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Computer graphics — a space-age approach to medicine

A computer-graphic technique to quantify heart damage is being developed at the National Research Council to assist the cardiologist in making more objective diagnoses.

A description of NRC's work appeared in Science Dimension 1978/3:

...In the past 30 years, computer technology developments have led to the machine's involvement in almost every aspect of daily life from the mundane processing of bills to assisting doctors in saving lives.

One medical area in which the computer plays an increasingly important role is heart disease, the foremost killer in North America. Although surgical techniques and medications are highly sophisticated, the assessment of heart damage before surgery often depends on the subjective evaluation of the cardiologist. Results from standard techniques, such as electrocardiograms, are often not sufficient to diagnose a heart condition. Angiocardiology (a method of X-ray that shows the walls of the heart), while precise in detecting heart problems, does not provide the cardiologist with a numerical or quantitative analysis to better assess the proper course of action.

Most common cause

It is ironic that the very organ that supplies life-sustaining oxygen to the entire body is also one of the most sensitive to its diminished supply. In our society the most common cause of heart disease is coronary arteriosclerosis, a condition in which the coronary arteries become partly or completely clogged by plaque deposits of cholesterol and fats. When the occlusion is major the patient may suffer a heart attack (myocardial infarct) — in which oxygen-deprived heart tissue dies, causing permanent damage to the heart muscle. In serious cases heart function may be impaired to the extent where insufficient amounts of oxygenated blood are supplied to the body.

In the heart, it is the left ventricle which, on contraction, pumps the oxygen-enriched blood throughout the body. Consequently, a quantification of the left ven-

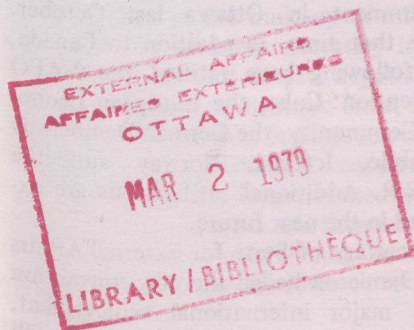
tricular function would increase a cardiologist's confidence in assessing the damage and, therefore, in judging the appropriate treatment.

The obvious solution to the quantification problem according to Dr. B.C. Morton, a cardiologist with the University of Ottawa Cardiac Unit at the Ottawa Civic Hospital, was to use a computer facility capable of handling the graphic information contained in the X-rays of the left ventricle (i.e. angiograms) and converting it into a numerical analysis. With this thought in mind he approached National Research Council engineer Theodore Shepertycki, of the Computer Graphics Section in the Division of Electrical Engineering.

Computer program

Mr. Shepertycki's first approach to the problem was to establish a computer program that could calculate ventricular function — specifically its capacity for pumping blood to the tissues. "It was known that a normal left ventricle ejects 66 per cent of the total blood in the chamber with each pumping action," stated Mr. Shepertycki. "So, we expected that patients who had coronary artery disease with impaired left ventricular function would have ejection volumes below the normal level."

The procedure for calculating ventricular ejection volumes begins by obtaining X-ray pictures of the left ventricle walls in a serial time frame. The two frames representing the maximum and minimum ventricular expansion are selected and with the aid of a calibration grid their volumes calculated by a computer with an attached digitizing tablet and a computer display cathode ray tube (CRT). As the silhouettes of the left ventricle are traced on the digitizing tablet, the profiles are registered in the computer and



Eight years ago Saturday, January 20... Radio Tuktoyaktuk (Northwest Territories) began broadcasting. The station uses two languages — English and Inuit.