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History of health informatics

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'Those who cannot remember the past are condemned to repeat it.'
George Santayana (1863-1952)
American philosopher, poet

In considering a 'history' of Health Informatics it is important to be aware that the discipline encompasses a wide array of activities, products, research and theories. Health Informatics is as much a result of evolution as planned philosophy, having its roots in the histories of information technology and medicine. The process of its growth continues so that today's work is tomorrow's history. A 'historical' discussion of the area is its history to date, a report rather than a summation.

As well as its successes, the history of Health Informatics is populated with visionary promises that have failed to materialise despite the best intentions. For those studying the subject or working in the field, the experiences of others' use of Information Technologies for the betterment of health care can provide a necessary perspective. This chapter starts by noting some of the major events and people that form a technological backdrop to Health Informatics and ends with some thoughts on the future.

History of computing

While thousands of individuals have been part of the evolution of computing in the last century, some perspective on the history of computing development is useful in understanding the current level of development and sophistication (or lack of it) in today's computing environment.

The desire to represent information in ways that allow real world issues to be more easily managed has been a common pursuit for centuries. As far back as in the 17th century Wilhelm Von Liebnitz was advocating the idea that it might be possible to represent the entire nature of human behaviour in some codified form. This principle still forms the basis on which many software developers, especially in medicine, view coding. That is, if we developed a fine enough coding system, then all things may be classified (not that Herr Liebnitz was in possession of tools that could assist in this desire).

The first example of how such tools might be created and the uses to which they could be put can reliably be ascribed to Charles Babbage in the 19th Century. It is generally agreed that Mr Babbage created the first computer, a mechanical device aimed at solving mathematical problems. The machine never succeeded in functioning as desired and he stumbled from

funding source to funding source (Kings, Queens and heads of State). The issue of whether or not his ‘analytical engine’ could ever have succeeded is moot, however his machine not only still exists, but has also been recreated in an attempt to settle the argument. It appears that, if accurate enough engineering techniques had been available, his life work could have succeeded.

The above two historical figures highlight the fact that the principles underlying today’s use of computers has been around for a very long time. The punch card system devised by Herman Hollerith in the 1890’s to manage the United States census data demonstrates the effectiveness of technologies that do not use the microchip capabilities of today.

This system was so successful that it was still being used after World War II. It involved hundreds of workers developing the ability to punch cards and also to pass long needles through trays of such cards to perform data analysis. Even when digital (electronic) computers were developed, punch cards were still used as the major form of data input, as any computer science student of the 50’s and 60’s can verify. Despite the development of ever increasingly powerful computers over this time, it was not until the end of the 1960’s that this technique finally was laid to rest.

Computers

The electronic computer

The need for information management during World War II spurred the development of electronic computers. The first digital or electronic computer was ENIAC, created in the 1940’s. This device occupied a large room and ran on valves with enormous power consumption and remains at the Smithsonian institute as a reminder of the scale of change in this century. Post WWII computers continued to evolve in speed, capacity, sophistication and reliability, they also continued to reduce in size. Due to the specialised environments, space and support needed to run these devices, the concept of mainframe computing evolved.

Mainframe computing implies a central computer which supports users at distance through the provision of ‘dumb’ terminals. Note that the idea of computing at distance (via a terminal) only occurred in the late 40’s and early 50’s. This centralised form of computing services supported by an Information Management Service (IMS) remained the norm until the late 60’s, early 70’s.

In the late 1950’s Ledley and Lusted, living in a world of now powerful new computing devices, where among many who recognised the potential of computer-assisted medical decision making. While access, cost, and implementation were seen as limiting the ability to provide such support in a widely available fashion, the belief was evident that increasing computational power could be harnessed to model, assist and enhance health care. While the ‘dumb terminal’ - mainframe model of computing services was not able to adequately address this desire, the coming years would see the ‘personal computer’ become a reality, initially as the minicomputer.

The emergence of minicomputers in the late 60’s provided what were, in essence, stripped down mainframes with their own storage ability, aimed at supporting a small number of local user and promising a future of ‘personal’ computing. These were still very expensive but were a major leap forward from the distributed, ‘dumb terminal’ philosophy of previous

decades. So enthusiastic were many of the proponents of minicomputers that advertisements from the 60's and 70's described the desirability for Medical Practitioners to purchase them to improve their office and patient management. The promise that such technologies could so intimately assist health professionals at a personal level remains today. That promise is satisfied more often today than then but disappointment often remains even with current advanced systems.

Microcomputers arrive

The highly personal availability of computing technologies became more possible with the advent of the microcomputer. The Apple II microcomputer (6502 chip, monochrome display, tape or floppy storage) provided the first real personal computer, Whilst many other microcomputers existed (Tandy, Commodore, Zenith etc) this was the first that encouraged average users to indulge in programming and the production of software on a large scale destined for personal use.

While these machines initially penetrated the home / hobbyist market rather than business, the introduction of the program VISICALC (the first, functional, spreadsheet program) altered the perception of microcomputers and their usefulness. The business world suddenly had a powerful new tool for financial modelling offering a familiar paradigm (an accounting sheet) with the power of microcomputer based technologies behind it. Such applications did not escape the attention of those responsible for the financial management of health care. As for all aspects of society, the personal computer found its way into practice environments, hospital systems, organisations working in epidemiological work and a host of other health related areas.

In 1982 IBM released the IBM PC (640K, cassette or floppy storage, colour display). It appears that IBM did not consider this machine as a serious project and that the explosion of clones, acceptance by business and the massive secondary industry generated by software developers was completely unpredicted. Initial projections were for a few thousand sales. The currently installed base of machines with this architecture is well into the millions.

The release of the Macintosh computer (evolved from the Xerox PARC work and the Apple Lisa) offered a whole new principle in how users could interact with computers. Now called the WIMP interface (Windows, Icons, Mouse and Popdown menus), this was the first practical, commercially available, Graphic User Interface or GUI and its underlying philosophy can be attributed in large part to Douglas Engelbart, the inventor of the mouse as a pointing device.

As these microcomputers became increasingly powerful and popular through the 1980's IMS groups finally started agreeing that these 'toys' should have some access to mainframes, usually if they agreed to behave as dumb terminals. Users also found the need to connect PC's together resulting in the development of Local Area Networks (LANs).

Without an agreed standard for these endeavours we have the current situation with a wide (but reducing) number of ways to link PC's together. LAN structures now communicate with each other forming Wide Area Networks (WAN) with links into mainframe services.

Overall, this progression of increasingly powerful, smaller and faster computing possibilities has resulted in the availability of the 'personal' computer. Ideally, technology

should be an additional tool for individuals providing connectivity to resources far greater than personal experience, education or traditional paper based repositories of information could provide.

All of this is possible because of the development of the microchip or integrated circuit, predominantly developed by the companies INTEL and MOTOROLA. These 'chips' are evolving at a rapid pace providing more and more processing power. These 'hardware' advances are not matched by developments in software; processors spend much of their time doing nothing. The widespread adoption of the GUI interface, larger and more sophisticated software creations and the need to enhance the means whereby users interact with the computer means that the hoped for developments of handwriting and speech recognition in a highly interactive graphic environment are now occurring.

Computer languages - telling the computer what to do

The software programs have evolved along with the hardware base itself, although at differing rates. These languages range from telling the computer what to do at a very low level, such as assembly language, to much more abstracted means of representation provided by Object Orientated Systems, Natural language tools, Artificial Intelligence methodologies and a variety of others. In an inevitable progression, the increased hardware capabilities are used by developers to create more and more sophisticated means of 'communicating' with the computer to manage information in more and more natural ways.

While the above is promising, the actual tools we use on computers today are still in their infancy in many ways. The vast majority of computer human interaction is via the keyboard, itself an unfriendly legacy of the past. The QWERTY keyboard design aims to reduce typing speed so as to decrease the possibility of the letter 'hammers' jamming, despite the fact that such typewriters are now museum pieces.

Health care poses some of the greatest challenges for both the technologies and those seeking to apply them to patient care. Health care often deals with the most abstract of ideas such as 'well', 'pain', 'happy', 'sad'. Health care also generates enormous volumes of information regarding the community and its needs. Thus understanding Health Informatics requires not only familiarity with the technology but, more importantly, insight into the nature in which health care delivery occurs. These questions are not yet answered but Health Informatics lays claim to some of the possible directions and solutions most likely to be of benefit.

Health informatics - a discipline

Health Informatics is often described as a new discipline. It has evolved to address the desires to apply and explore the uses of these relatively new tools for the better provision of health care. This is a bold claim with some merit. The successes of the field in living up to the claim have been less than expected and have, at times, disrupted the timely delivery of health care rather than enhanced it. This is not entirely surprising given the accelerating rate of change in technologies and the relatively 'young' nature of a discipline which is now examining itself to clarify its role. Health Informatics began as Medical and Nursing Informatics during the 1970s, a period described by van Bemmel & Shortliffe (1986 p.x) as undergoing exponential development due to the growing availability of steadily less expensive hardware, more powerful software and the advent of microcomputers.

A gradual change from electronic data processing in health, through the use of informatics in medical care, to health informatics, is discernable from the types of papers presented at the three yearly World Congresses on Medical Informatics (Medinfo), which began in 1974 in Stockholm. The use of computers to support medical decision making, including artifical intelligence, was strong during the 1980s. The linkage of systems emerged in 1989 when multiple disciplines began to work together to develop integrated systems utilising new database technology and the power of networks. This produced synergistic applications where the whole became greater than the sum of its parts. The most popular papers presented at Medinfo'92 in Geneva were those on knowledge based work such as concepts, methodologies, software and other tools, systems and evaluations of systems and experiences (Mandil 1992 p.xxxiv). These congresses were organised by the International Medical Informatics Association (IMIA), which began as a special interest group of IFIP.

While Health Informatics aims to articulate its place in health care, other health care professionals continue to adopt the technologies into their own areas. For example, the use of computing systems in radiological imaging is extensive. Amongst the lessons to be learned from the history of Health Informatics is that Health Informatics as a discipline must be cognisant of, and involved in, the aims and activities of health care itself. Technologies are becoming ubiquitous in their availability with ever increasingly powerful tools allowing health care workers to readily create systems for their own benefit. Health Informatics should communicate to the health care profession the lessons of its past, just as Health Informatics needs to learn from the work and activities of this same community.

The benefits of the technology as well as the ability to demonstrate such benefits to others are becoming compulsory. The reasons for this include: the effect of computer usage by practitioners on patients themselves; the security of medical information; the need for new skills to be learned; and the price of the technology at a time when rising health care costs are an international concern.

Health Informatics strives to enhance all aspects of health care at all times. If this is kept in mind, the lessons of history to date will be heeded and incorporated into the future of Information Technology in health care, rather than ignored.

References

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