STRUCTURAL PRINCIPLES IN THE DEVELOPMENT
OF INFORMATION REFERENCE SYSTEMS FOR MEDICAL
TRAINING

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There is a considerable literature on the role of computer training in primary and higher education. This indicates the importance of this problem and shows that the already existing information reference system should be updated and new systems should be developed, particularly systems for medical use.

On the basis of our experience in the development of computer training systems for medical purposes [2-4], we reviewed three of the most popular information training programs (BodyWorks, 3DBody, and MAYO Clinic) in order to assess the opportunity for adapting these software programs (SP) to the domestic training process and for developing recommendations for their further updating.

1. BodyWorks

The BodyWorks (version 2.0) program system was developed by Informative Graphics Corp. (USA) in 1991. The program system implements demonstration material for various parts of the human body: skeleton, muscles, respiratory system, circulation system, urinary tract, male and female genitals, alimentary tract, lymphatic system, endocrine system, and central nervous system. All the listed systems are illustrated with detailed color images up to the level of individual organ and rarely up to the level of tissue.

Textual information is rather brief, although additional information on some topical aspects of medicine (e.g., narcology, including alcoholism and drug dependence; prophylaxis and clinics of AIDS; urgent medical aid, including treatment of burns, frost-bite, poisoning, snake bite, disbolism, stress, etc.) is optionally available. Treatment of injury is available as a separate option. The reference information is simple enough and it is written in rather simple language, which is understandable for people with modest background in English. This material can be used for student training both in medicine and in English.

The BodyWorks SP allows image zoom, transition to associative images, graphic information storage in files, and printing.

The BodyWorks reference information subsystem implements search options by both subject (e.g., body organ or tissue) and alphabetic list of the system components (texts and images).

An advantage of BodyWorks is its context help with cross-reference to associated subjects.

A disadvantage of the BodyWorks SP is insufficiently adequate animation (only movements of upper limbs, act of breathing, and cardiac contractility); lack of actual images, absence of image rotation and presentation of images of parts of a patient's body as well-accepted views and projections; lack of three-dimensional presentation of images, and audio information.

The hardware required to implement the software: IBM PC/286 of standard configuration with 1 MByte RAM and a mouse manipulator. The software occupies 2.4 MByte of file memory.

BodyWorks SP is designed to be used in medical colleges and to train students and specialists in biomedical engineering.

2. 3DBody

The 3DBody program system was developed by Knowledge Adventure in 1993 on the basis of the in-house interactive software technology KA Interactive Book Engine.
The 3DBody program package was developed by a group of 10 programmers, one physician, one artist, one composer, one sound technician, three designers, and 16 assistants preparing illustrations and documentation. Such an impressive list of authors is indicative of the complexity of the package.

The 3DBody SP consists of four major subsystems.

First, a demonstration subsystem designed to demonstrate three-dimensional imaging of the human body skeleton, detailed imaging of spinal column and brain (including brain ventricles).

Second, major operating subsystem that includes an information-reference system for organs and tissues of the human body. The most specific features of the second subsystem are:
- ability to rotate the patient's body image (or image of individual organs, e.g., liver, heart, etc.) and present it as different views or projections;
- full support of three-dimensional (3D) imaging, capacity for generating wire-frame models of individual organs and stereo viewing of these models designed to improve spatial presentation;
- 3D half-tone shaded imaging of internal organs.

Audio support of training process is a significant advantage of the 3DBody SP. This includes English and Latin spelling of medical terms, some music, and audio imitation of functioning of medical systems of human body (cardiac murmur, heart beat, breathing sound, exhalation, inhalation, specific sound of joint crunch, etc.). Such audio support proved rather helpful for student training.

The 3DBody SP is supplied with an alphabetic index, which allows quick and effective search of the subject of interest. In addition, there is a screen balloon (by terminology of Mackintosh) prompt, which provides current service information and help.

The textual part of the 3DBody SP is more informative than the comparable part of the BodyWorks system. It contains about 0.5 page of simple English textual explanation for each object of study.

The animation capacity of the 3DBody SP is higher than that of the BodyWorks system. It implements 3D rotation and translational movement of internal organ images (both pictures and actual photographs) in the VGA-mode with 256-color resolution. The capacity of internal imaging and penetration into the object of interest (e.g., heart) is particularly impressive.

The 3DBody SP is compatible with various medical technologies based on actual imaging, devices, and instrumental methods of examination (computer tomography, magnetic resonance imaging, ECG, ultrasonic scanning, etc.).

The third subsystem of the 3DBody SP is a game control system which allows a multilayer approach to the object of monitoring: system—organ—tissue—cell. It also allows the feedback control of the level of comprehension of the studied material by the students.

The fourth subsystem of the 3DBody SP is a game subsystem called "journey through the hospital". It starts from the admission department, then goes through departments of functional diagnosis, where a hypothetical patient is examined for a hypothetical pathology in accordance with the examination strategy selected by the user. This does not exclude clinical, diagnostic, and therapeutic measures and procedures. For example, the Operation option allows penetration into the organ subjected to surgery, search for pathological lesion and its origin, and selection of optimum strategy. It should be emphasized that such approach stimulates the students, activates their memory, imagination, and significantly facilitates training.

The hardware required to implement the software: IBM PC/386 of standard configuration with 2 MByte RAM and a mouse manipulator. The software occupies 8 MByte of file memory.

The 3DBody SP is designed to be used in medical universities (training of junior students) and for training students and postgraduate students of technical universities and institutes.

3. MAYO Clinic

The MAYO Clinic (MAYO Clinic Family Health Book) program system was developed by the Mayo Foundation in 1992. More than 200 skilled programmers, physicians, and artists contributed to the development of the program. The program generalizes the long-term clinical and research data obtained in the famous hospital founded by W. D. Mayo and C. G. Mayo.

The MAYO Clinic SP can be regarded as a logistic continuation of the software systems described above. This system brings the functional pathology observed in patient into correlation with the structural changes of corresponding organ and tissue. Therefore, this system implements a clinical-anatomic approach.

The MAYO Clinic SP is designed for the Windows operating system and implements dynamic exchange between the graphic objects and audio support.