The health care computer user—“Where will we find the integrators?”

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ABSTRACT
This paper assumes that the primary objective of the medical care system is patient welfare. To best accomplish this objective the medical specialties must communicate and be well coordinated. The organization and distribution of information, which is the domain of the medical information scientist, is of central importance. In practice, medical information scientists often influence reorganization of human institutions, and thereby become change agents. They are commonly consulted about problems crossing disciplinary lines and see trends that allow them to predict and guide future developments. Many information scientists also simultaneously fill a role in some other specialty so that they exert influence both from inside and from outside the medical practice structure. The medical information scientists described are in an excellent position to be professional integrators. Good integration like any art is predicated on appropriate attitudes and has basic skills that can be taught. This paper suggests that formal preparation to integrate the activities of the medical practice environment is a desirable adjunct to the traditional preparation of students of medical information science.

WHERE WILL WE FIND THE INTEGRATORS?
The traditional academic hierarchy has served medicine well as a framework for dividing tasks in a knowledge-rich environment. However, specialty has tended to produce autonomy if not mutual isolation of one discipline from the other. Since patients continue to function as integrated units and patient care continues to be medicine’s prime objective, there exists a constant counter-demand to integrate the diverse activities of the specialty oriented health care team. But where do the integrators come from?

To answer the question, one must make some presumptions about integration. Integration can perhaps best be attacked as a boundary problem. It therefore focuses on communications—both technical and human. “Communication” has been defined by Mortensen and Sereno as “a process by which senders and receivers of messages interact in given social contexts.” It is fairly simple to see embedded in this definition the concept of input- and output. But this still leaves unresolved the issues of data compatibility, data perception (information), and social context with all the mystery of its deep structure. Going one step farther, one may presume that the problems of data are solvable, at least at a technical level. The issue of social context remains.

It is a position of this opinion paper that to exclude consideration of social context from the process of integration makes the process not only worthless but often dangerous. Good integration is still, in the last analysis, an art, and the artists are still emerging randomly and by accident. It would seem to be precarious for the stewards of complex systems to rely on accident to produce an essential skill.

Fortunately, the principles underlying these artists’ expertise are being subjected to increasing scrutiny and an abundant literature is appearing addressed to “communication theory,” “social organization,” “change dynamics” and a host of other related subjects. The tools exist for us to recognize aptitude and train artists of integration. These people will then be competent generalists as well as specialists.

Since a major concern of Medical or Health Information Science is systems, and since systems imply integration, the question which must be confronted is “Should the skills of integration be included in the basic curriculum of the Medical Information Scientist?”

A tight academic viewpoint might well generate a negative answer, contending that the medical information scientist should be limited to the technical aspects of interface design. This view would be predicated on the assumption that other specialists exist to deal with associated problems. In addition, such an academician could rightly assert that the field is already overburdened with content and that the addition of more material could only act to degrade the quality of current medical information science programs.

This view of any discipline, perceived from within, rightly emphasizes quality and tends to keep the specialty manageable. It also pragmatically recognizes that it is commonplace to deal with both information overload and increasing social complexity by repeated division of responsibility. It fosters the ability to maintain personal and academic order without which there would be a rapid erosion of effectiveness.
Unfortunately, the process of progressive specialization, as beneficial as it may be to integrity within the specialty, defaults on the need to preserve integrity among the specialties. The larger social or academic blocks which spawned the specialties are left untended, and the network of boundaries which permeates the interstices among the specialties is attacked late and with a total absence of coordination. In its default, specialization can be both socially and academically destructive.

This destructive element has not gone unnoticed. The public response is seen in consumerism, centralization of control, the explosion of the planning industry and, indeed, even among esoteric academics in the quest for a general system theory. These responses bear testimony to the fact that the ultimate purpose of specialties resides in combined rather than isolated effect. They are testimonies of the value of integration and of the need for competent generalism.

It may then be acceptable to say the skills of integration have value to the medical information scientist who leaves training to be a fulltime integrator, but what value will such skills have for the other graduates?

Sias in "An Analysis of the Job Market for Biomedical Computer Scientists" has suggested that training program graduates will be absorbed by three major categories of medical computer applications, (1) business data processing, (2) database management, and (3) automated medical instrumentation. In his conclusion, Sias states that, "It is likely that biomedical computer scientists will be matched most appropriately to positions with computer systems supporting large medical data bases that will be needed to establish a nationwide comprehensive health-care system."

Regarding development of this field he said, "Computers have been found useful in the ambulatory care setting so it is likely that this rapidly growing segment of medicine will require significant support while the larger hospitals will over a period of time introduce computer automation first in such areas as clinical laboratories and later in medical records and hospital-wide information and communications systems." A listing of graduates of training programs supported by the National Library of Medicine, while still too few in number to be a reliable trend setter, tends to support the Sias prediction and suggests a fourth, perhaps self limited, market in university faculties.

Business data processing appears to find its manpower in the general pool of data processors or through training new personnel on the job. Consequently, detailed preparation for that market need not be a major concern in training medical information scientists. Medical instrumentation is heavily oriented to engineering and is an appropriate field for the technically oriented computer scientist. The true medical information scientist, as his title implies, is the individual who may be expected to find his way into the world of data bases and medical systems.

It appears generally recognized that the popularity of large computers shown in the 1960's is being overshadowed by a rush to smaller computers in this decade. The pressure exerted by the maxis to agree and share can once again be circumvented by those who would rather go it alone. This is resulting in numerous applications that are counterparts of the laboratory systems to which Sias refers above. Most of these specialty oriented, standalone systems, although offering some service of process control, at a minimum develop some raw data for human consumption. Many systems include small verbal records even when their primary purpose is to produce data in other forms. Some examples in addition to the now familiar laboratory systems, are physiologic monitoring systems which display analog signals and derived numeric data but frequently keep patient mini-records as well; nuclear imaging employs computers to manipulate digitized pictures and to derive associated data, but patient records and registries are a frequent accompaniment. The computerized tomographic (CT) scanner probably outstages all the other special applications at the present time, and it too carries verbal data with the expectation that there will be more in the future.

Primarily verbal stand-alone systems are also proliferating. Specialty registries, patient records banks, reporting systems and scheduling applications (many of them structured) are a few examples. These merge smoothly into ambulatory care and the chain of development suggested by Sias where burgeoning hospital information and medical records systems are bearing out his predictions. Just over the horizon, one can see the combination of these communications oriented systems with more effective decision systems including the promising work in artificial intelligence. At some time, integrated with communications, the data base will have come into its own, and the stand-alone systems of today will have become prologue.

It is inconceivable that medical information scientists can be fully effective designers, administrators or implementors during the socially critical years comprising their professional lives without understanding and specific skill in the art of integration. It is also inconceivable that medical information scientists will always be in positions where all of the desired support expertise will be available. In fact, if past experience is any indication, they will often be the lone "vox clamantis in deserto"—the voice crying in the wilderness, and their main resource will be themselves.

If the current popularity of stand-alone systems can be accepted as only a phase of the trend projected in the preceding paragraphs, one would then have to reply with "yes" to the question of "Should the skills of integration be included in the basic curriculum of the Medical Information Scientist?"

If the medical information scientist were entering a society with mature demand, and his only role were to be filling that demand in a pre-defined manner, then the value of adding generalism to his expert base might again be questioned. But he cannot expect the luxury of such a predictable professional life. He will live, instead, in a world of transition and turmoil, and his professional activities will be punctuated by surprise.

There are four roles which many medical information scientists will play, that may further accent the need for skills of integration. These are the roles of (1) change agent, (2) internal medical and health care consultant, (3) multi or at least dual specialist and (4) futurist.
Change agent

One becomes a change agent whenever he is charged with the responsibility of introducing new technology or for revising organization. By their nature, computer systems, small or large, are innovations, and the medical information scientist will be viewed as their champion. It makes no difference whether the computer scientist acts as application consultant, systems analyst, administrator or advisor; he will be the harbinger of change and instability. How he acts will affect the course of change, perhaps even to the extent of success or failure. Basic principles of psychology and management of change have been well explicated and their teaching can be well accommodated by any degree granting educational program.

Internal consultant

By virtue of his association with new methods and because of the cross disciplinary nature of his specialty, the medical information scientist is often consulted when other members of his institution are actively considering innovation. These other members may be themselves change agents or in search of solutions to specific problems or merely curious. In addition the computer scientist may expect to make contributions to in-house educational programs. The quality of contribution made by the medical information scientist will be influenced by his understanding of the boundary conditions in his institution, including interrelation of medical expertise, the impact of financial constraints and policy, and internal politics. To truly integrate, he will have to understand overall medical objectives.

Dual specialty-niche

During at least the next few years of the current transitional period, the medical information scientist may have to continue to operate in two different specialties simultaneously. This practice is perhaps most clearly delineated in the domain of the M.D., Ph.D. Any one who has personally investigated the job market has recurrently encountered situations where expertise in medical information science is recruited with no appropriate slot. Instead the physician is offered a clinical position and salary with the expectation that he will divide his time. Cursory reflection will reveal that much current research is conducted by people fitting this description. On the other side of the coin, academia is beginning to have people with advanced degrees in information science apply for training as M.D.’s or for residencies in medical specialties. Some of these candidates are already well established, recognized professionals in their original discipline. Others, according to the reports to NLM, are recent graduates of the NLM funded training programs.

at least the near future, one can expect to see many more niches provided by established disciplines than by formal positions for medical information scientists. Those filling dual roles will be living interdisciplinary lives which will be more comfortable and of greater value if they are generalists in possession of skills of integration.

The futurist

Finally, the medical information scientist will have to be to some extent a futurist. The health care science is changing at an astounding rate, both clinically and politically. Shifting power is redistributing the machinery of goal and policy setting. By the time an innovation is established, it is on the way out. The people who are most effective in such mercurial times are those who are reacting, not to what is, but to what will be. The success of these people is the proof of their ability to predict. Good futurism is still largely intuitive, but it is yielding to examination. Techniques of forecasting and simulation have become common tools. There is a literature on the sociology of complex organizations. And “long range planning,” although controversial, has become a household phrase.

One well known futurist, Robert Theobald, has posed the challenging question, “Are we more interested in coming up with sophisticated answers to obsolete questions than defining the new questions that are developing as the world continues to change?” The call for papers for the Conference led off with the still young question, “How should health computer facility directors and staff be trained to interact effectively with actual or potential health users?” As a partial answer, this paper has suggested that the early efforts of a minority of programs to include training in the skills of integration and to foster the attitude of generalism be recognized and supported.

In conclusion one should again ask, “Where will we find the integrators?” The answer—probably always from a variety of sources, but Medical Information Science should be a major contributor.

REFERENCES
