EXPLORATORY BEHAVIORS AND THE DESIGN OF COMPUTER INSTRUCTION MANUALS IN HYPERTEXT

AUDE DUFRESNE
ISABELLE TREMBLAY
SYLVIE TURCOTTE

This study explores the problem of designing an environment for the learning of procedures using an hypertext environment. It presents an HYPERCARD interface for the learning of database procedures for the EXCEL spreadsheet. Direct manipulation interfaces (Shneiderman, 1982) encourage exploration and learning, but are not very effective for complex and abstract applications, which require planning and the coordination of many operations. For these interfaces, written documentation and help features are generally too fragmented and static. As for rigid tutorials they prove ineffective for the learning of complex procedures, as they leave no room for inferences. We will discuss the design of a learning environment to encourage and support exploration in this context. The system is based on a protocol analysis of users reading the written documentation and trying the system. Semantic, syntactic and process analyses have shown how users build their representations of the procedures to be learned (lexical ambiguities, inversion of sequences, search for illustrations, etc.). Based on this user model and drawing from studies on learning, a new environment was developed in Hypercard which put forward an interactional structure for the learning of direct manipulation procedures. Inspired both by the G.O.M.S. model (Card, Newell and Moran, 1983) and by "planning interfaces" (Miller, 1982), it first presents the hierarchy of goals, then outlines methods with accessible definitions, examples, exercises and various tests. Only there after these are alternative methods and selection rules explained. As in "planning interfaces", the system offers explanation both at the general level of goals and methods and at the concrete level of their integration into concrete examples. The user is free to explore this "training wheel" environment, where aspects of the Excel environment are simulated and gradually made accessible, with appropriate guidance and feedback.

A content index and "trace indicators" were introduced to facilitate the user's orientation in the system. The system was evaluated on ten subjects. Performance and satisfaction measures show that users learn within fifty minutes, that they enjoy the feedback and guidance. Users did complain of feeling lost, and experiments suggested the need for more support to exploration: limit access, integrating "trace indicators", adding "position indicators" in the index. An intelligent version is also being developed, in which a model of user knowledge is retained (which units of knowledge have been explored, how many times a test has been failed). This is used to structure access, tune feedback and redirect exploration. The system is innovative as a tutorial because it offers both guidance and

structure, still leaving the user free to choose items of knowledge and the type of communication prefered (users very often look the test before the explanations or the examples). Protocol analysis of the traces is used to bring to light possible links between aspects of the interfaces and the users' strategies. The system has the advantage of exploring the limits of hypertext: procedural applications, simulation of environments, and intelligent features.
Sponsored by the Social Sciences and Humanities Research Council of Canada.

Biographical notes
Aude Dufresne as received a Ph.D. In Cognitive Psychology at the University of Montreal in 1986, specializing in the simulation of various cognitive processes (learning and automatic protocol analysis). Working as a researcher at the Institute of Clinical Research in Montreal, she developed health education and diagnosis programs, using hypertext. She is now a professor at University of Montreal's Department of Communication, where she teaches human information processing, telematics, cognitive modelling and engineering. She is currently doing research on interfaces for learning procedures, using hypertext or coupled with expert systems. Sylvie Turcotte and Isabelle Tremblay are both graduate students working on the project.