

ABSTRACTS OF INTEREST



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AN University Microfilms Order Number
ADG85-16973
AU GAY, GERALDINE K.
IN Cornell University Ph.D. 1985, 154 pages.

TI Interaction of learner control and prior conceptual understanding computer-assisted video instruction.

DE Education, Psychology.

It is commonly assumed that individual differences in abilities and aptitudes will be accommodated if learners have more control over the pace, amount of practice, or style of the instruction they receive. The purpose of this experiment was to examine the question of how much control should be given to individuals with varying degrees of prior conceptual understanding within the context of computer-assisted video instruction.

Based on pretest scores, 80 subjects were randomly selected, half with low and half with high prior conceptual understanding of the subject matter. Half of the subjects from each group were randomly assigned to a program vs. learner control treatment comprised of computer-assisted video instructional modules on protein synthesis. A 2 x 2 analysis of variance was conducted on posttest scores and time on task, followed by a regression analysis to assess the relationship of other independent variables with post-test scores and time on task.

As expected, in the learner control condition, subjects with high prior conceptual understanding in the subject

area made significantly better use of control options (sequencing of material, review, remediation, depth of study, and amount of practice) and their time than did subjects with low prior conceptual understanding. In the program control condition, there were significant time on task differences between low prior conceptual understanding and high prior conceptual understanding subject. Low prior conceptual understanding subject had significantly higher post-test scores in the program control conditions than in the learner control condition. However, there were not significant differences in time on task between conditions. Finally, high prior conceptual understanding subjects performed equally well in both program control and learner control conditions. They were much more efficient in their use of time in the learner control condition.

AN University Microfilms Order Number
ADG85-28268.
AU KONDAKCI, SUNA.
IN State University of New York at Buffalo Ph.D.
1985, 262 pages.

TI An interactive approach for scheduling of job shops with dual constraints.

DE Engineering, Industrial.

For the last two decades, the main emphasis in the research of job shop scheduling was on the development of rules that are heuristic in nature. The analytical techniques not only oversimplified on the job shop environment but also were computationally unattractive.

This research proposes an interactive man-computer approach for a scheduling task which is the final stage in production planning. An interactive system was developed for a dual-constraint dynamic job shop production environment.

The interactive scheduling and fifteen dispatching rules were tested for different shop conditions. Three factors — the arrival rate of the jobs, the tightness of due dates and the variation in processing times — were varied to create different shop conditions. Several information displays were designed to help the human scheduler in his decision-making process. The performance of the human scheduler and the performances of dispatching rules were evaluated on the basis of tardiness and other measures relevant to job shop environment.

The usage of displays were analyzed in terms of different shop conditions and the human schedulers' ability to process information.

AN University Microfilms Order Number
ADG85-29529.
AU MCCLURG, PATRICIA ANN.
IN University of Oregon Ph.D. 1985, 106 pages.

TI A study of the effects of playing selected microcomputer games on the spatial ability of fifth, seventh, and ninth grade males and females.

DE Education, Curriculum and Instruction.

This experimental study investigated whether fifth, seventh, and ninth grade students participating in selected computer games utilizing spatial skills would improve their scores on spatial ability measures. Three treatment conditions (students playing The Factory, students playing Stellar-7 and a control group) were considered.

The subjects were 57 students from middle class school in Laramie, Wyoming. The random assignment by sex to treatment groups of subject resulted in roughly equivalent grade level groups. A measure of spatial visualization (Mental Rotation Test) and a measure of spatial orientation (Structure of Intellect-Learning Ability-CFS) were administered as pre and post tests. The six week intervention consisted of 45-minute sessions twice a week.

Analysis of covariance, covarying on the pretest, was used to examine the results. A significant treatment effect ($p > .02$) was found on the spatial visualization measure. Both the Factory and Stellar groups outperformed the control group ($p < .05$). No significant interaction effects of main effects were found for trade level or sex, indicating that the observed treatment effects were beneficial to both male and female subjects at the fifth, seventh and ninth grades. Significant Pearson Correlation Coefficients were found between Stellar-7 scores and MRT scores ($r = .484$, $p < .02$) and SOI-LA-CFS scores ($r = .48$, $p < .02$).

Planned comparisons found no significant differences between males' and females' unadjusted MRT scores. However, a significant difference ($p < .05$) was found in favor of the males when only the seventh and ninth grade MRT scores were considered. Intra-sex variation was greater than inter-sex variation. No significant ($p > .05$) sex by grade level interaction was found.

A distinct ceiling effect was noted on the spatial orientation test and no statistically significant results were detected using this instrument.

Results of this study suggest that the computer may be helpful as a tool for enhancing the development of spatial ability as measured by the Mental Rotation Test. Identified spatial components of the two games included visual perception and discrimination, differentiation of opposite obliques visualization of transformations in series, and the development and updating of cognitive maps.

AN University Microfilms Order Number
ADG85-27769.
AU ABRAMS, ARNOLD H.
IN Oregon State University Ph.D. 1986, 261 pages.

TI Effectiveness of interactive video in teaching basic photography skills.

DE Education, Technology.

The major purpose of this study was to assess the effectiveness of interactive video in the teaching/learning process. More specifically, comparison was made of the relative effectiveness of interactive video and linear video as delivery modes in the acquisition of basic photography skills in an independent learning environment at a college level. All instructional materials were produced expressly for the study by the investigator.

This study employed the largest sample size of any research project to date published on the instructional effectiveness of interactive video (N 128). An experimental pretest to posttest design was used. Students in educational media classes were randomly assigned to interactive video (IV; N 64) and linear video groups (LV; N 64). Analysis of covariance was used to compare achievement of the experimental group with that of the control group.

Participants also completed an attitude survey. This form offered insights into students' perceptions concerning the instruction. Significance of between group differences on individual items was tested using the Mann-Whitney U-test, and ordinal consensus was measured using a Leik scale.

Results indicated that the IV group recorded significantly and consistently larger achievement gains than did the LV group. There was a difference in means between pretest and posttest scores of 29.70 (from 49.80

to 79.50) points for the linear group as compared to 35.81 (48.94 to 84.75) for the IV group. the average difference of 6.11 points in favor of the IV group, is significant at the .001 level ($f = 10.48$).

Sixteen of 28 items on the attitude survey had significant differences in group means ($p > .05$). Twenty-one means favored the IV group. Key attitude differences concerned level of learner control, level of interaction, and preference over traditional methods of instruction.

Time efficiency was not increased with interactive video. The LV group took 30 minutes to watch the tape. The group's time ranged from 34 minutes to 70 minutes with an average of 49 minutes. Interactive video instruction, if carefully designed and implemented, can be a very powerful and effective method of instruction from the viewpoints of both achievement and attitude.

AN University Microfilms Order Number
ADG85-27354.

AU BROWN, STEPHEN FRANCIS
IN North Texas State University Ph.D. 1985, 172 pages.

TI The use of learning theory in the application of artificial intelligence to computer-assisted instruction of physics.

DE Education, Technology.

It was the purpose of this research to develop and test an artificially intelligent, learner-based, computer-assisted physics tutor. The resulting expert system is named ARPHY, an acronym for Artificially Intelligent Physics tutor. The research was conducted in two phases.

In the first phase of the research, the system was constructed using Ausubel's advance organizer as a guiding learning theory. The content of accelerated motion was encoded into this organizer after subclassification according to the learning types identified by Gagne. The measurement of the student's level of learning was accomplished through the development of questioning strategies based upon Bloom's taxonomy of educational objectives.

The second phase of this research consisted of the testing of ARPHY. Volunteers from four levels of first-semester physics classes at North Texas State University were instructed that their goal was to solve three complex physics problems related to accelerated motion. The only students initially instructed by ARPHY were from the class of physics majors. When the threshold values of the pedagogical parameters stabilized, indicating the fact that ARPHY's instructional technique had adapted to the class's learning style, students from other classes were tutored.

Nine of the ten students correctly solved the three problems after being tutored for an average of 116 minutes. ARPHY's pedagogical parameters stabilized after 6.3 students. The remaining students, each from a different class, were tutored, allowing ARPHY to self-improve, resulting in a new tutorial strategy after each session.

It is recommended that future research into intelligent tutoring systems for science incorporate the principles and theories of learning which this research was based upon. An authoring system based upon the control structure of ARPHY should be developed, since the modular design of this system will allow any field that can be organized into a net-archy of problems, principles and concepts to be tutored.

AN University Microfilms Order Number
ADG85-26522.

AU BIALAC, RICHARD N.
IN University of Cincinnati Ph.D. 1985, 253 pages.

TI Analysis of the effectiveness and efficiency of business decision-making using computer graphics.

DE Computer Science.

Business computer graphics have rapidly grown into what by 1986 will be an \$8 billion per year industry. Managers seem to feel they intuitively make better decisions aided by computer graphics (as measured by the number of applications that are cited), but so far there has been only limited empirical research in the area of computer graphics for decision making.

This study explores the relationships involved in determining how decision makers make more effective decisions more efficiently by using computer graphics. The mechanism for examining the many possible hypotheses was to use experienced managers in a timed, closed-cell examination. Many relationships are studied. Subgroups were established to test the effect of tabular versus graphical formats data interpretation.

The test is timed to simulate the need for efficient decision making under pressure. Several types of studies will be done comparing the data presentation formats found in trade papers, the national daily *USA Today*, the Graduate Management Aptitude Test (GMAT), and financial presentations and annual reports.

AN University Microfilms Order Number
ADG85-29893.

AU CHI, ULI HAN-HSIANG.
IN University of Washington Ph.D. 1985, 231 pages.

TI A model and notation for specifying user interfaces.

DE Computer Sciences

A new model and notation for describing and specifying user interfaces is proposed and evaluated. The model presents an object oriented view of user interfaces that explicitly provides for concurrent interaction with multiple users and/or applications. The notation is developed based on the dual approaches of algebraic specifications (for describing the objects of the interface) and flow expressions (for describing interaction between interface objects, users and applications). Using the notation, a range of generic user interface abstractions are specified, including logical input and output devices, editing-based objects, and time-constrained interaction. Combining these notions, three existing commercial user interfaces that involve text, graphical animation and concurrency are specified, demonstrating the practical utility of the model and notation. Finally, the notation is applied as a design tool and as a basis for rapid prototyping of a new user interface design for a simplified multi-user computer conferencing system.

AN University Microfilms Order Number
ADG85-26773.
AU GHAHARI, AGHA KAMAL.
IN The George Washington University, D.Sc. 1985, 239 pages.

TI A design methodology for on-line menu-driven information retrieval systems.

DE Computer Sciences

Currently, there are thousands of information specialists, each one handling hundreds of queries per year. The queries for information cover every aspect of available information. All information, if it is to be available for quick retrieval, has to be held in some sort of database as part of an information system. The problem is how to design these systems so any required information may be obtained quickly and easily. This thesis investigates a methodology for designing on-line menu-driven information retrieval systems that meet requirements for ease of use and quick response.

The dissertation characterizes an interactive user interface based on a menu-driven system. The characterization begins by describing the menu-driven interface and goes on to model the basic menu systems.

To address some the more practical issues the design and implementation of HC Online Information System is discussed: an interactive and menu-based information system with quick response time. The design methodology is applied to HC Online using a hierarchical searching keys concept and inverted file techniques.

AN University Microfilms Order Number
ADG85-28021.
AU MCDANIEL, JOHN WILLIAM.
IN Kansas State University Ph.D. 1985, 192 pages.

TI A model for instructional software programming concepts.

DE Computer Sciences

A methodology for conveying computer science concepts via game-playing to non-computer science majors using reductionistic teaching techniques was developed. Three different games were developed following the guidelines of the model.

The model is divided into several phases. In the early phases, the user is given a problem to be solved using only a "mouse" (or, alternatively, a selection of function keys) and successful completion of the problem results in one advancing to the next phase. The advanced phases generate code in a "Pascal-like" language to be replicated by the student.

Two of the games were implemented (one in Basic, one in Pascal) on microcomputers, and the graphic capabilities of the hardware were utilized whenever possible. One of the games was used as the first homework assignment in two CS-200 (Introduction to Computer Science) classes the Summer of 1984. The students in the two classes (one experimental group, one control group) were given questionnaires to determine their attitude towards (and, hence effectiveness of) the software package. The results from a statistical analysis of the responses were positive.

AN University Microfilms Order Number
ADG85-29946.
AU SCOFIELD, JEFFREY ALAN.
TI Editing as a paradigm for user interaction.

DE Computer Science.

The most difficult part of the programming task is often the creation of the component for interacting with the person who will use the program. This component is called the user interface. This dissertation describes the design of a framework for high-quality, highly interactive interfaces for all parts of a system. The uniformity, extensibility, and flexibility of this framework guarantee the existence of nearly identical user interfaces for all objects, automatically provide a means of interacting with new objects, and allow new interfaces to be built easily, when necessary, from a set of standard components.

The user interfaces of this system are based on the natural and responsive principles of the screen-oriented editor, generalized to allow interactions with objects of all types. Editors use structural information to control the editing process, which allows them to guarantee that edited objects are well formed, while assisting the user with structural details.

The editors are designed as interfaces to an object-oriented system. Furthermore, editors themselves are built using a set of cooperating objects and types (corresponding to Smalltalk classes). In particular, the syntactic descriptions of valid object structures are implemented as direct extensions to the type system.

The dissertation includes a detailed design and examples of interaction with many types of objects. The design has been tested by means of prototype implementation in Lisp, running on a standard timesharing system, from which the examples are drawn. The dissertation concludes with a discussion of the experience derived from this implementation, followed by suggestions for improvements and further research.

AN University Microfilms Order Number
ADG85-27918.

AU SNELL, JAMES LOFTIN.

IN State University of New York at Binghamton Ph.D.
1986, 225 pages.

TI A system model of cognition for improving human factors of computing environments.

DE Computer Science.

The literature on computer-human interaction is strong on empirical studies of particular problems and phenomena, and on practical design guidelines, but offers little in the way of overall theoretical framework for either. Meanwhile, in cognitive psychology and artificial intelligence various theories of human cognition are currently being debated, but have not been systematically related to issues of computer-human interaction. In this dissertation, a systems model of human cognition is developed that encompasses the relevant areas, based partly on model of Norman, Minsky, and Lowen. On the basis of this cognitive system model, a model of computer-human interaction is then developed, and from it are derived design principles with direct application to improving human factors of computer environments.

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Proceedings of the CHI'86 Conference, Boston, April 13-17. To be available in September 1986.