"...bring the principles and tools of AI research to bear on difficult applications problems requiring experts' knowledge for their solution ... It is the task of building complex computer programs that represent and reason with the knowledge of the world." ¹

A variety of medical and scientific applications programs has been developed to deal with the tasks of interpreting data, diagnosing, monitoring, and planning. Examples of these programs together with prescriptions for knowledge engineering to deal with different kinds of problems are provided in "The Organization of Expert Systems, A Tutorial." ²

One expert system developed for medical applications, CONSULT-I(®) ³ seems particularly well-suited to potential nursing applications. Bayes' Theorem has been suggested as a means of reaching decisions less conservatively and therefore more efficiently than by the usual human methods (Edwards, 1972). However, there are some difficulties in applying Bayes' Theorem in clinical situations because the theorem assumes that the multiple data items that may be considered in reaching independent of one another. Nurses know that many of the results they consider are interrelated. CONSULT-I includes an extension of Bayes' Theorem to include complex classes and states where there are dependencies among features. It may, therefore, offer a means of supporting nursing diagnoses, which are complex, multiple, and not mutually exclusive.

The Challenge to Nursing

Only nurses can fully understand and appreciate the kinds of decisions they must make in practice. Yet nurses generally have little knowledge of decision theory or of the principles of artificial intelligence and knowledge engineering. It is largely for this reason that the current generation of nursing information systems and other applications programs offers little or no support for decision-making, even though nursing care could benefit greatly from support that would help nurses to make decisions sooner and with greater certainty. Nursing must develop its own experts to participate in developing decision-support systems. The goal is a computerized system for nursing care that will help to collect data by branching appropriately to follow-up questions or to other areas of inquiry, produce lists of nursing diagnoses with their respective probabilities (since no diagnosis is ever a certainty); propose objectives appropriate to the diagnoses; and provide lists of nursing interventions with their relative probabilities of success. Ideally, such a system would be constructed to learn from experience, so that actual success rates were fed back to improve predictions.

A computerized system can never replace the nurse as a decision-maker. Responsibility and authority for decisions will always rest with the professional nurse. Nurses have the opportunity, however, to create systems that combine the nurse's unique ability to be sensitive to patients and interpret the meaningfulness of information with the computer's superior ability to remember, scan, and aggregate data. Such nurse-computer dyads would make better decisions than either could make alone, and nursing would gain a powerful tool for improving patient care.

References


support such an undertaking. Second, a prototype laboratory for designing and testing applications of new technology, specifically integrated into practical systems for assisting clinical nursing users, needs to be developed. Without these two resources, the currently diffused set of sparse resources available to nursing information scientists will continue to retard the development of applications of incipient technological breakthroughs to nursing information systems. Specifically, the "D" of "R & D" is not being sufficiently supported in the area of nursing information systems. The proposed 18% increase in the NSF computer research budget certainly bodes well for changing things. The purpose of this paper is to cite a variety of areas of coming technology which need underscoring and offer great promise as bases for nursing information systems of the future.

Certainly more than any other project, The Fifth Generation computing projects both in Austin and especially the Japanese version, sets higher goals for workable integrated computer technology for this decade. The project has a goal of developing what might be called a "desk-top expert"; the system, to be working by the end of the decade, would be a natural language, artificially intelligent, desktop computer, containing relational (knowledge) database management (and inference) system of relatively unlimited size. Most of this would exist in hardware at the microprocessor and coprocessor level and would have voice I/O with complete networking and graphics facilities. This project acts as a focus and magnet for a myriad of required technologies.

Some of these technologies include the new generation of 16/32 bit microprocessors (e.g. Zilog Z8000, Motorola MC68000, National Semiconductor 16032 and Intel 80860) and will undoubtedly serve as a base for fifth generation hardware. Multitasking, multiprocessing, megabyte RAM levels, virtual memory, 32 bit arithmetic, and wide varieties of coprocessors (e.g. graphics, network, voice, arithmetic, etc.) are all becoming available with this generation. Other hardware advances include much higher disk densities (e.g. vertical and optical recording technologies), interactive videodisk systems, alternate input (mouse, voice, touch screen, light pen) and lightweight portable systems.

Software tends to follow hardware, is less glamorous than hardware and thus seems to have fewer obvious leaps in technology. First glances at UNIX certainly convince few users of significant advances in appropriate software to match 16/32 bit MPU's. Exceptions seem to be object oriented languages like Smalltalk and highly integrated systems like Apple's LISA, Quarterdeck's Desq, and Visicorp's Vision.

Designers of nursing information systems must harvest this and other blossoming technology if current systems on the drawing boards are to exist in computing environments of the fifth generation. This has been only a brief potpourri of selected technology. Clearly, mechanisms for detecting, developing and disseminating these tools must be developed before nursing develops a fatal generation gap in the development of clinical information systems.

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