Editorial Comments

Lessons from the Origins of Informatics

This issue of *JAMIA* contains a paper by Dr. Morris Collen[1] that reviews the evolution of computer processors, programming languages, and communications technology. This review goes beyond the chronology of technical developments to highlight the people who were involved and the problems that led to innovation.

What lessons does this history have for modern medical informaticians?

First, change is the only constant, and the rate of change is increasing. Progress in medical informatics is tied closely to technological developments. People entering the field often dismiss the work of their predecessors as irrelevant because it was limited by old technology. They overlook the insight that can come from knowing what worked and what its limits were. Were the limits technological or was the effort people-bound? We should revisit past ideas that were discarded because the technology of their time could not support them. They may be workable today.

Today's new technology will be tomorrow's old technology. We should try to develop ideas, concepts, and lessons that are independent of the current technology base. We need to separate the principles that underpin a technology from the details of its implementation. Improvements in the technology base can then leverage our work instead of making us start over.

Second, the majority of effort goes into evolutionary, or step-by-step, development. However, the majority of progress comes from a few discontinuous, revolutionary ideas. An example is Stibitz's idea of using the binary system instead of the decimal system so that the mechanical computers of the day could use simple on/off switches instead of switches with ten gear teeth. Von Neuman's idea of storing program steps as data in an electrically alterable memory so that the computer did not have to be rewired between tasks was another revolutionary change.

The transistor was an enabling technology that permitted a paradigm shift by allowing magnitudes of improvement in reliability, speed, size and power requirement. However, the use of the transistor in the place of the vacuum tube is an example of an evolutionary change. One component was simply substituted for another one. Although the change was a significant improvement, it took the additional idea of using the crystal of the transistor as its own circuit board to result in the revolution represented by the integrated circuit.

It is often hard to sell a revolutionary idea to a funding agency. Acceptance requires a paradigm shift and review groups may not be tuned easily to the idea. Revolutionary ideas are not for the risk-averse. It may be hard to tell the ones that can not work from those that might. The probability of success is better estimated from the track record of the person with the idea than from the specifics of a research or development proposal.

Despite these barriers, medical informatics needs to look for revolutionary ideas if we are to meet challenges such as that of developing a life-time computer-based patient record. The work of the past 25 years suggests that evolution alone will not get the job done.

These two lessons have an implication regarding what a medical informatician needs to know. Medical informaticians should understand how the technologies that they work with actually carry out a task. At one end of the spectrum, they should be able to identify the limits that are placed upon their work by the operating system or the database manager. This understanding is best developed by actually working with memory mapping or seeing how data are physically placed on a disk. At the other end of the spectrum, medical informaticians need equally direct exposure to the problems in their areas of health expertise. A physician who sees 25 patients in a half-day clinic sees a different set of requirements than a similarly trained individual who sees only five patients in the same time.

In evolution, the past is a part of the future. In revolution, progress is built around the learnings of the past and generally comes from novel associations or superimpositions of concepts. By combining an understanding of what actually limits use of current technology with the experience of trying to apply the technology to a health-related problem, a medical informatician is positioned always to have a productive evolutionary idea and, on occasion, to have a truly revolutionary idea.

WILLIAM W. STEAD, MD

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Correspondence and reprints: William W. Stead, MD, The Village at Vanderbilt, Suite 2000, 1500 21st Avenue S, Nashville, TN 37212.

Received for publication: 11/10/93; accepted for publication: 11/10/93.

■ **J Am Med Informatics Assoc.** 1994;1:199–200.

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On the Relevance of Discipline to Informatics

Even when a word in a sentence has a standard definition, individuals from varied backgrounds may interpret the sentence differently. Take the following sentence for example: The decision to initiate a code remains a clinical choice. To a physician or nurse, the sentence defines the legal and clinical responsibilities of health care providers in deciding whether to resuscitate a patient after a cardiac arrest; to the computer scientist, the sentence contains an obscure reference to data representation. The meaning of the sentence to an individual derives from the combination of its literal content and that individual's own background. Discipline represents an important influence in shaping the language of clinical practitioners. With the emergence of controlled vocabularies, the impact of discipline on language commands attention in contemporary informatics.

Several attempts have been made to examine the representation of discipline in the language of health care. Henry's work[1] seeks to map the language of one discipline (nursing) onto a vocabulary developed for a different discipline (medicine). Ozbolt[2] takes the view that discipline is central to vocabulary development in that it provides guidance as to what language must, and must not, be included. To what degree does discipline need to be reflected in standardized vocabularies or information structures? To the degree necessary to preserve substantive meaning intended by the initiating discipline.

Discipline, a body of knowledge,[3] provides perspective, illuminating the values and beliefs that are fundamental to the service provided by the practitioners of the discipline. Discipline denotes the foundation from which practitioners approach patients and apply therapeutics. A discipline produces knowledge that is unique to it. The knowledge, in turn, is evident in the language of the discipline. Discipline is that which distinguishes nursing from medicine, or medicine from dentistry.

Discipline draws the attention of its practitioners toward certain phenomena and away from others, and provides its membership with the language necessary for expression. Discipline provides context to the words employed in describing the provision of care. Patient care results from the interplay of various professional groups. Each group holds a unique perspective of the patient and contributes essential services on the patient's behalf. The language employed by the physician to describe a patient includes words (descriptors) that express disease state, prognosis, and expected etiology. Words employed by a nurse include the human response to the disease state,[4] resources, and coping abilities. While some of the language em-