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SUSANNE M. HUMPHREY
BEN SHNEIDERMAN

AN UMI No. ADG89-03321.
AU BROWN, MARCUS EDWARD.
IN Texas A&M Univ. Ph.D. 1988, 112 pp.
TI AN INTERACTIVE ENVIRONMENT FOR
LITERATE PROGRAMMING.
SO DAI V49(11), SecB, p. 4901.
DE Computer Science.

Although interest in the field of Literate Programming is increasing, it is not yet clear whether WEB, the first system created for Literate Programming, will receive widespread acceptance. This is due in part to the increased complexity of programming using WEB. This research concerns the development of an environment to reduce the complexity of programming in WEB by creating a user interface which allows the user to interact more intuitively with the WEB program.

In order to evaluate the efficacy of the Literate Programming Environment, an empirical evaluation was conducted using a prototype of the WEB Editor, a central tool of the environment. The WEB Editor was chosen for the empirical evaluation because it was most unlike the normal tools and because the editor will be the dominant portion of the interface to the environment.

Advanced student programmers performed equally well in a maintenance task judged similar to a professional maintenance situation when using the WEB typeset listing or the prototype WEB Editor. The patterns of usage by the students and their post-experiment responses showed a definite preference for the WEB editor over both the typeset listing and a standard editor.

This preference indicates that development of the full Literate Programming Environment is justified.

AN UMI No. ADG88-26084.
AU YEAZEL, LOUISE FLUCK.
IN The University of Wisconsin - Madison Ph.D. 1988, 216 pp.
TI CHANGES IN SPATIAL
PROBLEM-SOLVING STRATEGIES DURING
WORK WITH A TWO-DIMENSIONAL
ROTATION TASK.
SO DAI V49(11), SecA, p. 3260.
DE Education, Curriculum and Instruction.
Education, Technology.

The purpose of this study was (1) to describe the changes in instructional treatment, and (2) to assess the role of the instructional treatment in stimulating those changes.

The process of solving a spatial problem is a complex mixture of visual imagery and logical analysis which varies across subjects depending on their capabilities and preferred strategies, making it difficult to plan instruction in spatial skills. This study adds to knowledge of the variety of strategies which may be used for a simple two-dimensional rotation task. It also identifies a variety of changes in strategy which were part of subjects' individual learning process.

Subjects were 25 high school students who had difficulty with two-dimensional rotation. Analysis of self-report data indicated that causes of difficulty

before instructional treatment included over-dependence on finding analytical solutions, over-dependence on self-referenced spatial processes, difficulty in following mental rotation through a large angle, right-left confusion and lack of flexibility in selecting appropriate strategy. Subjects received individualized computer-assisted instruction at a task which involved visualizing a clock in various orientations and drawing a line with a joystick to a specified hour position. After a pretest, subjects practiced the task using computer graphic "hints" which were designed to suggest various strategies reported by experts at the task. Subjects practiced as long as they wished, selecting the types of items to be practiced and "hints" they found useful. Performance data for each item on the pre- and posttests included Wait Time (mental processing time), Move Time, and Angular Error in degrees.

The types of items on which subjects' performance improved significantly were consistent with their reported changes in strategy. Improvement was attributed by subjects to multiple causes, including experimentation with more mature spatial and logical processes.

The principal contributions of the study are (1) the identification of some dimensions on which spatial problem-solving strategy can be evaluated, and (2) the description of a variety of productive changes in strategy which can occur in an instructional setting which encourages experimentation.

AN UMI No. ADG89-02646.
 AU HILL, WILLIAM COLYER.
 IN Northwestern Univ. Ph.D. 1988, 216 pp.
 TI ADVICE SEEKING, GIVING, AND FOLLOWING AT A GRAPHICAL COMPUTER INTERFACE.
 SO DAI V49(11), SecA, p. 3307.
 DE Education, Psychology. Computer Science.

Two studies of a hidden human advisor responding to clients' queries while they performed statistical calculations at a direct representation interface were conducted in order to investigate the dynamics of advice seeking, giving and following in a realistic setting. Thirteen types of data were collected including think-aloud protocols of the advisor justifying advice given. Chief among the findings were five advisory strategies observed to play critical roles in the generation of genuinely helpful advice. The declarative semantics of a procedural logic were used to state these strategies rigorously. Analyses of advice following behaviors revealed a pattern of efficient effective advice following in a little more than half the cases. For the other cases, failed prerequisite presuppositions on the part of the advisor were identified as a source of difficulty. Observed regularities in advice seeking, giving and following behaviors suggested that advice seekers and givers interact according to a tacit instructional

contract which was instrumental, asymmetric and collaborative. The contract's relevance for the design of self-advising interfaces is discussed.

AN UMI No. ADG88-26555.
 AU CARDINALE, ELLEN PATRICIA.
 IN St. John's Univ. Ph.D. 1988, 296 pp.
 TI TREATING CHILDREN'S WRITING APPREHENSION WITH WORD PROCESSING.
 SO DAI V49(11), SecB, p. 5016.
 DE Psychology, Clinical. Education, Technology.

A performance-based behavioral treatment was designed for use with word processing to decrease writing apprehension (an individual's tendency to fear and avoid situations requiring writing). The purpose of this study was to intervene with very young, anxious writers, in order to stop this kind of anxiety before it becomes an educational handicap, and adversely affects personality.

The 13-week experimental program used a pretest/posttest randomized control group design. A child version of the Writing Apprehension Test (Silverman & Zimmerman, 1982) was restandardized and the scores were used to select the 77 fourth- and fifth-grade subjects. Three groups were formed: two writing-anxious groups (experimental and control), as well as a third group (the normative comparison group), who scored close to the mean on the Child Writing Apprehension Test.

Following instruction on Bank Street Writer (1983) word processing program, all three groups of subjects were given writing assignments to compose at the computer. The experimental group, however, was required to use the following procedures designed to lower their writing apprehension: (a) free writing, (b) invisible writing, (c) practice in generating multiple drafts of an essay, (d) peer evaluation of their writing, and (e) a simulated electronic mail routine.

Scores on the writing attitude scale, and the quality of handwritten test essays (as measured by holistic scores and five syntactic maturity indices), were the dependent variables. Additionally, a test essay composed on the computer, toward the end of the program, was similarly analyzed.

The major result was that both the high anxious experimental males and the normative comparison males (which were not different from each other), wrote better computer essays, in terms of holistic scores only, than the anxious control males. None of the three groups changed in their writing apprehension scores by the end of the study. The usefulness of the syntactic maturity indices, and the issue of generalizability from handwritten to computer-composed essays, are discussed.

AN UMI No. ADG89-02030.
 AU BIER, ERIC ALLAN.
 IN Univ. of Calif. Berkeley Ph.D. 1988, 173 pp.
 TI SNAP-DRAGGING: INTERACTIVE
 GEOMETRIC DESIGN IN TWO AND THREE
 DIMENSIONS.
 SO DAI V49(12), SecB, p. 5394.
 DE Computer Science.

Graphic artists, mechanical designers, architects, animators, authors of technical papers and others create geometric designs (illustrations and solid models) as a major part of their daily efforts. Some part of this shape construction must be done with precision. For instance, certain line segments should be horizontal, parallel or congruent. In recent years, interactive computer programs have been used to speed up the production of precise geometric designs. These programs take advantage of high-speed graphics, equation solving, and computer input peripherals to reduce the time needed to describe point positions to the machine. Previous techniques include rounding the cursor to points on a rectangular grid, solving networks of constraints, and supporting step-by-step drafting-style constructions.

Snap-dragging is a modification of the drafting approach that takes advantage of powerful workstations to reduce the time needed to make precise illustrations. Using a single gravity mapping, a cursor can be snapped to either points, lines or surface. The gravity algorithm achieves good performance by computing intersection points on the fly. To aid precise construction, a set of lines, circles, planes, and spheres, called alignment objects, are constructed by the system at a set of slopes, angles, and distances specified by the user. These alignment objects are constructed at each vertex or edge that the user has declared to be hot (of interest). Vertices and edges can also be made hot by the system through the action of an automatic hotness rule.

When snap-dragging is used, shapes can often be constructed using a few more keystrokes than would be needed to sketch them freehand. Objects can be edited at arbitrary orientations and sizes. The number of primitive operations is small, making it possible to provide keyboard combinations for quickly activating most of these operations. The user interface works nearly identically in two or three dimensions. In three dimensions, snap-dragging works with a two-dimensional pointing device in a single perspective view.

AN UMI No. ADG89-05243.
 AU COHN, RICHARD JOEL.
 IN Carnegie-Mellon Univ. Ph.D. 1988, 173 pp.
 TI PROGRAMMABLE COMMAND
 LANGUAGES FOR WINDOW SYSTEMS.
 SO DAI V49(12), SecB, p. 5396.
 DE Computer Science.

Programmable command and macro languages have long served as important tools for users of computer systems. This thesis describes the design and implementation of a general-purpose command language for a window system. This has never been tried before because these systems are new and because the problems inherent in providing a command language for a window system are hard.

The thesis describes the requirements for a command language that can drive a wide variety of window system applications. Comparing these requirements with the properties of window systems and direct manipulation user interfaces shows why these requirements are difficult to meet and why some obvious approaches to the command language problem fail.

The thesis presents a practical strategy for providing a command language based on a compromise approach. This strategy defines an architecture in which developers provide programmable interfaces to their applications. Interfaces specify, at a semantic level, the objects understood by applications and the operations that manipulate these objects. The system incorporates these operations into a system-wide command language. The command language interpreter communicates with applications using remote procedure calls (RPC), enabling users to write command language programs that access operations of one or more applications transparently. The thesis describes a prototype implementation for Andrew, a multiple-process, multiple-window environment based on the UNIX® operating system. While the prototype uses Lisp as the command language and C as the application implementation language, the RPC mechanism makes possible the use of multiple command and implementation languages.

This architecture simplifies the mechanics of providing interfaces to applications, but the task of interface design is intrinsically difficult. The thesis examines interfaces built for a variety of applications and extracts from this experience a set of guidelines for designing command language interfaces and interactive applications.

AN UMI No. ADG89-06287.
 AU GUTFREUND, STEVEN HUGH.
 IN Univ. of Massachusetts Ph.D. 1988, 374 pp.
 TI THINKERTOY: AN ENVIRONMENT FOR
 DECISION SUPPORT.
 SO DAI V49(12), SecB, p. 5399.
 DE Computer Science.

White collar workers have been helped immensely by the introduction of computers and office automation equipment. However, most of the systems that have been introduced deal only with the clerical aspects of office-oriented jobs: meeting scheduling, letter writing, and office procedures. Considerably less work has been done to assist

people at doing the central portion of their job, decision making. The tools for decision makers that do exist are either paper and pencil methods or abstract mathematical and statistical modeling techniques.

ThinkerToy embodies a significant new approach in decision support. It uses graphical icons with concrete physical characteristics to replace mathematical relationships and properties. These in turn form the basis of a general purpose modeling language and environment. This environment has been used to create rich graphical analysis tableaux for such problems as landscape planning, service scheduling, and statistical analysis.

The ThinkerToy environment transforms the abstract characteristics of a complex problem into a physically tangible model. Here, all components of the model (computational substructure as well as user interface) are represented with visual objects whose manipulative characteristics portray the underlying semantic and structural properties of the problem. The user can interact with this model and explore the subtle interlocking connections that exist in large scale problem solving.

The result of this research is a modeling and analysis environment that can capture complex decision problems with a striking degree of physical realism. This realism can be utilized to inspire new insights in the analysis of complex problems.

AN UMI No. ADG89-06741.
AU SAKATANI, KENNETH KEN.
IN Stanford Univ. Ph.D. 1988, 152 pp.
TI A STUDY COMPARING THE EFFECTS OF
LOGO TURTLE GRAPHICS AND PAINT
GRAPHICS ON THE RESPONSE OF
STUDENTS TO COLOR, LINE, AND
SHAPE.
SO DAI V49(12), SecA, p. 3593.
DE Education, Art. Education, Technology.

This study investigated whether two approaches to microcomputer graphics, LOGO turtle graphics programming and Paint graphics software, had any differential effects on the responses of sixth grade students to color, line, and shape. As a result of the analytical character of LOGO graphics programming and the intuitive features of Paint graphics software, the author assumed differentiated and de-differentiated attention states would be developed, both which are crucial in the aesthetic perception of art.

A training program in art appreciation was developed to compare the effects of LOGO turtle graphics and Paint graphics in teaching sixth grade students to respond to color, line, and shape found in works of art. Fifty students were randomly assigned to three treatment groups: (a) LOGO, N = 12, CYBERLOGO turtle graphics programming; (b) PAINT, N = 12, KOALA TouchTablet and graphics

software; and, (c) TRADITIONAL ART, N = 13, paints, brushes, paper, and so forth.

Each treatment group was given two weeks training in the use of their particular art medium, six weeks of daily curriculum instruction, and one final week of follow-up activities. All treatment groups were administered a pretest, posttest, and post-posttest. A control group was given only the posttest. Individual student responses to three different styles of art (Realism, Surrealism, and Abstract) were tape-recorded and transcribed for each test period. Forty-six complete transcripts were scored using the Acuff and Sieber-Suppes system of scoring aesthetic responses to paintings.

An analysis of variance across all three treatment groups found significant effects for the shape and line variables at the posttest. No significant effects were found for the color variable at the posttest. In addition, post-hoc comparisons among groups showed that only the Paint group was significantly higher than the control group for both the line and shape variables. Post-hoc analysis of the combined variables of color, line, and shape revealed significant differences between the responses of LOGO and Paint students to styles of art.

Although there were no consistent main effects found in this study for either the LOGO or Paint graphics approach, differences between Paint and LOGO students along stylistic categories tentatively suggest a relationship between perceptual skills developed by microcomputer graphics and cognitive style.

AN UMI No. ADG88-25982.
AU BATTENBERG, JANICE K.
IN Ball State University D.Ed. 1988, 137 pp.
TI SELECTIVE ATTENTION: A COMPARISON
OF TWO COMPUTER INPUT DEVICES
UTILIZING A TRADITIONAL KEYBOARD
VS. A TOUCH SENSITIVE SCREEN.
SO DAI V49(12), SecA, p. 3691.
DE Education, Technology. Education, Special.
Education, Curriculum and Instruction.

The purpose of the study was to determine the efficacy of touch sensitive computer screens in focusing attention on a specific academic task. Forty nondelayed and forty delayed kindergarteners were compared as to their rates of task completion and performances on traditional computer keyboards versus touch sensitive screens. Two eight cell repeated measures experimental designs were used to compare the selective attention process of the nondelayed and delayed pupils. The two dependent variables manipulated in the study were two types of computer input device and the two developmental levels of the subjects. The dependent variable consisted of the number of previously unlearned French number words mastered through four performance measures involving speed, computer

recall, noncomputer recall and noncomputer recognition

Findings. As analyzed by a three factor MANOVA, a significant difference in the rate of task completion was shown in favor of the touch screens for all subjects in touching the sequential letters of the alphabet. Although there appeared to be no significant differences in noncomputer recall and recognition post tests, a four factor MANOVA verified significant differences in the subjects' computer recall post tests.

Conclusions. The data supports the conclusion that the use of the touch sensitive screen facilitates the focus of attention (selective attention) on specific academic tasks and thus increases the rate of learning and degree of integration of new information. The degree of compatibility between the learner and the computer input device is greater with touch screens than with traditional keyboards for both nondelayed and delayed kindergarteners.

The speed of completing the sequential touching of the alphabet letters was significantly faster for the touch screen than the traditional keyboard input. For mastery of information learned, the analyzed findings suggest a higher degree of recall for information learned through the touch screen intervention over the same instructional tasks with keyboard input.

As the result of this key study, it is suggested future research investigations will expand the use of computers beyond educational drill, repetition, and games. Future investigations into the relationships between cognitive processing and the individualization of CAI could involve various age ranges, exceptionalities, and developmental comparisons.

AN UMI No. ADG89-05113.
AU HENSEL, ROBIN ANN MORGAN.
IN West Virginia University Ed.D. 1988, 225 pp.
TI A STUDY OF TWO INSTRUCTIONAL MEDIA FOR TEACHING ADULT PROFESSIONALS HOW TO USE WORD PROCESSING COMPUTER SOFTWARE PRODUCTS.
SO DAI V49(12), SecA, p. 3692.
DE Education, Technology. Education, Adult and Continuing.

This investigation compared the cognitive and affective outcomes of two instructional media used in introductory word processing software training. Two groups of adult professionals who work in a high technology research environment were introduced to word processing concepts, functions and commands using a lecture-demonstration-laboratory strategy. The twenty-two members of Group 1 participated in a classroom-based training experience. The twenty-one individuals comprising Group 2 used a self-paced, videotape-based medium to direct their learning experience.

Four instruments were used to collect demographic, affective, and cognitive data about the participants, and evaluative information about the training experience. A pretest and posttest were administered to both groups. A market survey was conducted to collect cost data on the two training media.

Seven research questions were defined using null and alternative hypotheses to investigate the differences in means between the pretest and posttest scores for each group, and between the two groups. The resulting data were analyzed using independent and correlated t-test procedures and a covariance analysis method. All hypotheses were tested at the 0.05 level of significance.

The results of the analysis support several affective, cognitive and economic conclusions. Since no significant affective or cognitive differences between the two groups were indicated, it was concluded that for a certain group of employees, videotape-based training is not less effective in achieving stated cognitive and affective objectives than classroom-based training. Significant time and cost differences were indicated. The cost of the videotape-based training was significantly less than the cost of the classroom-based training. The videotape group required significantly less time to complete the training than the classroom group. The significant time and cost savings imply that videotape-based training can yield notable financial benefits to employers. Hence, it is recommended that companies interested in cost efficient computer software training offer videotape-based training as an economical and effective alternative to, but not a replacement for, classroom-based training.

AN UMI No. ADG89-03833.
AU POAGE, JULIE ANNE.
IN University of Oregon Ph.D. 1988, 103 pp.
TI IDENTIFICATION AND MEASUREMENT OF FACTORS CONTRIBUTING TO COMPUTER APTITUDE.
SO DAI V49(12), SecA, p. 3693.
DE Education, Technology. Computer Science.

The purpose of this study is to confirm that general computer aptitude exists as a second-order, latent trait and that the first-order, latent traits of non-verbal critical thinking ability, verbal critical thinking ability, creativity, memory, and attitude are major factors contributing to computer aptitude. General computer aptitude was also compared to computer programming aptitude to investigate the possible distinction of the two traits. In addition, measures of mathematical and reading abilities were introduced to establish their contribution to computer aptitude.

Four subscales of the Computer Aptitude, Literacy, and Interest Profile (CALIP) were used to form the non-verbal critical thinking factor; the Inference and Deduction scales of the Watson-Glaser Critical Thinking Appraisal (WGCTA) formed the verbal

critical thinking factor; the Remote Associates Test was used to identify associative creativity; scores on the Computer Attitude Scale (CAS) represented an attitude factor; and, two original memory tasks (word recall and algorithmic recall) formed the memory factor. Each of these scales were administered to 245 high school juniors and seniors. In addition, math and reading scores from the Michigan Educational Assessment Profile were collected from the students' records. Complete sets of data were available for 217 students.

The data was analyzed using EQS, a structural equations computer program. The proposed second-order, latent trait model was found to be the best fit when compared to two alternative first-order, latent trait models. A path analysis demonstrated that each of the measured variables and first-order, latent traits contributed significantly to the model. The path coefficients for the five first-order, latent traits were: Non-verbal Critical Thinking Ability (.949), Verbal Critical Thinking Ability (.820), Creativity (.464), Memory (.800), and Attitude (.250). A clear distinction could not be made between general computer aptitude and computer programming aptitude, and math and reading abilities did not contribute significantly to the model.

AN This item is not available from University
Microfilms International ADG05-64844.
AU SCULLY, DAVID F.
IN University of Southern California Ed.D. 1988.
TI THE USE OF A MEASURE OF THREE
DIMENSIONAL ABILITY AS A TOOL TO
EVALUATE THREE DIMENSIONAL
COMPUTER GRAPHIC LEARNING
ABILITY.
SO DAI V49(12), SecA, p. 3693.
DE Education, Technology.

This study focused on the three-dimensional visual demands placed on the worker using computer-aided design and computer-aided manufacturing (CAD/CAM) drafting in place of manual drafting. Many industries have spent significant amounts of monies to move into three-dimensional drafting and design. Elements needing consideration were cost-effective and efficient ways of identifying and training those persons who would give the most benefit to their companies by using the new technology.

This study assessed whether a current three-dimensional program would provide evidence for a cost-effective way to select or screen in advance persons who would benefit most three-dimensional computer graphics training. The instrument chosen to measure the effectiveness of the program to develop three-dimensional skills was the Guilford-Zimmerman Test for Spatial Visualization.

Two groups were followed through typical computer graphics training cycles. The control group, consisting of 44 persons, took basic two-dimensional computer graphics training for new users. The experimental group, consisting of 40 persons, took advanced training classes in three-dimensional computer graphics. Both groups were given a pretest and a posttest using the Guilford-Zimmerman Test for Spatial Visualization, with the results compared following the end of the training cycles.

The results of this study showed that both groups were influenced by the Guilford-Zimmerman test. Both groups had higher posttest than pretest scores. However, the experimental group did not improve significantly more in three-dimensional ability than did the control group.

It was expected that the control group would have no change in three-dimensional ability because they had no exposure to any three-dimensional training other than the Guilford-Zimmerman test. However, this group showed a growth in three-dimensional learning similar to that of the control group. That the control group improved comparably to the experimental group suggest that exposure to the Guilford-Zimmerman test provided a training experience from which the control group profited. If this conclusion is sound, one inference may be that week-long training classes in three-dimensional ability may be "over-kill": A shorter training period may suffice. (Copies available exclusively from Micrographics Department, Doheny Library, USC, Los Angeles, CA 90089-0182.).

AN UMI No. ADG89-03854.
AU WILSON, DANIEL BLAKE.
IN University of Oregon Ph.D. 1988, 145 pp.
TI THE DESIGN AND ASSESSMENT OF AN
AUDIO ENHANCED WORKSTATION.
SO DAI V49(12), SecA, p. 3694.
DE Education, Technology. Computer Science.

This study investigates the use of cassette tapes to provide sound tracks synchronized with software execution. Features of computer-assisted instruction, decision support, and cassette-computer systems are synthesized into a workstation design that supports user-directed learning and problem solving. A prototype is built for an IBM microcomputer and the details of its implementation are presented. This prototype was pilot tested by instructors who created sound-tracked software presentations and users who operated their presentations. The results of implementation and assessment suggest that this design is a viable medium for delivering software demonstrations and tutorials and for augmenting computer-based information with verbal explanations. Applications for this technology with optical disks, video disks, and telecommunications are discussed, and further research in the fields of audio-enhanced computer-assisted instruction and problem solving are proposed.

AN UMI No. ADG89-05999.
 AU BARRY, KEVIN THOMAS.
 IN Columbia Univ. Ph.D. 1988, 182 pp.
 TI PLANNING LEVELS OF NOVICES IN
 INTRODUCTORY COMPUTER
 PROGRAMMING TASKS.
 SO DAI V49(12), SecB, p. 5548.
 DE Psychology, Experimental. Computer Science.
 Psychology, Psychometrics.

This study examined: (a) the types of problem solving behaviors/strategies novice programmers use in the programming task, (b) the relationship between educational precursors and the programming process, and (c) the relationship between particular programming skills and task characteristics. A group of novice programmers (N = 35) was given two programs of different levels of difficulty, and wrote the programs as they thought aloud. No terminals were used. The proceedings were taped, transcribed, and merged with the written work. Twenty-four separate strategies were postulated. Two raters established five meaningful and reliable categories with 94% agreement.

Three levels of programmer proficiency were identified for the easier program. The most capable group was abstract, emphasized structure and design, and reviewed. The middle group gave little evidence of structure or design, connected subparts poorly, and was concerned with details. The least capable group seemed overwhelmed, and attempted to translate the program directly into code.

Four levels of proficiency were identified for the more difficult program. The top and bottom groups had planning strategies similar to their efforts on the easier program. But two middle groups emerged, the more capable had facility with subparts, yet had difficulty connecting these together; the less capable seemed careless, used partial solutions and often left the program incomplete.

The more difficult problem forced the poorest group to spend more effort constructing a problem representation at the expense of planning. General planning was a minor part of the protocols, but was greatest for the capable groups even when the program was easier. Less proficient novices focused on details; capable novices used planful approaches with less concern for details. The groupings obtained differed significantly from each other in average SAT-Math scores and first semester course grade, but not in mathematics achievement measures. This study demonstrated that changing a program's level of difficulty results in a shift of strategies used. Training novices in representation and general planning is suggested. Restricting activities to one cognitive strategy could be used to observe changes in strategy development. Future research should consider strategies operating at each successive pass through a program, and the interaction between strategy selected and program difficulty.

AN UMI No. ADG89-07008.
 AU CATRAMBONE, RICHARD.
 IN The Univ. of Michigan Ph.D. 1988, 112 pp.
 TI SPECIFIC VERSUS GENERAL
 PROCEDURES IN INSTRUCTIONS.
 SO DAI V49(12), SecB, p. 5549.
 DE Psychology, Experimental.

Many studies have shown that people have great difficulty solving novel problems after having studied procedures for solving specific types of problems. This failure to generalize suggests that general instructions might be more useful for people in the long run. This dissertation examined the trade-off in time to perform basic tasks versus the time to perform novel tasks for people learning to use a word-processor with general instructions or specific instructions. In Experiment 1, subjects who studied specific instructions got started on basic tasks more quickly than subjects who studied general instructions. However, the specific instruction subjects could not do novel tasks while general instruction subjects had no difficulty with them. In Experiment 2, the specific instructions were rewritten, based on a production system analysis of the instructional content, to help subjects form the necessary generalizations to do novel tasks. In this experiment, specific instruction subjects were able to do the novel tasks as well as general instruction subjects. In addition, the specific instruction subjects maintained their advantage on the initial tasks. The results suggest that learners can generalize to new tasks if the training they receive is carefully constructed to help them learn the generalizations they need for novel tasks. In addition, a production system formalism appears to be quite useful as a tool for analyzing and designing instructions as well as for predicting the performance of people who learn from those instructions.

AN UMI No. ADG89-04838.
 AU JOHN, BONNIE ELIZABETH.
 IN Carnegie-Mellon Univ. Ph.D. 1988, 301 pp.
 TI CONTRIBUTIONS TO ENGINEERING
 MODELS OF HUMAN-COMPUTER
 INTERACTION. (VOLUMES I AND II).
 SO DAI V49(12), SecB, p. 5551.
 DE Psychology, Experimental. Computer Science.

This dissertation presents two engineering models of behavior at the human-computer interface; a model of immediate behavior and stimulus-response compatibility and a model of transcription typing. Formulated within the architecture of the Model Human Processor of Card, Moran and Newell, these models are able to make zero-parameter, quantitative predictions of human response time in their respective domains. They are also completely integrated, making good predictions about performance on a dual reaction-time/typing task. Parameters of the models are set using response time data from an abbreviation recall experiment.

These parameters are then used to make predictions about response time in another abbreviation recall experiment, three classic stimulus-response experiments, and over 29 experiments that reflect robust phenomena associated with transcription typing. These models are the first to make successful predictions across domain boundaries, both within tasks exhibiting stimulus-response compatibility and outside that paradigm to transcription typing.

AN UMI No. ADG88-25689.
 AU KINZIE-BERDEL, MABLE BARBIE.
 IN Arizona State Univ. Ph.D. 1988, 94 pp.
 TI MOTIVATIONAL AND ACHIEVEMENT
 EFFECTS OF LEARNER CONTROL OF
 COMPUTER ASSISTED INSTRUCTION.
 DE Education, Technology.

This study investigated the effects of providing ninth-grade boys and girls with either learner or program control over content review within computer-assisted science instruction. The effects of providing subjects with a choice of control type were also examined. During each of two consecutive sessions, subjects completed learner and program controlled CAI and a unit posttest. At the end of the first session, one-half of the subjects were given a choice of control type for the second session, while the other half were assigned to the same type of control they had just experienced. At the end of the second session, all subjects were asked to select the control type they would like to have in the future. Subjects also responded to pre- and post-measures of motivation for science study and computer use. Results indicated that males performed better with program control than learner control in session one, but not for session two. Females scored slightly, but not significantly, higher under learner control in both sessions. This sex difference in performance is discussed relative to a possible differential effort on the part of males and females. Females under learner control selected a greater proportion of possible reviews than did males for both sessions, though the difference was significant only for session two. Differences in time to completion also indicate the likelihood of differential effort by sex. The data reveal a strong preference both for learner control and for instruction via computers. Implications of the data for classroom practice and for possible longer-term effects are discussed.

AN UMI No. ADG89-06208.
 AU ZIRKLER, DIETER JOSEPH.
 IN Bowling Green State Univ. Ph.D. 1988, 45 pp.
 TI THE EFFECTS OF GUIDED DISCOVERY
 AND EXAMPLE-BASED INSTRUCTION ON
 THE COGNITIVE CONSEQUENCES OF
 LOGO PROGRAMMING.
 DE Developmental. Education, Technology.

Programming in primary and secondary education often is justified by claims that programming develops high-level cognitive skills (Pea & Kurland, 1984). Empirical research on the cognitive consequences of computer programming can be divided into three areas: (a) understanding language features, (b) design skills, and (c) general problem-solving skills (Linn & Dalbey, 1985). The current programming research has several limitations including a lack of longitudinal research and confounds of instruction with computer/programming effects. This study utilized a longitudinal design to examine the development of the three cognitive consequences listed above in 58 fifth grade children as they learned the Logo programming language. This study also compared the effects of two instructional methods (guided discovery, example-based) on students' cognitive development. Results suggested that subjects in both instructional groups increased their understanding of Logo language features and improved their programming/design skills. While approximately half of the subjects were able to learn a strategy for drawing polygons, very few subjects were able to apply the strategy after a four-week vacation. Children in the two instructional groups differed in their development of each of the three cognitive consequences.

AN UMI No. ADG89-08937.
 AU STURGES, DAVID L.
 IN North Texas State Univ. Ph.D. 1988, 182 pp.
 TI VISUAL ASPECTS OF INTERNAL
 CORRESPONDENCE AND THEIR IMPACT
 ON COMMUNICATION EFFECTIVENESS.
 SO DAI V50(02), SecA, p. 485.
 DE Business Administration, Management. Speech
 Communication. Information Science.

Technologists predict that electronic information dissemination will create a paperless work environment. In spite of such predictions, paper-based internal communication will remain the primary medium for disseminating information in organizations for decades to come. However, electronic technology will have an impact on paper information production that may be more profound than changes following word processing's introduction. Previously unavailable for everyday production to enhance word meaning, certain graphic techniques now can be used to access readers' preconditioned symbol meanings to increase comprehension of routine correspondence and information internalization.

This quasi-experimental field study examines interactions among laser-printer graphic treatment and communication variables as contributors to explaining variance in comprehension. Set Multiple Regression/Correlation analysis identifies significant variance explained by conditional relationships between near-typeset quality text and readers' self-interest and between near-typeset quality text

and text's readability. The conditional relationship of near-typeset quality and self-interest shows increase in reader comprehension at a greater rate than the comprehension increase rate attributed to the reader's self-interest increase alone. This suggests that conditional relationships may be accessing an internal judgment process interpreting greater self-interest in near-typeset printed text. The conditional relationship between near-typeset quality and readability reveals that at more difficult reading levels comprehension is greater for near-typeset text. The significance of this relationship indicates that an internal judgment process is involved rather than the difference being attributed to legibility treatment.

The strength of these conditional relationships suggests that planning for communication policies and practices should be a part of organizational strategic planning in the same ways as are financial analysis, operations planning, or human resource management.

AN UMI No. ADG89-09511.
 AU DODANI, MAHESH HASSOMAL.
 IN Univ. of Central Florida Ph.D. 1988, 363 pp.
 TI GENERATING MULTIPLE USER
 INTERFACES FOR MULTIPLE
 APPLICATION DOMAINS.
 SO DAI V50(02), SecB, p. 640.
 DE Computer Science.

This Ph.D. dissertation presents a classification scheme for User Interface Development Environments (UIDEs) based on the multiplicity of user interfaces and application domains that can be supported. The SISD, SIMD and MISD (S = Single, I = user interface(s), M = Multiple, D = application Domain(s)) generator classes encompass most of the UIDEs described in the literature. A major goal of this research is to allow any user to develop a personalized interface for any interactive application, that is, the development of an MIMD UIDE.

Fundamental to the development of such a UIDE is the complete separation of the user interface component from the application component. This separation necessitates devising less tightly coupled models of the application and user interface than have been reported to date. The main features of the MIMD UIDE model are as follows. (1) Interactive applications are modeled as editors providing a set of functions that manipulate 2-dimensional graphical objects. (2) Interactive data structures are introduced for maintaining and manipulating both the internal and external representation(s) of application information as a single unit. These external representations form the basis for presenting internal information to the user. (3) Since interaction with the user must be the sole responsibility of the user interface component, function interaction is modeled as follows. Application functions are modeled as a set of services. Each service processes a (set of) parameter(s) independently. For each service in the application, a corresponding service interface object

is defined in the user interface component. The service interface object interacts with the user to specify the required (set of) parameter(s), calls the associated service within the application, and displays the result of the service to the user.

Using the above model, the user interface component is modeled to allow personalized specifications at all levels; including the internal entities of the interactive system, the characteristics of the display of information, and the interaction tasks, techniques and devices used for parameter specification.

AN UMI No. ADG89-10290.
 AU CUNNINGHAM, ANN JULIE.
 IN East Texas State Univ. Ed.D. 1988, 131 pp.
 TI THE CONTRIBUTION OF
 COMPUTER-GENERATED
 INSTRUCTIONAL GRAPHICS ON
 MEASURED ACHIEVEMENT GAINS: A
 META-ANALYSIS.
 SO DAI V50(02), SecA, p. 340.
 DE Education, Curriculum and Instruction.
 Education, Technology.

Purpose of the study. The purposes of this study were to: (1) Review the validity of claims about the contribution of computer-generated graphics on measured achievement, gains found in related research studies, (2) Analyze problems underlying the instructional graphics processes presented in the studies, and (3) Prescribe guidelines for future research studies in the teaching/learning environment based on the findings of meta-analysis.

Procedure. The quantitative data investigation was conducted in the following stages: (1) Locating Studies--through computer online search bibliographic search, and RTD (Research and Theory Division) documents of AECT conventions. (2) Describing Characteristics of 161 studies related to learning--to be illustrated in tables. (3) Quantifying Outcomes of 37 studies pertaining to teaching/learning. (4) Discussion of Findings. (5) Summary (Development of Guidelines).

Findings. The average effect sizes of four main variables and two sub-variables evaluated in this meta-analysis were as follow: (1) Overall achievement..33, a small positive effect, or a 33% increase of a standard deviation unit compared to other instructional modalities; (2) Correlation between aptitude and achievement. $-.099$, a negligible negative effect; (3) Course completion time. $-.161$, which indicated that the computer graphic-enhanced instructions did not contribute to any time savings compared to other instructional modalities, (4) Student attitudes toward computer graphic-enhanced instruction..54, a moderately significant effect; (5) Learning from electronic text..37, somewhat noticeable trace of significance when compared with less structured text organization methods; (6) Field-independence/dependence..39 for the field-independent group and..27 for the field-dependent group.

Conclusions. Except for the attitudinal survey, the effect sizes were too small to support the general assumptions that the computer graphic-enhanced instruction would be more efficient than other instructional modalities. The most effective subject areas were: geometry, physics, chemistry, and health education. Representational graphics were the most widely used graphic level, while the animated graphics were the most efficiently employed graphic form. The higher level learning tasks benefitted most from the graphic-enhanced instruction. Very little interactions were between the statistical findings and the learners' differences in their achievement.

AN UMI No. ADG89-10451.
 AU PETERS, CHRIS L.
 IN University of Georgia Ed.D. 1988, 113 pp.
 TI THE EFFECTS OF ADVISEMENT,
 CONTENT MAPPING, AND INTERACTIVE
 VIDEO ON LEARNER CONTROL AND
 ACHIEVEMENT IN COMPUTER-BASED
 INSTRUCTION.
 SO DAI V50(02), SecA, p. 348.
 DE Education, Curriculum and Instruction.
 Education, Technology.

This study took place in the context of efforts to improve the effectiveness of computer-based instruction (CBI) by giving the learner more control over the instructional process. Recent research in learner-controlled CBI has had mixed results: students typically display increased motivation and decreased achievement.

Three variables hypothesized to increase the effectiveness of CBI were investigated. These variables were: advisement (feedback given to help students evaluate their readiness for a lesson posttest), content maps (graphic organizers of lesson content), and interactive video (brief lesson-related news clips).

One hundred twenty, 7th grade students were randomly assigned to: (a) one of four treatments in a 2 x 2 design (advisement crossed with content mapping); or (b) a treatment which combined interactive video with advisement and content maps; or (c) to a control group. Students in all treatments except the control group were allowed to determine the instructional sequence and the amount of practice obtained before taking the posttest. Subjects engaged in an orientation lesson and three lessons on the U.S. Constitution.

Outcomes measured included time spent in each lesson, posttest scores, amount of practice requested and practice question achievement ratings. Qualitative data regarding students use of the program were gathered through observation and interviews with students.

The results of data analysis indicated that students receiving advisement requested more practice and answered more practice questions correctly on the first attempt than did students who received no

advisement. There were no differences in posttest scores among the two groups.

Students using maps scored no higher on posttests than students who did not use maps. Qualitative data suggest that students using maps did not have sufficient instruction or practice in using content maps as mnemonic devices for a map-related increase in performance to occur.

Students using interactive video scored no higher on posttests than students who did not use interactive video, although motivation and interest were apparently enhanced.

Qualitative data suggest that the effective exercise of learner-control options in CBI can be enhanced through mechanisms embedded in the program which support the learner's exercise of those options.

AN UMI No. ADG89-10075.
 AU TRIPP, STEVEN DUNDAS.
 IN The Penn. State Univ. Ph.D. 1988, 164 pp.
 TI A COMPARISON OF THE LEARNABILITY
 OF METAPHORICAL, FLOWCHART, AND
 TEXTUAL MEANS OF REPRESENTING
 COMMAND LANGUAGE SYNTAX.
 SO DAI V50(02), SecA, p. 350.
 DE Education, Curriculum and Instruction.

The effects of visual and verbal representations on the learning of command language syntax were investigated at two levels of language: consistent and inconsistent. First, a task-action grammar of four rules of the SuperPILOT lesson text editor was written. Structural inconsistencies were identified and a functionally equivalent, more consistent, language was designed. Three presentation treatments were devised. The first treatment consisted of a metaphorical notation plus text. The second and third treatments consisted of flowcharts plus text and text alone.

Subjects (n = 78) were given a short introduction and then immediately proceeded to learn the first of two command languages. Each language consisted of four rules. For each rule three practice problems were presented. After completion of the 12 practice problems, subjects returned to the first rule and proceeded to do three new problems for each rule. After the two blocks of practice problems, 12 application problems were administered without reference material or feedback. Subjects then advanced to the second command language for which the procedures were identical.

Statistical tests indicated that both graphic treatments were superior to text alone during the practice period. However, a posttest requiring application of the rules showed that the metaphor plus text treatment was superior to the other two. During both practice and application the consistent language was easier to learn and remember than the inconsistent one. No interaction between language and

presentation format was measured. Tests of elapsed times did not reveal speed-accuracy trade-offs. Results indicated that although graphic representations were superior to verbal presentations, within graphics there are empirical differences. Logical graphics and analogical graphics did not have equal instructional effects. It can be concluded that in situations where command languages must be recalled after limited training, a metaphorical notation of the type used herein is the most desirable form of representation. Although the research demonstrated that a consistent language is easier to learn than an inconsistent one, it also indicated that relatively consistent languages of at least a certain level of complexity will benefit from being presented in the metaphorical notation.

- AN UMI No. ADG89-08846.
- AU SIMMERS, MICHAEL JOHN.
- IN University of Illinois at Urbana-Champaign
Ph.D. 1988, 126 pp.
- TI VISUAL IMPAIRMENT AND COMPUTER
DISPLAYS: THE EFFECTS OF
FOREGROUND AND BACKGROUND
COLOR ON ORAL READING SPEED.
- SO DAI V50(02), SecA, p. 406.
- DE Education, Secondary. Education, Special.
Computer Science.

Nine female and 6 male visually impaired junior and senior high school students with a mean age of 14.75 years were individually tested using a microcomputer with a color monitor. The research questions were: (a) What is the relationship between the pairs of foreground and background screen colors and each of the dependent variables (oral reading rate, comfort rating, and brightness-contrast adjustment) for partially sighted junior and senior high school students reading CRT displayed text? (b) Is there a difference between the results obtained for the dependent variables across the pairs of foreground and background screen colors? The independent variable had six conditions: white, green, or yellow text against black and black text against white, green, or yellow. A multi-element baseline repeated measures design was employed.

Fourteen practice and 42 test passages were randomly displayed without replacement over eight sessions. The condition used with each passage was determined by the item's position in a Latin square generated for each subject. Prior to the display of a passage, the subjects could adjust the brightness and contrast of the screen. The subjects rated the comfort of the condition used with each passage on a Likert-type scale. The brightness-contrast levels, comfort ratings and oral reading rates were recorded.

ANOVAs were calculated for each dependent variable. Significant results were obtained for brightness-contrast only. This suggests that brightness-contrast is the most crucial factor for effective CRT use by visually handicapped students. The results for brightness-contrast differed from

those obtained for oral reading rate and comfort rating. The results for oral reading rate and comfort rating were parallel. Foreground and background color appear to have little influence on oral reading rate or perceived comfort of display colors. However, a visual inspection of the data revealed a strong tendency for CRT reading tasks to be performed better with light background displays, but for dark background ones to be preferred. Software and hardware developers need to use color displays which provide maximum perceived contrast and incorporate ways for the user to select colors which meet his/her personal needs.

- AN UMI No. ADGDX-85288.
- AU MOHAMEDALI, MAZAHIR HUSSEIN.
- IN Council for National Academic Awards (United Kingdom) Ph.D. 1988, 415 pp.
- TI MICROCOMPUTERS IN EDUCATION: THE
INFLUENCE OF FEEDBACK ON
LEARNING AND MOTIVATION.
- SO DAI V50(02), SecA, p. 419.
- DE Education, Technology. Available from UMI in
association with The British Library.

This thesis contains one survey and six experiments which have examined microcomputers in education. The survey was conducted in Herfordshire to provide information about microcomputer use both in school and at home. All schools were found to possess microcomputers but only a limited number of pupils reported using the machines. The extent and type of use was found to be affected by gender, access to home computer, experience, and competence. The survey included a measure of programming competence and factors that influenced this were investigated. Able programmers were frequently found to be male and to have access to home computers. A series of experiments examined the influence of feedback on learning and motivation. Experiment one involved the learning of grid co-ordinates in conditions of either no feedback, comments, competitive, self targeted feedback, or a combination of these. Pre- to post-task learning measures supported the view that learning of co-ordinates had occurred but there were no between condition differences. Experiment two, however, showed these conditions differed in their motivational appeal to children. Experiments three to six used a "clock" task where children learned to tell the time using an analogue clock. Experiment three revealed that delayed feedback produced inferior learning to either no feedback or immediate feedback. Experiment four demonstrated that explicit information concerning errors did not facilitate pre-post test learning although simple knowledge of correctness, or having no feedback, did aid learning. Experiment five showed that learning improvements in no-feedback groups could not be attributed to the use of a digital strategy since even without the presence of a digital display, no feedback groups performed as well as immediate feedback groups. Experiment six examined the issue

of attention for feedback. Pre- to post-task tests showed that the no feedback group performed as well as try-again, answer-till-correct and example conditions. The no feedback group also required less time to complete the task. The thesis has extended the existing literature on feedback into the domain of child learning. The research has demonstrated that expectations from feedback generated by research on adult subjects do not consistently apply to children using microcomputers. The findings are discussed in terms of computer experience, types of feedback, subjects, and cognitive development in terms of Piaget and Karmiloff-Smith.

AN UMI No. ADG89-07952.
 AU CASS, KIMBERLY ANN.
 IN The Univ. of Arizona Ph.D. 1988, 351 pp.
 TI ASSESSING THE USEFULNESS OF
 DOMAIN AND METHODOLOGICAL
 TUTORIALS FOR NOVICE USERS
 EMPLOYING AN EXPERT SYSTEM AS AN
 ADVICE-GIVING TOOL.
 SO DAI V50(02), SecA, p. 282.
 DE Information Science. Computer Science.

The purpose of this dissertation is to examine the impact of domain and methodological tutorials on the attitude and performance of end-users who are neither well-versed in the domain area nor well-versed with an expert system which is designed to assist them in solving software selection tasks. With respect to these tasks and the mechanism for accomplishing them, the end-users can be categorized as "non-technical users." The design of this experiment was a 2 x 2 full factorial laboratory experiment employing eighty novice users as subjects. Each of the experimental subjects was randomly assigned to one of the four treatment groups corresponding to receipt or lack of receipt of tutorials concerning the problem domain and methodology employed by an expert system. The results of this research indicate that there is a significant interaction between receiving the application and expert system tutorial videos; better performance in terms of correct categorization of problems was observed in subjects who saw either both or neither video whereas worse performance was observed in subjects who saw only one video. In general, the video treatments were unrelated to a variety of attitude measures applied to the subjects. However, it was found that prior attitudes towards the use of computers were significantly related to the majority of the (posttest) attitude measures. Further, the general pattern was for attitudes towards computers to improve as a result of undergoing the experimental process with the viewing of the expert system video to be significant in the level of improvement.

AN UMI No. ADG89-09952.
 AU SHAMP, SCOTT A.
 IN The University of Utah Ph.D. 1989, 225 pp.
 TI MECHANOMORPHISM AND PERCEPTIONS
 OF COMPUTER COMMUNICATION
 PARTNERS.
 SO DAI V50(02), SecA, p. 283.
 DE Information Science. Speech Communication.
 Mass Communications.

In computer-mediated communication (CMC), little information outside of content is exchanged. Because nonverbal elements are missing in CMC and the appearance one person's message is indistinguishable from that of another person's, it was hypothesized that the perception of the computer plays an influential role in perception of the computer communication partner. This study investigated whether use of the computer to communicate leads to mechanomorphism, the perception of the computer communication partner as machine-like. Twenty-five computer bulletin board users accessed a computer bulletin board operated by the researcher and completed an individualized computer administered questionnaire. In the questionnaire, respondents used 20 adjective agreement scales to assess (1) the computer, (2) a person from whom they received personal information via the computer, (3) a person from whom they received nonpersonal information via the computer, (4) a person with whom they communicated through media other than the computer, and (5) themselves. In addition, respondents provided information on their computer use, computer skill level, and their previous communication with the communication partners that were assessed. The assessments were compared to determine how use of the computer to communicate with a person affects the perception of that person. The findings indicate that perceptions of computer communication partners were more similar to perceptions of the computer than were perceptions of a person with whom the individual communicated through media other than the computer. In addition, perceptions of computer communication partners from whom the individual received nonpersonal information were more similar to perceptions of the computer than were perceptions of computer communication partners from whom the individual received personal information. These findings suggest that mechanomorphism takes place in computer-mediated communication. The implications of mechanomorphism are discussed and methods for minimizing its negative impact are presented.

AN UMI No. ADG89-08509.
 AU KREIGH, ROBERT JOSEPH.
 IN Texas Tech Univ. Ph.D. 1988, 116 pp.
 TI AN EVALUATION OF THE EFFECTS OF
 TRANSFER OF PRACTICE BETWEEN
 VARIOUS COMPUTER MENU
 CONFIGURATIONS.
 SO DAI V50(02), SecB, p. 772.
 DE Psychology, Experimental. Education,
 Technology. Education, Curriculum and
 Instruction.

The storage and retrieval of information is rapidly evolving as a major function performed by computer systems. One common approach for database information retrieval is the use of menu selection systems. Studies to date have focused on three major approaches towards improving menu retrieval performance: by changing the macro structure of the menu hierarchy, by changes to the micro structure of specific menu pages, and through the provision of training and practice.

The effects of experience have been readily demonstrated in menu selection tasks, where performance improves with extended practice on a particular menu hierarchy. Studies suggest that experience with a particular menu database enhances user performance, because the user becomes familiar with the location of selection alternatives on specific pp. However, recent evidence suggests that the general process of menu selection, independent of database familiarity, is also enhanced with practice.

The current study is concerned with the effects of practice on the general processing of menu items. If this General Processing Effect is independent of the menu's configuration, then the effects of practice should be similar between menu configurations of various breadths (i.e., number of alternatives per page). However, if this effect is related to the specifics of the menu page, then the transfer of practice (positive or negative) should vary between menus of different breadth.

Subjects worked through 2 series of 30 single-page menu searches. Menu pages contained either 2, 4, or 8 alternatives per page. Results suggest that a General Processing Effect exists, where menu selection performance is influenced by prior experience with menu selection. Both positive and negative transfer of practice was found, where prior experience with narrow menus (i.e., 2 alternative per page) was found to be detrimental to menu selection from broader menus (i.e., 8 alternatives per page). It is hypothesized that the General Processing Effect is due to the use of different search strategies for menus of different breadths. Further research is suggested to validate these hypotheses.

AN UMI No. ADG89-10833.
 AU HURLEY, WILLIAM DAVID.
 IN The George Washington University D.Sc. 1989,
 343 pp.
 TI A GENERATIVE TAXONOMY OF
 APPLICATION DOMAINS BASED ON
 INTERACTION SEMANTICS.
 SO DAI V50(03), SecB, p. 1021.
 DE Computer Science.

User interface designers need tools that actively encourage good user interface design, provide sophisticated software development support, and are easy to learn and use. Three goals for the next generation of user interface tools are helping designers to separate user interface from application, enhancing software reuse, and generating run-time user interface software from high-level specifications. Achieving these goals requires a better understanding of the interface between user interface and application---the UI-AP interface.

This study defines a model of the UI-AP interface and describes a methodology for generating a taxonomy of application domain descriptions based on the model. The UI-AP interface model consists of a set of modeling primitives with more descriptive power than those in traditional object-centered models and serves as a template for describing interaction semantics: interactions between user interface and application and knowledge about the application required by the user interface to process these interactions. The model provides a high-level representation for describing interactive systems and supports specification techniques that enhance opportunities for reusable software components. The model is incorporated into a generative taxonomy system that defines a methodology for generating new application domain descriptions from existing descriptions, starting with descriptions of interaction semantics common across a broad range of applications. The application descriptions provide a framework for resolving trade-offs involving separation, facilitate identifying opportunities for reusable software, and serve as more detailed templates for design and implementation of interactive systems. The model and the generative taxonomy system are implemented as a knowledge-based tool that demonstrates the feasibility of the model and the generative taxonomy system as an architectural base for specifying interactive software and for creating an exploratory research environment.

AN UMI No. ADG89-11322.
 AU NOVICK, DAVID GRAHAM.
 IN University of Oregon Ph.D. 1988, 237 pp.
 TI CONTROL OF MIXED-INITIATIVE
 DISCOURSE THROUGH
 META-LOCUTIONARY ACTS: A
 COMPUTATIONAL MODEL.
 SO DAI V50(03), SecB, p. 1025.
 DE Computer Science. Language, Linguistics.

Human-computer interaction typically displays single-initiative interaction in which either the computer or the human controls the conversation. The interaction is largely preplanned and depends on well-formed language. In contrast, human-human conversations are characterized by unpredictability, ungrammatical utterances, non-verbal expression, and mixed-initiative control in which the conversants take independent actions. Traditional natural-language systems are largely unable to handle these aspects of "feral" language. Yet human-human interaction is coherent for the participants; the conversants take turns, make interruptions, detect and cure misunderstandings, and resolve ambiguous references. How can these processes of control be modeled formally in a manner sufficient for use in computers?

Non-sentential aspects of conversation such as nods, fragmentary utterances, and correction can be seen reflecting control information for interaction. Such actions by the conversants, based on the context of their interaction, determine the form of the conversation. In this view ungrammaticality, for example, is not a problem but a guide to these "meta" acts. This dissertation develops a theory of "meta-locutionary" acts that explains these control processes. The theory extends speech-act theory to real-world conversational control and encompasses a taxonomy of meta-locutionary acts.

The theory of meta-locutionary acts was refined and validated by a protocol study and computational simulation. In the protocol study, subjects were given cooperative problem-solving task. The conversants' interaction, both verbal and non-verbal, was transcribed as illocutionary and meta-locutionary acts. The computational model was developed using a rule-based system written in Prolog. The system represents the independent conversational knowledge of both conversants simultaneously, and can simulate their simultaneous action. Simulations of the protocol conversations using the computational model showed that meta-locutionary acts are capable of providing control of mixed-initiative discourse. The model agents can, for example, take and give turns. A single agent can simultaneously take multiple acts of differing control. The simulations also confirmed that conversations need not be strictly planned. Rather, mixed-initiative interaction can be plausibly controlled by contextually determined operators.

This research has application to natural language processing, user interface design and multiple-agent artificial intelligence systems. The theory of meta-locutionary acts will integrate well with existing speech-act-based natural-language systems.

AN UMI No. ADG89-15768.
 AU TSAI, CHIA-JER.
 IN The Florida State Univ. Ph.D. 1989, 132 pp.
 TI THE EFFECTS OF COGNITIVE LOAD OF
 LEARNING AND PRIOR ACHIEVEMENT IN
 THE HYPERTEXT ENVIRONMENT.
 SO DAI V50(03), SecA, p. 670.
 DE Education, Technology. Education, Curriculum
 and Instruction. Education, Sciences.

This experimental study explored the optimal use of hypertext for instruction by investigating the following questions: What are the effects of cognitive load of learning on learning outcomes and efficiency? Are there interactive effects between cognitive load and aptitude on students' learning outcomes and enjoyment of instructional method?

Seventy-nine ninth-grade students from a north Florida urban research school participated in this research. Six students participated in one-to-one evaluation of the materials, and 73 participated in the experiment.

The independent variables were cognitive load of learning and learning aptitude. Cognitive load was manipulated with learning guidance and access constraint to create two treatment groups--Hierarchical hypertext and prototype hypertext. Learning aptitude was chosen to be prior achievement in science, the subject area of the instructional treatment. Subjects' science scores on the Comprehensive Tests of Basic Skills were used as prior achievement data.

The dependent variables were general, intentional, and incidental learning outcomes, learning efficiency, and enjoyment of instructional method. Learning outcomes were measured with a multiple choice posttest, and enjoyment was measured with a questionnaire with an eight-point scale.

The experiment was a posttest-only, equivalent-groups design. Subjects of the same sex were pair-matched based on prior achievement and randomly assigned to the treatment groups. After subjects finished the hypertext instruction, they took the posttest and then answered the questionnaire. The results were analyzed with interval estimation.

Except results on enjoyment, most results are not statistically significant at the .05 alpha level. But the pattern of most results is consistent with theoretical predictions. Hierarchical hypertext was more effective for all categories of learning outcomes than prototype hypertext, but the advantage decreased with increasing prior achievement. Also hierarchical hypertext was more efficient for low aptitude students, but was less efficient for high aptitude students. Low aptitude students preferred

hierarchical hypertext, and high aptitude students preferred prototype hypertext. Implications of learning path data collected for educational research are also discussed.

AN UMI No. ADG89-11159.
AU CALLOWAY, LINDA JO.
IN New York University, Graduate School of Business Administration Ph.D. 1989, 218 pp.
TI AN APPROACH FOR ASSESSING TOOLS FOR DESIGNING DIALOG STRUCTURES: A STUDY OF THE DIALOG CHARTS.
SO DAI V50(03), SecA, p. 563.
DE Information Science. Computer Science.

When a person interacts with a computer, a dialog occurs. The dialog component of an interactive human/computer system provides the interfaces between user task requirements and system functions. This dialog component also maintains control and contextual information during the interaction. The Dialog Charts (Ariav & Calloway, 1988) were developed specifically for the conceptual design of the control structures of interactive human/computer systems. Designing highly interactive human/computer systems is a most critical area in Software Engineering. However, rigorous research into the way designers use tools to structure these dialogs is practically non-existent.

This dissertation constructs a qualitative research methodology aimed at discovering a set of categories and relationships that characterize usage of a target tool and applies the assessment methodology to the Dialog Charts. The research methodology uses empirical information derived from a field experiment with teams of designers who used the Dialog Charts while developing interactive systems. Each team selected its own system. The data was gathered in a non-directed, semi-structured interview where the agenda was hidden from the respondents. The taped interviews were used in the fashion of archival data, as a source for data-driven qualitative content analysis.

The methodology has uncovered a rich set of observations about designers and their tools. The study reveals that designers develop strong attitudes and feelings towards their tools. They also related using the target tool in a rather striking variety of tasks including communicating information from task to task and among team members, in all levels of design generation, while programming, and in design evaluation. The tool and its design products were used opportunistically, wherever the designers found them applicable. The designers did not report discovering the usefulness and value of the tool until late in the design and development process. Many observations were surprising and unanticipated, and

it therefore seems that the methodology is useful in establishing categories and relationships that are characteristic of new design tools.

AN UMI No. ADG89-11464.
AU DAWSON, DAVID LIONELL.
IN Univ. of South Dakota Ph.D. 1989, 130 pp.
TI MENUING VERSUS WINDOWING WITH SPATIAL CUES AND GLOBAL SCREEN ACCESS.
SO DAI V50(03), SecB, p. 1137.
DE Psychology, Experimental. Computer Science.

In response to the increasing prominence of windows in human/computer interfaces, this study was undertaken to explore the impact of window spatial relationships and multiwindow availability on errors made and time required to find terminal points in a nested menu system.

Subjects in the present study were presented with either a screen that made available all the targets directly in a large menu, a screen containing only one window, a screen containing several windows arranged to provide information concerning the underlying relationship between the windows, and a screen that allowed users to move the cursor globally over the screen and select from any visible window.

Data regarding the number of selections, the number of errors and the time required to find a given terminal point in the tree structure of windows were collected.

The condition that presented the subjects with an arbitrarily ordered list of terminal points without requiring menu structure navigation produced the fewest errors and took the least time for users to complete their tasks. Spatial organization of the windows on the CRT did not have an impact upon the criterion variables.

Allowing users to move a cursor anywhere on the screen did reduce the number of transactions required to reach a given target, indicating the users took advantage of the greater variety of often more direct routes through the menus. Surprisingly, it took users about the same amount of time to reach a given terminal point when they could access the entire screen and all the windows on it as when they only had access to one window at a time.

It appears, at least for this study, a simple disorganized list of options was better than requiring the navigation of a group of windows. Also, neither the ability to access many windows or the spatial layout of windows assisted the users in completing the navigation task more quickly or accurately.