Management Systems Laboratories
1900 Kraft Drive
Blacksburg, Va. 24060

(2)

Subject: ONR Quarterly Progress Report; First Quarter Period March-June 1991.

Title: Automating a Detailed Cognitive Task Analysis For Structuring Curriculum.

Activities: N00014-91-J-1500 (VPI)



Official notification of grant award was not received by the University until April 30, 1991. Due to the delays in processing, I was not notified of formal award until May 6. Consequently, no official charges to grant activities have been made. We have, however, for the past five months been reviewing the body of knowledge relating to knowledge acquisition and cognitive task analysis techniques. A rather substantial literature has been amassed relative to automated knowledge acquisition but only seven references have been found in our data base search of literature specifically addressing cognitive task analysis. A variety of forms of cognitive task analysis are implied in the literature relative to automated knowledge acquisition. These analysis methodologies are not made explicit with the exception of repertory grids. This may be why repertory grids are so popular within the research community. The problem with grids is that they do not lend themselves to eliciting process models involving multi-step chains of inferences. They do appear to be quite adequate when forming classifications.

Our review of the literature has in a sense validated our proposed approach to employ GOMS for knowledge elicitation. Although we are focusing upon knowledge elicitation for structuring curriculum, it's only one application which can potentially benefit from automating GOMS. Other potential applications include: 1) developing knowledge bases for production systems for any application which requires task specific knowledge; 2) generating problem representations for both group and individual problem solving environments; 3) conducting a complexity analysis for establishing ease of use of man machine interfaces. With slight modifications to the semantics of a GOMS analysis I also believe that the analysis can elicit models of physical systems made up of a hierarchy of components. That is, GOMS may lend itself to an analysis of physical systems by way of a functional decomposition of system components.



Our body of knowledge review relative to knowledge acquisition is currently being organized. We are creating a classification of methods along a continuum which reflects the degree to which a method for compiling knowledge is automated. We have identified three classes of methods: 1) Manual (e.g. interview, questionnaire, protocol analysis, card sorting, ordered trees, etc.); 2) Machine-Aided (e.g. functional decomposition, repertory grids, hierarchical scaling, multi-dimensional scaling, general weighted networks, etc.) and Machine Compiled (e.g. induction, neural nets, EBL, genetic algorithms etc). We have identified well over thirty methods form our review of the literature and we will be specifying the characteristics which both generalize and discriminate methods. We will then augment GOMS based upon lessons learned.

Attached you will find a second level work breakdown of tasks to be accomplished for year one. This is an expanded version of tasks specified in the proposal. We are compressing our schedule due to the delay in receiving formal award. We do not anticipate any deviation from the attached schedule which will keep us on track with the work originally proposed. We shall complete our body of knowledge review by the end of July and will complete our analysis of design

MSL

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May 28, 1991

Defense Technical Information Center
Building 5, Cameron Station
Alexandria, Virginia 22304-6145

Dear Sir/Madam:

Enclosed please find two copies of the first quarterly report of our grant activity #N00014-91-J-1500, "Automating a Detailed Cognitive Task Analysis for Structuring Curriculum."

Sincerely,

Kent E. Williams

KEW:cmm
Enclosures

College of Engineering • Department of Industrial and Systems Engineering
Virginia Polytechnic Institute and State University

constraints by the end of August. A technical report of our review will be generated by the end of August.

I have made contact with Dr. Robert Ahlers of NTSC who will be kept informed of our efforts. Bob as you know is interested in this activity. I have also made contact with David Kieras to discuss activities and his involvement. He will be receiving a subcontract as consultant and a copy of this letter report with attachments.

Sincerely,

Kent E. Williams

**Automating a Detailed Cognitive Task Analysis For Structuring Curriculum:**
**Research Plan**
**Year 1**

Task 1.0 Design

Task 1.1 Conduct body of knowledge review relative to cognitive task analysis techniques and automated knowledge acquisition techniques.
Complete by end of July.

Task 1.2 Analysis of cognitive task analysis methodologies and automated knowledge acquisition techniques to identify needed constraints for both elicitation and refinement.
Complete by end of August.

Task 1.3 Chart process flow of design identifying constraints at each activity within the process flow diagram keeping in mind any interactions between activities and constraints.
Complete by end of September.

Task 1.4 Select software package for implementation of process flow DOS compatible.
Complete by end of September.

Task 1.5 Develop rules which will formalize process flow as a production system for both elicitation and refinement.
Complete by mid-December.

Task 1.6 Specify interface requirements for user interaction for both inputs and outputs.
Complete by end of October.

Task 1.7 Design and prototype interface.
Complete by end of January.

Task 1.8 Conduct manual Simulation and Review of Design; develop a complete worked through example of an interaction with the system for review and critique of the design.
Complete by end of January.