

TECHNOLOGY

Lie Detection at a Distance

Devices now available or that could be developed on the basis of known technology would make possible lie detection at a distance.

By ANN EWING

► LIE DETECTION at a distance, without a person even knowing he is being tested, is possible in the not-too-distant future.

Some of the devices to record breathing rate and temperature changes are already available. Instruments to measure blood pressure, heart beat rate and perspiration could be developed on the basis of known technology.

These instruments do not touch the body of the person being monitored. They can be operated at a distance of up to 30 feet.

Long distance lie detection would have many applications, most of them reminiscent of the late George Orwell's "1984," which could be much closer than the 19 years the calendar shows.

How Instruments Work

How such instruments work and some of the possible applications for them have been outlined by Dr. Carl Berkley, scientific director of the Foundation for Medical Technology, New York.

When an electrocardiogram is taken now, a transducer, which changes mechanical energy into electrical energy, is a key part of the equipment.

Quartz is probably the material most often used to accomplish this change. It occurs because quartz and a few other compounds produce an electrical charge when their shape is changed, an effect called piezoelectricity.

The most familiar example of this effect is in a phonograph. There the pickup crystal in the head of the phonograph arm changes the mechanical vibrations of the needle into electrical pulsations that are amplified and then changed into sound by the speaker.

Transducers are now available for investigating a large number of the body's responses. However, as a great majority of persons who have had electrocardiograms taken can testify, the mere fact of attaching the electrodes causes a considerable change in a person's body functions.

This is but one example of what is known in science as Heisenberg's uncertainty principle, which may be stated simply as indicating that the measuring instrument in some way, however slight, always affects the measurement. This is particularly true in biology and medicine, where even the doctor's tone of voice in prescribing a new drug has been found to have a marked effect on a person's reaction to the drug.

Another example is the case of observing living cells under a microscope, where the light producing the image substantially

affects the cells. Therefore, in order to obtain valid results from an animal or a patient, it is desirable to use methods that interfere as little possible with normal responses. Transducers are now available that produce a minimum of discomfort to a patient, or that can be left implanted for long periods of time.

Among the most commonly recorded body responses monitored are respiration, temperature, galvanic skin resistance, blood pressure, pulse and heart action by taking an electrocardiogram.

Dr. Berkley suggests that these could be registered as follows:

Respiration. Respiration might be monitored by measuring the slight changes in a patient's profile produced by breathing in and out. This can be done by a variety of scanning methods or by the use of a follower that tracks the edge of a shadow from a distance. Another possibility would be to

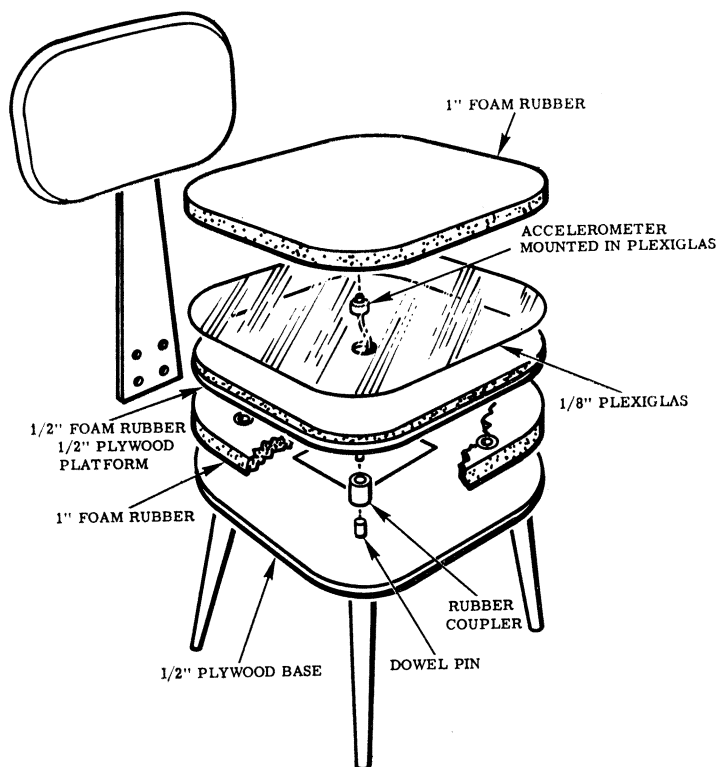
beam a single frequency of ultrasound at the subject, then detect the changes in the reflected beam caused by the in-and-out movement of the chest wall.

Temperature. Several different methods for measuring the infrared, or heat, radiation from a subject without his knowledge are already available.

Galvanic Skin Resistance. This is closely correlated with sweat gland activity. The presence and amount of a layer of perspiration on the skin surface could be monitored by the reflection of microwaves at the frequency where water is absorbed or by the reflection of polarized light at an angle.

Blood Pressure. Changes in vascular blood pressure could be observed by measuring the amount that veins in the forehead or neck protrude above the skin surface. This might be done using a spot scanner such as suggested under respiration.

Heart Rate. The pulse could be detected by the cyclic variation in the reflection of skin. Ultrasonics could also possibly be used in a pulsed radar technique to detect a second reflection through the chest wall from the motion of the heart, or a spot follower method might give the pulse rate.



The American Journal of Medical Electronics

LIE DETECTION DEVICES—The difference between the old and the new in lie detection is shown in the illustrations. On the next page is the old-fashioned way, with electrodes strapped to the subject's arms. Above is a drawing of what might be any ordinary office chair, except for the special equipment it contains that can record the heart rate of an individual without using attached leads and radio the information to a remote recorder.



National Lie Detection Laboratory

OLD LIE DETECTOR

Electrocardiogram. Using heavily shielded electronic equipment, it might be possible to detect heart action a few millimeters away from the skin surface.

Ordinary Office Chair?

A device that demonstrates the feasibility of an indirect heart rate monitoring instrument, an upright ballistocardiograph, has been built and tested by two scientists from General Motors Corporation while they were at Santa Barbara, Calif. The chair, which looks like an ordinary office chair, is now being used for tests at the Space/Defense Corporation, Birmingham, Mich.

A very sensitive piezoelectric accelerometer and a vibratory system are mounted in the chair. When an individual is seated in the chair, the forces exerted by the pumping action of his heart are sensed, changed from mechanical to electrical energy, then broadcast to remote recording instruments. An individual weighing less than 140 pounds will not generate a satisfactory signal.

Since the chair so closely resembles an ordinary chair, the heart data can be obtained without the conscious knowledge of the subject.

Another chair has been successfully tested in experiments at Syracuse University, Syracuse, N.Y. It takes an electrocardiogram indirectly by detecting the circulating electric current produced by heart action potentials.

Some or all of the six kinds of instruments would be necessary to conduct lie detection at a distance. When used remotely, responses of those undergoing tests would be much less inhibited. However, doing such tests without a person's knowledge ignores the moral question of whether they should be made without the subject's consent.

Value in Diplomatic Negotiations

These devices would also have possible application for the following:

1. Court procedures. Judges and juries now use certain reactions of a witness, such as his speaking rate or the flushing of his

face, to make a judgment as to whether the witness is telling the truth. Such judgments would be based on more information and less biased guesses if instruments were used to measure the changes.

2. In diplomacy. The installation of such equipment in diplomatic offices and at international conferences might do much to encourage truthfulness on the part of the participants, Dr. Berkley said. At the very least the instruments should make statements of policy, which are part of the political line of a particular country, much more readily appreciated at their true values.

3. In espionage and surveillance. The availability of such equipment might reduce the need for installation of "black boxes" to detect nuclear blasts. It might be sufficient merely to examine a number of the representatives of the countries involved with or without their consent using the new techniques.

Dr. Berkley suggested that the United States would be one of the prime prospects for the development and purchase of such equipment. In political debate, he said, "certainly every forum should be equipped with one of these devices."

4. The art of electronic eavesdropping. The recording of conversation at a distance might be possible by a modification of the radar used to measure changes in respiration. Electronic eavesdropping, exemplified by a device called the "big ear," has already reached a high level of perfection.

• Science News Letter, 88:106 August 14, 1965

Electron Beam Welder To Aid Astronauts

► THE DEVELOPMENT of a hand-held, electron beam welder that works in a vacuum is expected to play an important role in giving astronauts the proper tools for construction and repair work in outer space.

The welder is to join metals by firing a highly concentrated beam of electrons traveling 50,000 miles per second. The portable part of the welder—a cylinder housing the electron gun, its electromagnetic focusing lens and a transparent shield through which the welding can be observed—will be five inches in diameter, ten inches long and will weight ten pounds. It is being developed by the Hamilton Standard Division of United Aircraft Corporation.

• Science News Letter, 88:107 August 14, 1965

ENGINEERING

Oil-Wax Layer Saves Water from Evaporation

► SPREADING OIL on troubled waters may smooth them, but spreading an oil-wax layer on fresh water keeps it from evaporating in storage tanks and facilities, reports R. C. Fox of Richmond Laboratory, California Research Corporation, Richmond.

A layer of this petroleum-oil-wax floats more easily over the water surface than a layer of fatty alcohol, which has sometimes been used to retard evaporation, Mr. Fox reported in *Nature*, 205:1004, 1965.

The oil-wax layer also reforms more easily after being distributed, is biologically more inactive and is less expensive. Further investigations of this system are underway.

• Science News Letter, 88:107 August 14, 1965

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