Porting a Mental Expert System To a Mainstream Programming Environment
Chiang S. Jao, Ph.D., Daniel B. Hier, M.D., Winifred Dollear, RN, MPH, and Wenying Fu, M.S.
Department of Neurology and Rehabilitation, University of Illinois, Chicago, IL 60612-7330

ABSTRACT
Expert systems are increasingly being applied to problems in medical diagnosis and treatment. Initial medical expert systems were programmed in specialized “expert system” shell programming environments. As the power of mainstream programming languages has increased, it has become possible to implement medical expert systems within these mainstream languages. We originally implemented an expert system to record and score the mental status examination utilizing a specialized expert system programming environment. We have now ported that application to a mainstream programming environment without losing any functionality of an accurate and comprehensive diagnostic tool. New system supplements the need of normative consultation report and offline reference library to the traditional patient care system.

BACKGROUND
The mental status examination is one of the most complicated and time-consuming parts of the neurological examination. In order for the examination to be comparable across time and across patients, structured quantitative information must be obtained from each patient. Traditionally the mental status is done in a qualitative, informal, and semi-structure fashion. Furthermore, some examiners utilize a topographic approach (e.g. left temporal, left parietal, right parietal, etc.), some use examiners use a deficit approach (apraxia, alexia, aphasia, etc.), whereas others use a skill approach (e.g. language, memory, executive functions, etc.) to the mental status examination. At the University of Illinois, we decided to create a structured mental status examination that sampled the major domains of higher cortical function (language, orientation, visual-spatial, executive, memory, etc.) and support that mental status examination with an expert system that scored the examination, stored the results in a longitudinal database, created a consultative report, and utilized production rules to interpret the findings during clinical neurology rotation.

METHOD
In 1993, we developed a Windows®-based Mental Status Expert (MSE) to help our neurologists and psychologists adopting a standardized examination on screening and measuring neuro-cognitive impairment. After 7 years of operation, the original expert system, programmed in specialized expert system shell environment called Knowledge Pro®, lacked flexibility. Report formatting and data retrieval was especially difficult in the original programming environment which had failed to keep pace with the advances in the Windows® operating system. During the fall of 2000, we made a decision to port the Mental Status Expert from the Knowledge Pro® environment to the Microsoft Access® 2000 environment. We elected to reprogram the original production rules in the enhanced Visual Basic programming environment. By using the Microsoft Access® 2000 environment combined with the Visual Basic supporting language, we were able to preserve the production rules from our former system and gain the advantage of an intuitive user-oriented interface that performed consistently across different versions of the Windows operating system (Win95/98/Millenium/2000). By using the Microsoft Access® environment, our expert system automatically gained access to the significant database capabilities of this application.

RESULTS
We successfully ported the Mental Status Expert from the specialized expert system environment of Knowledge Pro® to the mainstream programming environment of Visual Basic® and Access 2000®. Production rules were translated into the new programming environment. The Mental Status Expert is designed to sample the full range of mental status including attention, orientation, judgment, language, memory, visual-spatial function, and executive function. Data entry of the ported Mental Status Expert is controlled via a “switchboard” interface created in the Access 2000® environment. The “switchboard” allows the user to add new records, maintain existing records, search patient records by primary key (patient’s name or medical record number), add or edit results, and generate consultations. A two-page consultation report can be previewed on screen or printed. Production rules select explanatory text from an integrated reference library dedicated to neurocognitive deficits.

CONCLUSION
The Mental Status Expert has been ported to a mainstream programming environment. It uses production rules to rate the severity of deficits and to generate a deficit summary that lists all detected neurocognitive deficits with appended explanatory text. Results stored in a database file to provide a searchable record of consultations for review purposes, report generation, and statistical analysis.