1990

TO: Katherine J. Fugitt
MA in Psychology Candidate

FROM: Robert A. Fox
MA Coordinator

SUBJECT: Design and Analysis Review

Your proposal was reviewed by Drs Nishita and Hawkins for the Design and Analysis Committee. Both of them approved your prospectus as submitted. Thus, the collection of data for your thesis will be approved contingent on documentation of compliance with University policy regarding the participation of subjects in research projects. University policy requires approval of your project by the Human Subjects Institutional Review Board. Please provide me with a file copy documenting such approval as soon as you receive it. After that copy is part of your file you may begin collecting data.

I have appended comments by the reviewers. I hope you will discuss these comments with your thesis committee and take them into account.

Congratulations on your progress to date, and Good Luck with the project.

cc: Cooper
Fox
Jordan
Hawkins
Nishita