

...a report on the much-talked-about psychological stress evaluator - man's latest electronic effort to aid justice and cancel bias with the impartiality of science...

TRUTH VERIFICATION

By Gion B. Green

In any investigative situation the central effort is always to ferret out the truth. And the truth is frequently most elusive largely because people who become involved in the investigation are often willing to deal with the truth only from the viewpoint of their own interest. Viewpoints that fall short of the truth can vary from an honest bias to a series of carefully considered lies. They can range from distortions to half-truths to simple omissions of fact, and every such answer makes arriving at the truth that much harder. This has always been a problem in human affairs.

Some of the earlier efforts to separate truth from the worse, to say the least, severe. In many such tests the guilt and the innocent alike perished in the testing. Fortunately we've come a long way, and today's truth testing devices are now regarded as highly reliable in the hands of a competent operator. The latest and most convenient device in the field is the Psychological Stress Evaluator (PSE) -- an instrument that uses the human voice as

the medium to provide measurable physiological responses to psychological stimuli.

In this instrument the voice, and the voice alone, is evaluated in various ways. The need for attached sensors and attendant equipment is eliminated, thus tending to reduce the psychological stress in the subject. As an added convenience, the voice that is the physiological medium to be examined can be transmitted over the telephone or radio for evaluation. There is little available evidence that such transmissions are currently called for, but should the PSE come into more general use they may prove useful.

Like the polygraph, the PSE operates on the relationship of involuntary physiological change to psychological stress. This stress, which may be induced by fear, anxiety, guilt or conflict, creates physiological responses that may, in some cases, be observed without the aid of any instruments. In most cases, however, such stress can be detected only by measuring

particular physiological changes. The polygraph, with a detectable record of validity and reliability, records blood pressure, pulse, respiration, and changes in the skin's resistance to electricity, generally referred to as the galvanic skin response. In the hands of a trained operator this information regarding stress can be interpreted to detect attempts at deception during interrogations; and it can additionally be useful in discovering areas of tension, basic reliability and honesty, and even provide some insights into a subject's motivation and his stability in a given, limited area. As to this last, both the polygraph and more recently, the PSE, are used in psychiatric diagnosis.

Unlike the polygraph, however, the PSE uses the subject's voice as the only medium for examination. No attempt is made to incorporate additional data such as heart action or other physiological phenomena into the evaluation.

In order to better understand the psycho-physiological process upon which the PSE operates, it is necessary to

which the operation of the PSE is based, it might be well to examine briefly pertinent portions of psychology and physiology that must be understood in order to understand the basis of the PSE.

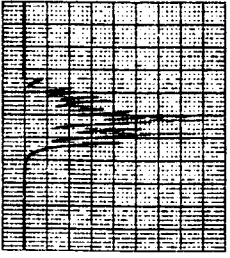
The human nervous system can be classified under two headings: the central nervous system and the autonomic nervous system.

Basically, the central nervous system concerns itself with those physical and sensory functions that occur within conscious awareness.

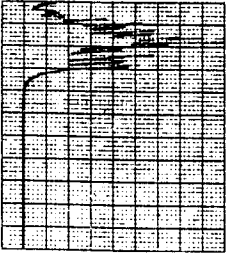
The autonomic system, on the other hand, concerns itself with those functions over which we exercise no control and is thus, as its name implies, autonomous or self-regulating. The functioning of the kidneys and the liver, the operation of the lungs, the beating of the heart, the digestive and eliminatory processes are some of the many complex functions that operate within the control of the autonomic nervous system.

This autonomic system is further divided into two complementary though opposing branches: the sympathetic and the parasympathetic nervous systems. Both systems are equally concerned with those functions in which self-regulation is essential. The breathing rate, for example, normally occurs at a rate established by bodily needs and is kept at that rate by the balance between the sympathetic and parasympathetic systems. When, however, there is an increase in physical exertion or when there is a heightening of emotion such as fear or anger, the sympathetic system will increase the parasympathetic, and the rate of breathing will increase. After the conditions of exertion or the emotional

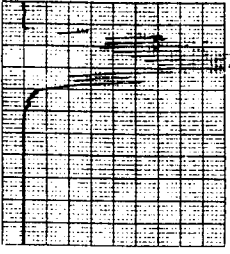
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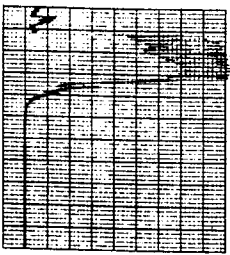
Q - Do you like beer?
A - Yes



Q - Did someone help you start the fire by the fire?
A - No



Q - Did you help someone start a fire by the fire?
A - No



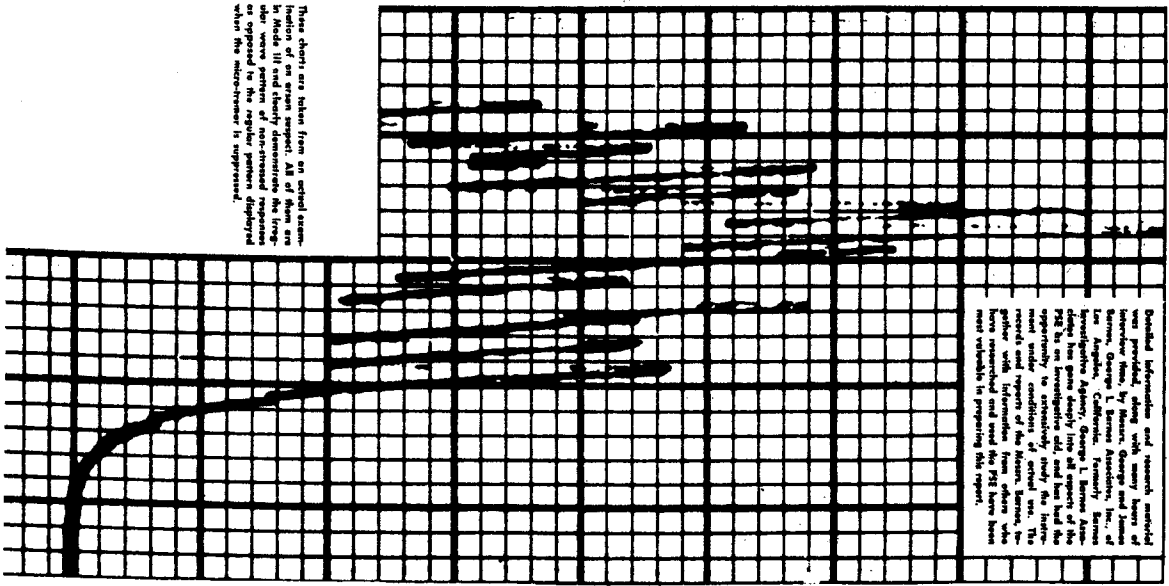
Q - Did you start the fire Monday night?
A - No

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These charts are taken from an actual demonstration of an stress response. All of them are in Model II and clearly demonstrate the long-term stress pattern of non-stressed responses as opposed to the regular pattern displayed when the micro-stressor is suppressed.



Specialized information and research provided by the author, Gion B. Green, is available through the Psychological Stress Evaluator, Inc., at Los Angeles, California. Kennedy Bureau of Psychological Services, George T. Barnes Associates, Inc., and the Psychological Stress Evaluator, Inc., are also available for information and to help the interested parties to understand the instrument and its operation. The author is available for information and to help the interested parties to understand the instrument and its operation. The author is available for information and to help the interested parties to understand the instrument and its operation.

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stimuli have been dissipated, the parasympathetic nervous system works to re-establish the body's balance or homeostasis. Generally speaking, the sympathetic nervous system is reactive to external stimuli; the parasympathetic might be thought of as essentially reactive to the sympathetic. In most though not all cases, the sympathetic system is dominant under conditions of strong emotion, exertion, or need; the parasympathetic system is the dominant branch of the autonomic system under conditions of calm and relaxation.

Most of the visible or measurable indicators of stress are attributed to the autonomic nervous system as in the case of breath rate we have just touched upon. There is, however, for the purpose of this discussion, one important exception—a low frequency muscle tremor that exists throughout the body, including the voice mechanism.

This tremor, referred to as micro-tremor, is a normal accompaniment to the activity of any voluntary muscle and occurs at a rate of between 8 and 14 cycles per second. Curiously though, this tremor appears to be controlled by the central nervous system even though it is involuntary. The effect of this is fundamental to the operation of the PSE. As the autonomic nervous system gains dominance in a situation of stress, the micro-tremors are suppressed or eliminated entirely. This tremor suppression continues until the stress situation is eliminated and a homeostatic condition returns, at which time the micro-tremor can again be observed.

The PSE measures and displays certain specific stress-related components of the human voice. In this display, the inaudible frequency modulations resulting from the micro-tremor are superimposed over audible voice frequencies. The strength of the FM indicator relates inversely to the degree of psychological stress felt by the subject at the time of the utterance. As we have seen, the greater the stress, the greater the dominance of the autonomic system; hence, the greater the suppressive effect on the micro-tremor.

The PSE deals with three aspects of the voice from which a highly reliable evaluation is possible. These consist of:

1) The third formant frequency,

which is useful because it resonates at a fixed frequency that is found most conclusively to the PSE.

(The third formant encompasses the sinuses, the turbinate, the ossicular area, bony and tissue.)

2) The fundamental voice frequency,

which originates in the throat area and encompasses the vocal cords, bone, muscle tissue, and the cavity itself.

3) Micro-tremor

It is important to know that the PSE is not a recording device. From a recording the PSE is used to chart the characteristics of the subject's voice, and it is from this chart the examiner is able to make his evaluation. It is also important to note that the PSE has the ability to accept narrative answers as well as YES/NO.

This has proved valuable in certain situations in screening examinations.

There are four modes and ten different indicators of stress that are used on the PSE. These can be further examined in various ways, so that eventually from one taped interview 12 different charts can be made. This versatility allows the examiner to thoroughly check the different mode patterns, and thus to arrive at some positive conclusion even under the most difficult circumstances. It is, of course, rarely necessary to examine a test with such minute attention. Normally an accurate evaluation can be arrived at long before all the modular possibilities have been exhausted. In all cases, tapes recorded at 7 1/2 FPS are used.

Mode I, which examines respiration or voice amplitude, is used largely to give the examiner a quick overall look at the chart to see if stress appears. This is charted at the recorded tape speed of 7 1/2 FPS.

Mode II is an extension of Mode I, in that not only the difference in amplitude but the beginning of a wave

formation can be seen. In this mode a diction or pattern block can be identified. This block, in which several words are given the same volume and emphasis as opposed to the more normal trailing off or declining emphasis, is usually indicative of a stress situation. It frequently indicates deception.

Mode III, which is concerned with the autonomic nervous system and its effect on micro-tremor, gives the examiner a complete study of the subject's stress patterns. It is here that he looks for square or diagonal patterns on his chart, and above all he looks for the regularity in the trace caused by the reduction or elimination of the FM that indicates that the micro-tremor has been suppressed or eliminated. He can also find cyclic rate change which, like pattern or diction block, indicates a change into a speech or word pattern of measured equal emphasis. Here again stress or deception is indicated.

Mode IV, which is normally charted with the tape played at 15/16 FPS, gives the examiner the ability to study the elements of Mode III (except for amplitude) in greater depth. Especially helpful where the examiner has a chart indicating considerable stress throughout, Mode IV can indicate the responses with the most stress.

Questioning techniques used in conjunction with the PSE are, in general, the same as those used with the polygraph. In using both instruments, careful pre-testing routines must be established. Testing and, if necessary, re-testing must be carefully constructed. *Outside issue and guilt complex questions* must be structured to identify those problems when they arise. For those of you unfamiliar with these problems in truth verification testing they can be described simply.

Outside issue: A subject who has been involved in a situation similar to the one under examination may react associatively to the prior experience even though he has no involvement or knowledge of the issue under examination.

Guilt complex: There are some rare persons who will show stress reactions to any questions asked of them. It is important that both of these situations be recognized and dealt with. A trained examiner will structure his test to identify these problems if they exist.

Peak-of-tension, zone comparison, and general question tests are used in

various forms and combinations.

The PSE is in current use as an effective tool in industrial psychology, criminal investigation, corporate security, employee screening and, as previously noted, in psychiatric diagnosis.

Since the PSE itself is to serve only for the evaluation of tapes of examinations or tests of given subjects, it can be used in an infinite number of applications. For example, efforts are already under way to get LEAA funding for a study of PSE usage in jury selection to uncover any prejudices that might distort adjudication of cases. With the PSE at the *voir dire* hearings, the comments of the jurors can be taped and evaluated by the PSE simultaneously, and areas of stress that might be prejudicial to the case can be examined in greater detail. It has additionally been reported that some lawyers have made use of the technique to verify the facts from their own clients' allegations.

Obviously all such use of the PSE can only effectively be made with the permission and the cooperation of the subject. Recent newspaper articles made much of the PSE evaluation of various witnesses in the Watergate proceedings. The clear implication of these articles was that certain witnesses were lying and others were not. No responsible PSE operator would allow such an implication to go unchallenged. Without proper control questions and without a carefully structured interrogation technique, the truth or falsity of any given statement could never be known.

The operator can indeed read the areas of stress, but without further knowledge or controls, the significance of such stress can never be known.

The PSE is an important new development in the area of truth verification—the detection and stress evaluation. It has already demonstrated its usefulness, and in the hands of competent, trained, and ethical operators it should continue to develop an enormous potential as an effective instrument and security as a valuable aid in the administration of justice. ■