Research Methods in Human Factors and Applied Cognition:

Task Analysis and Cognitive Task Analysis

PSYC 645 -- Spring 2003

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Catalog Description

Hands-on approach to selected current and/or classical Human Factors and Applied Cognition research methods. (The exact methods will be announced in advance.) Potential methods include task analysis, critical incident analysis, reliability/error analysis, workload measures, verbal protocol analysis, user interface evaluation methods, and engineering models of human performance. May be repeated for credit.

Spring 2003 Description

For the spring 2003 semester, the course will be a project-based, hands-on approach to hierarchical task decomposition, task analysis, cognitive task analysis, cognitive walkthroughs, and protocol analysis. Task analysis techniques allow you to describe the activities (both physical and cognitive) required in the execution of a task. The course will maintain a dual emphasis on task analysis techniques for both the usability lab and advanced cognitive research. Task analyses will be conducted of routine tasks performed with standard office software as well as problem solving tasks performed with experimental software.

Course Goals

This course is designed to develop/strengthen independence in conducting (1) hierarchical task analyses; (2) cognitive task analyses using KLM, GOMS, NGOMSL, and APEX; (3) protocol analysis, and (4) cognitive walkthroughs. The course is also designed to provide working familiarity with a number of alternative methods of task analysis.

Method of Instruction

This course will use a combination of lectures, discussion, and individual projects to convey the material to be learned. The detailed schedule of topics and weekly assignments (to be sent to all students on email or located on the class website each week) lists the specific approach used for each class meeting.

Required text:

Kirwan, B., & Ainsworth, L. K. (Eds.). (1992). A guide to task analysis. Washington, DC: Taylor & Francis. ISBN: 0-7484-0058-3

Articles:

Fisher, C., & Sanderson, P. M. (1996 March). Exploratory sequential data analysis: Exploring continuous observational data. *interactions*, 25-34. **(electronic -- Association for Computing Machinery)**

Gray, W. D., & Kirschenbaum, S. S. (2000). Analyzing a novel expertise: An unmarked road. In J. M. C. Schraagen & S. F. Chipman & V. L. Shalin (Eds.), Cognitive task analysis (pp. 275-290). Mahwah, NJ: Lawrence Erlbaum Associates.

Gray, W. D., John, B. E., & Atwood, M. E. (1993). Project Ernestine: Validating a GOMS analysis for predicting and explaining real-world performance. Human-Computer Interaction, 8(3), 237-309.

Green, P. (1999). Estimating compliance with the 15-second rule for driver-interface usabilty and safety., Proceedings of the Human Factors and Ergonomics Society 43rd Annual Meeting.: . Santa Monica, CA: Human Factors and Ergonomics Society.

John, B. E., & Kieras, D. E. (1996). Using GOMS for user interface design and evaluation: Which technique? ACM Transactions on Computer-Human Interaction, 3(4), 287-319.

John, B. E., & Kieras, D. E. (1996). The GOMS family of user interface analysis techniques: Comparison and contrast. ACM Transactions on Computer-Human Interaction, 3(4), 320-351.

John, B. E., Vera, A. H., Matess, M., Freed, M., & Remington, R. (2002) Automating CPM-GOMS. Proceedings of CHI, 2002 (Minneapolis, April 20-25, 2002). ACM, New York.

Kieras, D. E. (1997). Task analysis and the design of functionality. In A. Tucker (Ed.), The Computer Science and Engineering Handbook (pp. 1401-1423). Boca Raton, FL: CRC Press, Inc.

Kieras, D. E., & Meyer, D. E. (2000). The role of cognitive task analysis in the application of predictive models of human performance. In J. M. Schraagen & S. F. Chipman & V. L. Shalin (Eds.), Cognitive task analysis (pp. 237-260). Mahwah, NJ: Lawrence Erlbaum Associates.

Kieras, D. (1997). A guide to GOMS model usability evaluation using NGOMSL. In M. Helander, T. K. Landauer, & P. Prabhu (Eds.), Handbook of Human-Computer Interaction, (Second ed., pp. 733-766). New York: Elsevier.

Kieras, D. E., & Meyer, D. E. (2000). The role of cognitive task analysis in the application of predictive models of human performance. In J. M. Schraagen & S. F. Chipman & V. L. Shalin (Eds.), Cognitive task analysis (pp. 237-260). Mahwah, NJ: Lawrence Erlbaum Associates.

Nowakowski, C., & Green, P. (2001). Prediction of menu selection times parked and while driving using the SAE J2365 method (Technical Report UMTRI-2000-49). Ann Arbor, MI: University of Michigan Transportation Research Institute.

Olson, J. S., & Moran, T. P. (1996). Mapping the method muddle: Guidance in using methods for user interface design. In M. Rudisill, C. Lewis, P. G. Polson, & T. D. McKay (Eds.), Human-Computer interface designs: Success stories, emerging methods, and real world context, . San Francisco: Morgan Kaufmann Publishers, Increase.

Rogers, W. A., Mykityshyn, A. L., Campbell, R. H., & Fisk, A. D. (2001). Analysis of a "simple" medical device. Ergonomics in Design, 9(1), 1-14.

Russo, J. E., Johnson, E. J., & Stephens, D. L. (1989). The validity of verbal protocols. *Memory & Cognition, 17*(6), 759-769.

Shepherd, A. (2001). Hierarchical task analysis. New York: Taylor & Francis. (Selected Chapters)

Strayer, D. L., & Johnston, W. A. (2001). Driven to distraction: Dual-task studies of simulated driving and conversing on a cellular telephone. Psychological Science, 12(6), 462-466.

vanSomeren, M. W., Barnard, Y. F., & Sandberg, J. A. C. (1994). The think aloud method: A practical guide to modelling cognitive processes. New York: Academic Press. (Chapter 4.)

Wharton, C., Rieman, J., Lewis, C., & Polson, P. (1994). The cognitive walkthrough method: A practitioner's guide. In J. Nielsen & R. L. Mack (Eds.), Usability Inspection Methods, . New York: John Wiley.

Williams, M. G., & Buchler, J. N. (1997). A study of program entry tiime predictions for application-specific visual and textual languages. In S. Wiedenbeck & J. Scholtz (Eds.), Empirical Studies of Programmers: Seventh Workshop (pp. 209-223). New York: ACM.

Zachary, W. W., Ryder, J. M., & Hicinbothom, J. H. (1998). Cognitive task analysis and modeling of decision making in complex environments, Cannon-Bowers, Janis A. (Ed); Salas, Eduardo (Ed). (1998). Making decisions under stress: Implications for individual and team training. (pp. 315-344). Washington, DC, US: American Psychological Association.

Readings

Readings will be assigned on a weekly basis from the required texts and/or the articles listed.

Grading

Group Projects

70% of the grade will be based upon hands-on projects and class discussions of projects assigned to all students. The goal of these projects is to demonstrate mastery of the various analysis techniques. As some of the projects involve software that may be new to you, students are encouraged to work together to master the mechanics of software use (e.g., downloading a file from the web, how Excel works). However, all analyses (including, e.g., task decomposition, methods, NGOMSL statements) are expected to be the work of one individual. Exceptions to this rule will be announced in class.

If you have any uncertainty about where the line between individual vs. group effort is to be drawn while doing your projects, please come and see me.

Late projects

All projects are due on the date announced in class by the instructor. As many of the projects will be discussed in class the dy hey are due, no projects will be accepted late. Students desiring an exception to this policy must contact the instructor BEFORE the project is due. Exceptions may be granted on a case-by-case basis.

Lectures/Class Discussions

15% of the grade will be based upon class participation. This is a project-oriented course and substantial in-class time will be devoted to discussions of the current project. Lectures will introduce the various techniques, their strengths and weaknesses, and theoretical foundations. All students are expected to have read all of the week's assigned readings before coming to class and oversee the discussion of an article. Adequate preparation for a class will be demonstrated by both 1 & 2, or 3:

1. leading a class discussion of all or part of a reading and
2. explaining a topic to the rest of the class, or
3. providing a focused and detailed discussion of those aspects of the readings that you found vague or confusing

In addition, there will be email discussion of articles read for the class. This discussion will take place BEFORE the class meets. You each will be expected to make a comment on each article, read all of the email discussions, and to participate in on-line discussion by responding to points raised by other students.

Individual Project/Presentations

15% of the grade will be based upon a hands-on project and classroom presentation completed by an individual student. The goal of these projects is to increase the breadth of task analysis techniques learned in the class. Each student shall select a task analysis technique described in the KA book (a list of suggested techniques follows). For the selected technique, you must do the following:

1. Read about the technique in the KA book
2. Find further sources of material describing the technique
3. Apply the analysis technique to a data set (to be discussed with, and approved by, the instructors)
4. Give a classroom presentation describing the technique and illustrating your presentation with your data set. The description of the technique should include a description of the steps necessary to perform the technique, in what circumstances this technique would be

appropriately used, and a discussion of the advantages and disadvantages of using the technique.

5. Submit (a) an electronic copy of your class presentation slides and (b) a short written report in APA format (5-6 pages of text with 1-2 pages of figures or tables as appropriate, and an ANNOTATED bibliography of the sources (outside of KA) that you used in completing your project.

Analysis techniques to choose from:
1. Activity sampling & critical incident technique 2. Charting and network techniques 3. Table-top analysis 4. Event trees 5.Failure modes and effects analysis 6. Fault trees 7. Interface survey 8. barrier and work safety analysis 9. ethnographic 10. walkthroughs and talkthroughs 11. hazard and operability analysis 12. management oversight risk tree technique (MORT) 13. influence diagrams

Note
There will be no exams in this course. Grades will be based on projects, class participation, and the individual project only. The final exam for this class is scheduled for May 13. Although there is no final exam in the class, I would like to use that time as a class period. I will discuss using this date or the reading day (May 6) with the class during the first class meeting.

Honor Code
George Mason University has an Honor Code (see http://www.gmu.edu/facstaff/handbook/aD.html) that each of you accept by enrolling as a student. This code is consistent with APA's ethical principles for working professionals. Your instructors view it as especially important that each of you adhere to that code of honor. Working in a group to discuss course materials is encouraged, but all products submitted for this course (unless specifically described as a group project) should represent your work as an individual. If you have any questions about what is permitted and what is not, please come and see one of your instructors. We are your first contact on this issue.

Outside sources (e.g., journals, books) will be required to complete some course assignments. Plagiarism is defined as in the APA's "Ethical Principles of Psychologists and Code of Conduct" and in the Publication Manual of the American Psychological Association (see pages 292 – 298 of the Fourth Edition). Taping lectures is permitted.

Special Help
If you have a disability documented by the Disability Support Services Office, which requires special conditions for exams or projects (extended time, large type, etc.), see me the first week of classes.

Attendance
You are responsible for all information from each class meeting, including dates when projects are due, information not contained in the text, etc. If you miss a class, you should borrow notes from a classmate and/or download the slides from the web.

Electronic Distribution of Course Information:
This course will use an electronic listserve to allow distribution of information, announcements, etc, to you by email. In addition, copies of powerpoint slides used in class will be available on the web; students are encouraged to download these slides for use in note-taking in class.