Factors Influencing Reliability and Validity of Lie-Detector Techniques

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INTRODUCTION

I shall attempt in this paper to show some of the conditioning factors which influence the reliability and validity of the results of the various physiological measures used in deception detection by criminal psychologists.

In order to efficiently present and discuss this subject, it will be necessary to include certain explanations and discussions which have bearing only indirectly on the problems of validity and reliability, but which, if left out, would deprive this report of a foundation upon which to draw certain conclusions.

I consider the administration of any lie-detector test, in a very valid sense, to be, by virtue of its physiological and psychological nature, a scientific experiment subject to the procedures, precepts, and considerations involved in any laboratory experiment. Moreover, the determination of individual innocence or guilt, either partially or wholly upon the basis of physiological tests, makes their validity an ethical and moral problem as well as a psychological one. Therefore, the exercise of scientifically determined, controlled and accurate procedures is of the utmost importance if these tests are to have any contributing value towards the preservation of the standards of law enforcement and the possible punishment of criminals. In this regard, the primary importance, because of the necessity of a high degree of validity, is to ensure conditions of test administration as nearly uniform as possible. The extreme degree of correlation between each
administration of a lie-detector test and a complete psychological experiment performed in a laboratory demands that the criteria for successful testing be reliability and validity. The chief factors influencing these criteria are those concerning the several variables involved. These variables must be controlled, balanced, or in some way equated to reduce or cancel out their influences on the results of the tests.

PRINCIPLES INVOLVED IN THE USE OF PHYSIOLOGICAL METHODS OF LIE-DETECTION

The primary purpose of using physiological methods is to measure emotional activity. This is done by determining the nature and amount of physiological change present in various emotional states and under particular conditions. Emotional activity has been measured by tests for conduct including the Woodward Psychoneurotic Inventory (5, p. 401). The results of this test have not been able to show a very direct correlation between conduct and emotions present in a specific situation. More applicable are measures of "visceral changes which are characteristic of the emotional, stirred-up state" (5, p. 401). Many of these changes are extremely difficult to determine and for that reason a restricted number are used. These changes are most clearly presented by Symonds who describes them as "the rate of the heart-beat, the amplitude of the heart-beat, blood pressure, volume of blood in a limb, rate of breathing, amplitude of breathing, and psychogalvanic reflex" (5, p. 401). Because of the irregular variability of many of these factors, their measurement must be made at one time in a controlled atmosphere. In order to do this various devices and instruments have been intro-
duced and adapted to lie-detection.

VARIOUS DEVICES ADAPTABLE TO MEASURING EMOTIONAL REACTION

Cardiotachometer. The rate of the heart beat is measured by the cardiotachometer which gives the heart rate immediately as a dial reading.

Sphygmograph. Heart-beat rate is also measured by means of the pulse rate. A sphygmograph records the pulse beat which changes both in frequency and in amplitude. Pulse rate is relatively simple to determine but, nevertheless, it has not been used as widely as other measures of physiological activity. This is because of the variety of forces which influence the result: sex, size, age, temperature, exercise, drug stimulus, posture, eating, swallowing, emotion, and blood pressure (5).

Sphygmomanometer. Blood pressure is measured by the sphygmomanometer. Using this as a measurement recorder of emotional excitement, Marston (4) had considerable success in actual criminal detection. He worked upon the principle that:

"Blood pressure rises when the subject lies. If a person tested is suddenly stricken with fear at a question which puts him in a tight corner, the blood pressure record may show a sharp drop with a still greater rise thereafter" (4, p. 52).

The successful determination of whether a subject is lying or not by means of blood pressure alone was an oversimplification of the variety of possible emotional responses and needed further research and combination with other devices before a high standard of accuracy of deception detection could be achieved.

Arterial blood pressure varies because of many factors.
The most important of these are enumerated by Symonds (5):

- the volume of blood,
- the elasticity of the vessels,
- the peripheral resistance,
- gravitational variations,
- sex (being generally higher in women),
- size, age,
- breathing,
- Traube-Hering waves,
- eating,
- exercise,
- extreme degrees of temperature,
- fatigue,
- menstruation,
- pregnancy,
- pain,
- glandular products and disturbances,
- and emotion.

This makes it evident that blood pressure cannot be considered alone as an efficient or even accurate determination of whether emotional activity is being measured or not. As Symonds emphasizes in concluding some remarks on blood pressure:

"If blood pressure is to be used in the study of emotion, it must probably be used when the emotion is so very intense as to outweigh in effect any of the lesser variable forces acting\" (5, p. 414).

Plethysmograph. The measurement of blood volume is taken by means of a plethysmograph which records the volume of blood circulation change in a single finger or limb. This measure is, of course, complementary to the measure of pressure and pulse.

"Since emotion has an influence on the vaso-motor system, the measurement of the volume of an organ is another important means of estimating the presence and amount of emotion\" (5, p. 415).

Pneumograph. The rate and amplitude of breathing is measured by the pneumograph. This instrument indicates the amplitude of breathing during various emotional states and is also influenced by mental concentration (1). Respiration, however, is not constant and changes with age, and as physiological conditions alter. The rate of respiration varies with size, and increases because of barometric pressure, carbon dioxide content of the air, pain, while speaking, with temperature, exercise, posture, and emotion.
The rate may be decreased by will, fright, or sleep. Momentary variations in breathing are caused by the composition of the blood, because "respiration is directly proportional to the compression of the arterial blood" (5, p. 419).

As in the other measures of physiological activity, the rate and amplitude of breathing cannot be traced to emotional reactions alone, but is dependent upon a variety of factors. Galvanometer. Psychogalvanic reflexes are measured by a psychogalvanometer. The psychogalvanic reflex is a complex reflex distinguished by "a change in the electrical impedance of the skin following the action of stimuli which arouse emotion" (1, p. 236). These reflexes are most marked in body areas where a large number of sweat glands are located, particularly on the palms of the hands and on the soles of the feet. These changes take place as a result of variations in the perspiratory glands which are not completely correlated with the secretion of sweat. Certain shifts also occur in the permeability of the cell walls of surrounding tissue. The exact nature of the electrodermal response which is "innervated over sympathetic nerve fibers" (1, p. 236) is not known but it seems safe to assume that it is the result of a number of factors including:

"a change in polarization of the body tissues"

"a matter of skin construction and circulatory changes" (2, p. 47).

This is in addition to the sweat-pore activity changes discussed above.

The psychogalvanometer merely records the changes as
variations, "in the amperage of an electric current running through electrodes on the hand under constant potential." (1, p. 236). Variations in the electrical skin impedance also occur because of skin-resistance-variance in particular emotional states: high in relaxed condition, lower in an excited condition.

This constitutes, in outline, a list of the various devices which can be used to measure physiological activity. They are used in varying combinations as lie-detectors, or at least, as determinants of quantity of emotional activity under stress.

Separate measures of physiological change are highly inaccurate records of emotional tension. However, when a combination of records of the different physiological changes is taken, and interpreted as a unit, the resultant correlation enables the trained administrator to determine the quantities of emotional tension displayed by a subject under specific circumstances and questionings.

THE VARIOUS LIE-DETECTORS

The modern lie-detector uses many of the above devices and works on the following principle:

"that internal emotional strain draws forth a temporary excess of adrenalin into the blood from the adrenal glands and produces a moment of adrenal flutters which demonstrably affect the heart and lungs" (2, p. 44).

A combination of devices is used because, in general, the greater the number of physiological variables measured, the greater the possibility of obtaining useful data. More concretely, however, the potentially most effective combination thus far,
according to Inbau, is:

"a continuous and simultaneous recording of the relative changes in blood pressure, pulse and respiration" (2, p. 5).

Of the four most referred to devices: Keeler Polygraph, Marston apparatus, Berkeley psychograph and the Darrow Behavior Research Photopolygraph, the Keeler Polygraph is probably the most effective combination of the different devices.

"It is essentially a pneumatically operated recorder of these various mechanical phenomena" (2, p. 6).

In addition to the above catalogued measurements, since 1939, a galvanometer unit has been optionally attached to record electrodermal responses.

TESTING CONDITIONS: PHYSICAL

In administering a lie-detector test it is of the utmost importance to effectively control various factors present in the examination room. These external factors are important because they serve to orient the subject and make adjustment to other test conditions more readily attainable. The examination room should be private, free from extraneous noises, and stripped of wall ornaments which might divert the subject's attention. If possible a special room should be set aside and maintained for testing purposes alone. The subject should also be seated in such a way that the sight of the machines and the administrator does not disturb him.

TESTING CONDITIONS: MENTAL

By this, I mean the subject's orientation to the testing procedure. He should under no circumstances have been subjected to a "third degree" or any form of physically indoctrinating questioning beforehand because:
"the positive suggestions of guilt constituting part of a 'third degree' procedure may produce test reactions which will simulate true deception criteria (2, p. 28).

The subject should be assured that there is no physical pain resulting from electrical shock or from failure to tell the truth aside from the slight constant pressure on the arm caused by the blood pressure cuff. The subject should also be informed, in some degree, as to the nature and administration of the test. It should also be made clear to him that no leading questions will be asked concerning past actions or situations in his private life. The tone of the administrator's voice is important and should be modulated and soothing enough to help relieve anxiety.

TEST ADMINISTRATOR

This variable can only be controlled by having the test given by highly trained and fully competent psychologists. Aside from the interpretation of results, which demands a great degree of technical skill and experience, it is necessary for the administrator to be considerate in dealing with his subjects and to have the psychological knowledge and insight to be able to do this effectively. If a subject has confidence in the administrator, his nervous tension will be considerably lessened. This allows more indicative factors to influence readings and makes possible more accurate conclusions.

CONDITIONS INVOLVED IN SUBJECT'S ATTITUDE TOWARD THE TEST

The ideal in test administration is for the subject to be completely relaxed and in a highly susceptible state. This condition is not always obtainable as in many cases there is a
certain amount of fear, anxiety, emotional tension, possible fatigue, drug and narcotic influence. If the subject is in accord with the administrator and does not overtly or covertly try to thwart the procedure, the results will be immeasurably easier to interpret.

**TYPE OF INDIVIDUAL RESPONSE TO TESTING PROCEDURE**

Individuals will respond in various ways to the procedure of a lie-detector test. A person may be subject to considerable emotional tension because he is incensed and upset that his integrity and his veracity should be questioned. An actual accusation of an innocent person produces as large a result as if the person were guilty. This occurs because of a variety of factors: anger, resentment, indignation, and fear of the discovery of some past misdeed not associated with the present crime. There is also a certain tension present in the form of anxiety-anticipation of the test and, when this is coupled with the fact that the subject fears his nervousness will be interpreted as deception, considerable test reaction can be expected.

In some cases the bare proposal of the test causes confession.

"the instrument, the tests, and the accompanying procedures have a decided psychological effect in inducing admissions and confessions from guilty individuals" (2, p. 54).

**THE PROBLEM OF NERVOUSNESS**

Nervousness, as a result of anger, resentment, indignation, or fear of discovery of a past crime, is to be expected in any lie-detector test and provisions must be made to effectively check these emotional conditions and to take their effects.
"physiological changes or disturbances induced by nervousness appear on the lie-detector record without relationship to any particular question or questions" (2, p. 25).

In order that this inconsistency may be observed it is advisable to begin the test with a series of non-relevant questions and to end the test in the same manner. One test is not considered sufficient for any valid results.

"To adequately safeguard against the possibility of misinterpreting reactions produced by nervousness, it is necessary in some cases to obtain several records, possibly as many as ten" (2, p. 25).

This test repetition allows the innocent subject to become oriented and increasingly familiar with the test process. Much of the original nervousness and emotional tension is qualified and systematically reduced by this means. The guilty subject would remain in most cases, in a state of anxiety and tension.

The fear of having other crimes brought to light is one of the most difficult of these nervous emotional states to control. Merely to tell the subject that the test is for the sole purpose of establishing guilt in the single, present, specific situation is not enough. If a subject continues reassured after four or five test repetitions, there should be some direct questioning as to possible past offenses. The resulting records on these answers can then be compared with the previous records and by interpolation it can be deduced whether the emotional tension of the subject is due to a previous or a present offense.

"As a general rule, it may be stated that if the responses to the questions pertaining to other possible offenses are greater than (or equal to) the responses to questions referring to the particular offense, the subject is probably truthful as to the latter but deceitful as to the former" (2, p. 31).
This indicates that although this factor is the most persistent problem of nervousness, a capable administrator will be able to differentiate with relative ease the responses to a past and a present crime.

In sum, if the test administrator is properly trained and handles the person under examination properly, there will be complete cooperation throughout the examination. This cooperation usually increases proportionally to the knowledge of the process and as repetition of it continues. This, in most cases, is effective in cancelling out the emotional effects in nervous tension of anger, resentment, indignation, and fear that a past crime will be detected.

THE PROBLEM OF UNCOOPERATIVENESS

A person who is deliberately physically uncooperative on these tests may be so only for a limited number of reasons most of which would lead to a suspicion of guilt. There are also special psychological conditions such as feeblemindedness, and various pathological conditions which will be discussed separately. It can be stated with reasonable assurance that the only more or less successful method of uncooperativeness is that of unresponsiveness.

THE PROBLEM OF UNRESPONSIVENESS

Very few people are capable of controlling their physiological responses to the degree necessary to escape detection and "as a general rule, the more a subject tries to avoid detection, the easier it is to detect his guilt." (2, p. 41). If a subject is utterly devoid of fear of detection, he will be unresponsive and his record of physiological responses will be unindica-
tive. It is often the person of inferior or abnormal intelligence who is able to do this successfully and these mental states are easily ascertainable by the criminal psychologist who then acts accordingly. It is, however, the normal person with this ability, who has the potentiality of frustrating the administrator and his highly developed techniques. If the subject believes that the machines are a "bluff", he may feel that they may be "beaten". This sort of attempt may only be successful under certain conditions.

"A factor which may account for the absence of deception criteria in the record of a person who is actually lying, is the ability possessed by some individuals to control their responses by certain mental sets or attitudes" (2, p. 40).

Included in this would be the individual who had "confessed" his guilt to a priest and, therefore, felt absolutely no personal responsibility. This is in the nature of rationalization.

"There is much evidence to support the view that it is possible for a person to rationalize his criminal behavior to such an extent that lying about the offense, even during a lie-detector test, will arouse little or no emotional disturbance" (2, p. 45).

Rationalization and the ability to substitute responses for the ordinary ones by either concentration on an external object or symbol or by preparing a set of responses before the examination, are the two most frequent sources of unresponsiveness in a normal subject. These occur more often in habitual criminals as these are more likely to unconsciously find in rationalization and substitution convenient "outs" or "excuses" for their behavior.

When dealing with rationalized behavior in an unresponsive subject, the administrator may go through a process of trying to
Most unresponsive is the knottiest test. This may be done by various comments and by procedure indoctrination. During one of the repetitions of the examination, it would then be desirable to include a question on the individual's past. The answer to this question would be known by the administrator. This question may be in reference to a police record, the subject will be unknown and will, therefore, lie about. Inbau says, in reference to this:

"The response or lack of response on the lie-detector record at this point will serve as a valuable indication of the subject's degree of responsiveness, or non-responsiveness." (2, p. 41).

After the administration of the control question and comparison with the previous records these facts may be pointed out to the subject.

"A display of the known lie response alongside the response to a question regarding the particular offense under investigation is usually quite effective in inducing an admission of guilt regarding the latter." (2, p. 42).

Most unresponsive are broken down in this manner but this problem is the knottiest faced by psychologists administering lie-detector tests today.

"Sub-shock" unresponsive. One other type of unresponsive is known. This results from a condition of "sub-shock" or "adrenal exhaustion". This condition is only operative within a few hours after the crime and may be controlled by a series of examinations over a period of time.

CHILDREN

Children present another type of problem to the examiner because, in many instances, they may be incapable of distinguish-
ing "right" from "wrong". They also may suffer physical discomfort from the inflated blood pressure cuff. Physiological changes will not occur in the body if the person is not aware of the moral significance of lying. Therefore, children and mental defectives will not be conscious of lies as such; children because of insufficient socialization, and defectives because of their insufficient mental structuralization. A precept which can generally be followed in the treatment of children is:

"adolescents over thirteen or fourteen years of age are suitable subjects, but this will depend, of course, upon the stage of the mental development of the particular person under consideration" (2, p. 37).

THE PATHOLOGICAL LIAR

Pathological lying is defined by Healy (Healy as quoted in 2, p. 37):

"falsification entirely disproportionate to any discernible end in view, engaged in by a person who, at the time of observation, cannot definitely be called insane, feebleminded or epileptic."

This type of deception is comparatively undeterminable by any known technique of direct testing of the subject. Only by supplementary knowledge, and a confession can this means of lying be definitely determined. Psychopaths and psychoneurotics would constitute the majority of pathological liars. These variations of emotional instability often produce erratic and unpredictable results on the tests. Only the experienced administrator will be able to determine whether one of these mental conditions is in effect and causing pathological lying. The interpretation of test results will depend upon this and independent information, to determine whether the results are due
to guilt or not.

THE FEEBLEMINDED PERSON

Idiots and imbeciles, the two lowest categories of feebleminded persons, may be considered, for the purposes of reaching conclusions in lie-detector tests, as children and subject to the same inability to make proper value judgments and distinctions. They are not fit subjects for a lie-detector test. Morons, however, have a mental age of from seven to ten years and as Inbau says:

"the subject's mental inferiority does not give rise to lie-detector responses which may be mistaken for deception criteria" (2, p. 36).

The unresponsiveness of a mental defective can usually be evaluated by various experimental tests previous to the examination proper. On the basis of this criteria it can usually be decided whether a lie-detector test will prove feasible and efficacious.

PHYSIOLOGICAL ABNORMALITIES AND CONDITIONS AFFECTING PHYSIOLOGICAL FUNCTIONS

A comprehensive physical examination should be given before the lie-detector test is administered. The physical conditions of the subject will definitely limit the use of the test. Blood pressure itself, whether high or low, will "not ordinarily prevent accurate deception diagnosis" (2, p. 32). A heart condition, hyperthyroidism, an alcoholic state or narcotic condition, will render the lie-detector of limited use. The subject who has a severe cold, prolonged coughing, asthmatic attacks, hay fever, or hiccoughs, is not in proper physical condition for the test and the results should either be
interpreted accordingly or no test should be given at the particular time. These physical conditions being, to a large extent, temporary, the test may be postponed.

OPERATIONAL TECHNIQUES OF TEST ADMINISTRATION

This section obviously could be a paper in itself. Therefore, I shall just emphasize some of the overall methods rather than specific details. The manner in which a test is given, the care with which each step in the process is taken, and the technique used in interpreting results, are all important in determining what value, or reliability and validity the test may have.

Card control test. The "card control test" as a measure of emotional response is often used to begin the examination. This test necessitates a deliberate lie on the part of the subject as to which card he has chosen. The degree of emotional activity surrounding this lie indicates a pattern to be searched for when interpreting the results of the lie-detector test.

"The disturbance, or the lack of any disturbance, which may be indicated in this experimental record when the subject lies about his chosen card, will serve more or less as a yardstick for evaluating the subject's preceding records obtained when he was questioned regarding the matter under investigation" (2, p. 11).

"Peak of tension" test. If a subject has not been informed of the details of the crime, the "peak of tension" test may be used. This method involves the use of a group of questions only one of which is directly concerned with the crime in question, and that with a detail of the crime about which only the guilty party could know.
"A 'peak of tension' on a lie-detector record may be either (a) the highest point in the blood pressure-pulse tracing, or (b) a line of demarcation, so to speak, between a somewhat irregular, unsteady portion of the respiration or blood pressure-pulse tracing, and a more regular, steady recording from that point on." (2, p. 17).

The "peak of tension" occurs because the subject, if guilty, anticipates some question concerning something about which he must lie. The emotional relief, the release from tension after the question or questions have been "safely" negotiated will also be indicated.

Relevant-irrelevant question test. The "peak of tension" test may be used alone or in connection with the "relevant-irrelevant question" type test which records the "simultaneous extinction of a supression in respiration and an increase in blood pressure immediately after the subject answers a question asked by the examiner" (2, p. 17). This test predisposes a knowledge, from the card test, of the subject's norm and records specific deviations from that norm. Because of this, in possible, the "peak of tension" test is preferred by some authorities. Another point in favor of the "peak of tension" test is that the emotional reaction of a guilty person may be more intense over some specific detail of the crime than it would be concerning the idea of the crime in general. If a person is innocent, specific details of a crime will be of no concern to him and will not cause definite reactions.

Discontinuous vs continuous. There are two distinct types of over-all procedure used in lie-detection testing: the discontinuous and the continuous methods. These are both effective
and the preference of one over the other is of little concern here. Either method if administered properly and conscientiously interpreted may yield similar or corresponding information.

INTERPRETATION OF RESULTS

Interpretation consists of direct analysis of the pen-tracings on the test by a competent person, who may or may not be an M.D., but who should have had training in psychology and physiology. This analysis is a pulling together of the various measures and interpreting them as a unit. The difficulty involved in determining guilt or innocence is caused because of the following:

"lies are not accompanied by markedly different emotional changes from those of truth."

"detection of a guilty person depends upon the observer's analysis of a pattern of measured changes."

"the guilty person does not have a larger but a different pattern of associative responses." (1, p. 237).

This clearly shows the necessity for an expert to interpret. The interpreter must, aside from test results, take into consideration the attitude of the subject, the questions he may ask, his mental ability as demonstrated in IQ tests, his previous record if he has one, and his position in life, for whatever deductions can be made from these. The emphasis, however, should necessarily be on the tracings themselves and other criteria used only as additional information.

QUESTIONS CONCERNING THE RELIABILITY AND VALIDITY OF RESULTS

Reliability and validity are really separate problems in this consideration. Reliability concerns the test results as
given to a large group of individuals, whereas validity is concerned with the specific innocence or guilt of each subject. Validity is the soundness of conclusions drawn from the record of physiological measures and the usefulness of these conclusions in determining guilt or innocence. Validity naturally presupposes reliability but the reverse is not necessarily true.

It has been found that these tests have an accuracy of about 90%. Indefinite records are obtained in about 20% and about 10% of the results are in error. This standard is high enough to indicate that the tests have proven reliable as a general measure. They are not, however, uniformly valid as individual differences and the difficulties with unresponsive individuals have not all been successfully solved. The results are only valid and reliable in so far as the previously outlined conditions are scientifically controlled and adhered to by qualified individuals. Any serious deviation from the controlled procedures, inaccuracy anywhere along the line, will tend to invalidate or seriously impair the results. The conditions and factors going into the determination of guilt by physiological measurement are so varied and numerous that they demand constant supervision and study.

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