

men regard it as a realistic goal capable of eventual achievement.

Obviously the key word in this whole debate is thinking, but most of the scientists who work with computers are wary of giving it a precise definition. When an engineer at NBS was asked whether a computer was really anything more than a combination of its built-in functions and its programmed capacity to learn, he simply grinned and asked: "Are people?"

Those who argue that people, unlike machines, solve problems not only by logic but by hunches may be surprised to learn that machines can do this too.

One of the ways of describing computers' "thinking" processes is to distinguish between algorithmic and heuristic functioning. In algorithmic procedures a machine is presented with a problem and given the formula necessary for its solution. Or it follows a step-by-step procedure that will eventually terminate in an answer, or in the conclusion that no answer is possible.

Heuristic thinking, in people, is what can be called reasonable hunches or intelligent guesses or the trying out of likely possibilities. To some extent this is the way a detective operates when he tries to get his man. He draws on his past experiences, his information of other crimes employing the same techniques, his knowledge of psychological types and a wide array of other factors that in total make up a good lead.

There are machines in existence that can function in this way. One or many people can develop a program for a machine that incorporates their own and other hunch capacities, enabling a computer to pick the two or three approaches out of many alternatives which may very well lead to success—though there is no guarantee.

Computers now in operation have been programmed to read an article (in numerals, not in English) and to abstract the key points in it. The programmer instructs the machine to discard words appearing a great number of times—these will be articles, conjunctions, etc.—and to select only those sentences that contain words appearing less frequently, but not rarely. Since these words tend to be the ones that describe the substance of a piece, the computer can often, though by no means always, come up with a reliable abstract. This is also a kind of heuristic functioning.

Although computers have clearly proved that they can simulate certain reasoning processes in the solution of given problems, many people are still reluctant to concede that they actually think. In this position they are supported by the cartoon scientist who turns wryly to his colleague and says, "It will never replace the human brain, Stanley, until we find a way to make it worry."

• Science News Letter, 79:234 April 15, 1961

ASTRONAUTICS

# Oxygen System for Space

➤ A SYSTEM to convert an astronaut's breath into breathable oxygen is being designed at Battelle Memorial Institute in Columbus, Ohio.

It is planned for use on space voyages lasting as long as three years, Dr. John F. Foster and Justin S. McNulty of Battelle reported at the annual meeting of the Institute of Environmental Sciences in Washington.

Successful operational development of such a system is vital to extended space voyages. For long journeys away from earth, space and weight limitations would make it impossible to carry all the necessary oxygen, either in tanks or in the form of a chemical compound. One solution is to make use of the exhaled breath (carbon dioxide) of the space traveler.

Sponsored by the Air Force Air Research and Development Command, the Battelle research has resulted in a working prototype of a device to convert carbon dioxide into water. This is a major step in developing a complete oxygen recovery system.

The Battelle apparatus has carbon dioxide fed into it at the rate of 500 cubic centimeters per minute. The carbon dioxide reacts with hydrogen over a heated iron-containing catalyst (a combination of steel wool and iron oxide pellets) to produce water vapor and solid carbon.

The condensed water vapor will be fed to an electrolytic cell, now under development at Battelle, where it will be broken down into breathable oxygen and hydrogen.

The latter will be used to react with more carbon dioxide. Solid carbon will be removed from the reactor every two or three days and discarded.

The Battelle system is less than five feet high, occupies about two square feet of floor space, and weighs about 200 pounds. Prior to its test in a space probe, the apparatus will be redesigned to increase the conversion rate and capacity while cutting down on weight.

• Science News Letter, 79:235 April 15, 1961

MINERALOGY

## Pure Beryllium Is Not Brittle

➤ HIGH-PURITY beryllium metal produced by the Franklin Institute Laboratories has a ductility that is 50 times that of ordinary beryllium. The brittleness of ordinary beryllium is caused by the impurities present.

The Laboratories, located in Philadelphia, used a specialized floating zone refining technique to produce this ductile beryllium. Their scientists are trying to determine the nature of the impurities causing the brittleness.

Beryllium is the lightest of the metals that can be used for construction. It is 34% lighter than aluminum and 77% lighter than stainless steel. It also has very great strength. These properties make it very desirable for space age consideration.

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