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THE ROLE OF OPINION IN POLYGRAPH TESTING

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Opponents and proponents of polygraph testing agree, oddly enough, one one thing--the process does work. They disagree strongly on the basic question, "How well does it work?" Psychologists, many of whom have neither conducted nor observed a meaningful polygraph examination, discourse learnedly on the possibility of "false negatives" or "false positives" in polygraph testing. The respected Harvard Business Review criticized the polygraph profession because a psychologist only achieved accuracy in the 70% range in a simulated crime paradigm. Later, studies, which paid proper attention to motivating the examinees and showed high accuracy, received only limited notice in technical journals.

We are undoubtedly entering a period of decision for the polygraph. The profession has begun a concerted attack on the Frye decision which, after almost 50 years, is still cited as a barrier to the admission of polygraph testing in court proceedings. In reviewing legal cases involving the polygraph several recurrent themes are almost always present. "Will this instrument and its practitioners usurp the functions of the judge and the jury?" "If they permit this expert witness to testify that the defendant is lying, doesn't this force a guilty verdict?" "How can the state prosecute a man who has 'passed' a polygraph test?" "How can I cross examine an instrument or a set of squiggles on a polygraph chart?"

Long a forceful, persistent, and effective advocate of the admissibility of polygraph evidence, F. Lee Bailey, in the Lazaros case, in the Medina Court-Martial, and in his books, has been answering the usual legal objections to polygraph evidence. Despite the close scrutiny of polygraph techniques by both friends and enemies, one area which has failed to receive proper attention is the important part played by opinion in each polygraph examination. Each polygraph examination ends in an opinion, generally along these lines, "It is the opinion of the examiner, based on analysis of the polygraph charts, that the examinee did (did not) answer the questions truthfully."

Distinguishing fact from opinion in polygraph testing is essential. For example, a specific physiological reaction is a fact. You can measure it; you can see it. You can count pulse rate and measure changes in amplitude or relative blood pressure. You can see suppressions and changes in the I/E ratio. You can point to the dramatic effect of a change in skin resistance on the GSR pattern. These things are demonstrable facts. They can be pointed out even to laymen.

The fact of a physiological reaction does not necessarily establish that it is a specific reaction, that is, occurring as a result of a given stimulus. Yet, this, too, should not be too difficult to establish, even to the satisfaction of a lay audience. We must show that the response in question occurs with a given stimulus and in such a physiological time frame as to have been caused by the stimulus. We must demonstrate that the reaction is definitely greater in intensity than the general level of reaction to other stimuli during the test. Last, we must prove that the reaction is consistent, that it occurs each time the given stimulus or a paraphrase of the stimulus is applied.

Although the decisions as to the intensity of a reaction and its consistency inevitably contain some elements of opinion, published research indicates a high degree of objectivity and agreement in chart analysis. The accuracy of chart analysis has been improved by development of subtle stimulation and control systems, which are an important feature of all generally accepted polygraph techniques. Thus, the role of opinion in basic chart analysis is fairly negligible, although legal cases might require an independent chart analysis by an expert selected by the court or by opposing counsel.

The place where opinion inevitably appears, and the place where polygraph testimony is subject to cross examination is the step following the chart analysis--the examiner's conclusion. In every case not substantiated by a valid confession or other definitive evidence, any conclusion based solely upon the analysis of the polygraph charts constitutes an opinion on the part of the examiner, and the accuracy of this opinion is in direct proportion to the expertise and integrity of the examiner.

In polygraph work we follow the principle of Occam's Razor, that is, that in any complex problem-solving situation, the simplest solution which satisfies the facts is most apt to be correct. Thus, we structure the entire examination to assure that the eventual conclusion by the examiner will be the most logical explanation for the presence or absence of specific physiological reactions on the polygraph charts. We discuss the questions and remove any semantic barriers. We try to attack the confidence of the guilty suspect, while at the same time reassuring the innocent suspect. We repeat the questions, paraphrase them, and cross-reference them to assure ourselves that no transient response will interfere with the accuracy of the test.

We interrogate concerning potential reactions and feed the data we obtain back into the examination. We try to maintain a testing environment which is free from outside noise and other distractions. We ascertain that the examinee was physically and emotionally suitable for testing from observation and from internal evidence in the charts. In cases of doubt we refer the examinee to medical or psychological professionals.

We use card tests, control questions, guilt-complex questions, "yes" tests, "no question" tests, and a hundred other stimulation and control procedures. We are aware that, despite our every effort, a small percentage of our examinations will be inconclusive, and our ethical standards require us to call them as we see them, regardless of any pressure which may be brought to bear.

I believe that all of the procedures set forth above are capable of being done well or done poorly. In direct examination counsel may establish that the examiner did a capable, competent, thorough job, one which should inspire confidence that his opinion as to the examinee's truthfulness was proper and logical under the circumstances.

Or cross examination may establish that the examiner was slipshod, careless, and incompetent--and that little credence should be placed in his opinion of the outcome of the examination.

Yes, opinion is inevitably present in each polygraph examination. We are just like the cardiologist, who reads the patient's electrocardiagraph tracing, sees no evidence of heart disease--and hopes the patient survives for the next appointment.

I see no reason why any of us should object to our operations and our results being placed under rigorous scrutiny. I continue to believe that any decision as to guilt or innocence belongs to the judge and jury. We of the polygraph profession may be of substantial help to them but we can in no way supplant them.

A HISTORY OF LIE DETECTION

PAUL V. TROVILLO

ABSTRACT

The history of the recognition of physiological changes signifying emotion and deceit is discussed. Included is an account of the development of instruments to record pulse rate, blood pressure, breathing, and GSR. The history and use of word association tests is included. Trovillo describes the application of the collected theory and instrumentation to the detection of deception, citing the contributions of scientists and practitioners. Validity, reliability, application and law are briefly discussed. Part 1. Ed.

The interrogation of criminal suspects may not be easier today than formerly, but it is at least on a more objective basis. Objectivity on the part of the examiner requires, however, not alone a scientific method and technique, but also discernment of the psychology of the suspect. Each of these three factors--scientific method, scientific technique, and psychological insight--were lacking in most of the ancient and medieval attempts to determine the truth. Indeed, in many parts of the world there are still employed the methods of the Ordeal and of Torture. Nevertheless, we have come a long way, and in this paper we record chronologically some of the outstanding episodes in the history of psychological interest in the lie.

Note: Reprinted from the Journal of Criminal Law, Criminology and Police Science, March-April 1939 and May-June 1939. The article will be serialized in Polygraph. Mr. Trovillo is active in psychophysiological research and will be a panelist at the APA Symposium in Chicago in August, 1972.

It is the unexpressed intention of the liar to mislead. And since people generally dislike to be misled, one who lies is apt to find his word contested and himself punished. For thousands of years, therefore, the liar has been penalized by law. Exceptions have been noted, however. Thus, an interesting example of group acceptance of the lie is to be found in one of the most ancient collections of books of law, manuscripts of which appeared among the Hindus around 900 B.C.- 600 B.C. In one of these "books," the Dharmasastra of Gautama, the judge is permitted to rely implicitly upon the testimony of witnesses and to adhere to the principle that "no guilt is incurred in giving false evidence in case the life of a man depends thereon."[1] Also, the Vasishtha Dharmasastra states that "Men may speak an untruth when their lives are in danger or the loss of their whole property is imminent."[2] Westermarck related cases wherein lying is applauded and recognized as a difficult art;[3] and Oscar Wilde in some of his essays, satirized the dull, serious fellow who is too conscientious to lie.[4]

In one of the papyrus Vedas written about 900 B.C. there are specific instructions for detecting poisoners by their behavior, and thus it would seem that poisoners, at least, were hunted out with some care:

> "A person who gives poison may be recognized. He does not answer questions, or they are evasive answers; he speaks nonsense, rubs the great toe along the ground, and shivers; his face is discolored; he rubs the roots of the hair with his fingers; and he tries by every means to leave the house...."

By the time of Erasistratus, the celebrated Greek physician and anatomist (300-250 B.C.), we find very definite attempts to detect deceit and these, interestingly enough, appear relatively objective in method (i.e., feeling the pulse). One such attempt is related by Plutarch and others. It concerned the love of Antiochus for his step-mother, Stratonice, and his efforts to conceal it from his father, Seleucus I of Syria, surnamed Nicator.

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1 Lea, H.C., Superstition and Force (1892) 268 (First Edition, 1866).

2 Supra note 1.

3 Westermarck, E., Origin and Growth of Moral Ideas (1908) 2: 72.

4 Wilde, O., "The Decay of Lying," Complete Writings of Oscar Wilde (1909).

Nicator, formerly a general in the conquering army of Alexander the Great, had married the beautiful Stratonice. Sometime after this marriage, Nicator's son (of a former wife), Antiochus, began to lose weight and to languish in an unknown disease. Nicator, whose associations with Alexander the Great had made him familiar with Alexander's respect for learning, decided to patronize learning himself and to look about for a capable physician who could cure his son's ailment. He called to his court Erasistratus, who had gained renown for his discussions of the functions of the brain and nervous system. When Erasistratus arrived at the court he acted on the current suspicion that Antiochus may have developed a consuming passion for the beautiful woman his father had married. In discussing with Antiochus the virtues of Stratonice he found occasion to feel Antiochus' pulse, and its tumultuous rhythm made him sure of his suspicions. Consequently Erasistratus informed the monarch that Antiochus was infatuated by Stratonice. Indeed, significant circumstantial evidence was to support this diagnosis: the second Stratonice was begotten of the intimacies of Antiochus and the Queen.

Early Objective Measures of Pulse and Blood Pressure

It is unfortunate from the historical standpoint that we can find few clear-cut early descriptions of symptoms of deceit. One remarkable observation, however, is found in the book "Gesta Romanorum."[5] During the Middle Ages it is related that a nobleman suspected his wife of infidelity, and told his suspicions to one of his advisers, who agreed to make a test to determine the facts. At a dinner he sat next to the nobleman's wife, casually laid his hand upon her wrist and conversed with her. During a brief conversation he mentioned the name of the man suspected by the nobleman, whereupon the lady's pulse immediately quickened; he later brought up the name of the husband but perceived no similar response. It is said a confession was later elicited.

How widely known was this idea of determining deceit by feeling the pulse cannot be ascertained. Perhaps other physicians of the pre-Christian eras, besides Erasistratus, had such information, but of this we cannot be sure. Erasistratus' technique may have been preserved, and brought to light hundreds of years later; at least this conclusion seems apt when we read of Boccaccio's story of how the illness of the Count of Antwerp was diagnosed.[6]

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5 "Gesta Romanorum," translated from the Latin by The Reverend Charles Swan (1906) 75.

6 Angelo Mosso gives credit for this story to Boccaccio.

Boccaccio (1313-1375) is commonly suspected of availing himself of all the common traditions which were floating about in his time and it may be that the following story is based on the early success of the physician Erasistratus to whom we have previously referred. It is said that the physician called in to diagnose the illness of the Count felt the young man's pulse at the wrist. Meanwhile, the Count's sweetheart, Giannetta, entered his room and his pulse began to beat violently. When she left it subsided. The physician, acting on a hunch, recalled the girl to the room and again observed the pulse quicken. Subsequently he reported to the young man's parents that the health of their son could not be restored by a physician, but only by Giannetta.[7]

Clendening, in an article entitled "The History of Certain Medical Instruments,"[8] calls attention to the early history of pulse counting, and although he makes no mention of its early application to deception, we should state at this point that, according to Clendening, Galileo (1581) must be given the credit for first inventing an objective way to count the human pulse. Galileo proved his apparatus by trying it out on himself under varying conditions, and also on a young and on old persons under various conditions, but he apparently did not use it to detect deception. Galileo's "pulsilogium," or pulse watch, was constructed so that a pendulum could be connected to a wheel behind a dial, the pendulum being a weighted string which could wind around the wheel. When this pendulum was set to swing synchronously with a person's pulse, the pointer would indicate the pulse rate.[9]

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7 According to De Lint, Cleyer demonstrated that the Chinese have been interested for thousands of years in feeling the human pulse and assigning a variety of reasons for its varying behavior. Whether the Chinese used the pulse in detecting deception is not indicated. De Lint, J.G., Atlas of the History of Medicine (Anatomy Section) (1926) 18.

Another practical demonstration of the value of noting pulse changes may be found in the autobiography of Benvenuto Cellini, in which he observes regarding his father: "I was ill about two months, during which time my father had me most kindly treated and cured, always repeating that it seemed to him a thousand years till I got well again, in order that he might hear me play a little. But when he talked to me of music with his fingers on my pulse, seeing he had some acquaintance with medicine and Latin learning, he felt it change so much if he approached that topic, that he was often dismayed and left my side in tears."

8 Clendening, L., "The History of Certain Medical Instruments," Annals of Int. Med., 4: 176-189 (1931).

9 Hart, I., Makers of Science.

The 18th Century, although it gave us no experiments of importance in the detection of deceit, produced a great wealth of interesting observations on the significance of the pulse rate. To the student interested in the psychology and history of deception it may be amazing that the pulse characteristics could be considered significant of almost everything else except lying.[10]

The celebrated Roman court physician, Lancisi, who in 1728 wrote "De Motu Cordis," conceived that emotion may be produced through the close dependence of mental functions upon the nerves, ganglia, and the coronary vessels of the heart. Emotions are produced, he thought, by more or less forceful heart action. From this he inferred that the characteristics of the mind derived from the structure and physical changes going on in the body. Such a theory formed an admirable basis for much of the later physiological experimentation on the action of the heart during deception, and the function of the body during other emotional experiences.

Aside from measuring the pulse, however, objective research on heart action in deception awaited development of suitable instruments. One such instrument was the sphygmomanometer. Clendening [11] traces briefly the history of the development of the sphygmomanometer, and although he makes no reference to its use in detecting deception, we take from his account some of the essential features of the development of this instrument. According to Clendening, a clergyman of the Church of England, by the name of Hales, is supposed to have been the first to study the measurement of blood pressure. Hales began experiments on dogs, and in 1733 he recorded further observations on horses and on a doe. He inserted a tube into the left crural artery of a horse and watched the blood rise in the tube to a height of eight feet, three inches, above the level of the left ventricle of the heart. But he did not translate this rise into units of measurement. In 1828 Poisenille, in a doctorate dissertation in medicine, described a "hemodynamometer," but he followed Hale's method of direct insertion, using a mercury column instead of a column of blood. In 1847 Ludwig developed a float for the top of the mercury column and had it write the pressure level on a recording drum. In 1856

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10 Mitchell, S.W., "The Early History of Instrumental Precision in Medicine," Transactions of the Congress of American Physicians and Surgeons 2: 159-198 (1891).

11 Op. cit. supra note 8.

Faivre, by the direct method, made the first measurement of the blood pressure in man. But in 1855, Vierordt (and later Marey) measured the blood pressure indirectly by obliteration of the pulse. Subsequently, Von Bosch, Potain, Zadek, and others made refinements in technique. In 1896 Riva-Rocci developed the rubber cuffmanometer method; and in 1897 Hill and Barnard added to this method a means of calibrating pressure.

In 1904, Erlanger,[12] an American, described an instrument patterned after the fundamental principles of Riva-Rocci of 1896. Four years later, in 1908, Munsterberg[13] was proposing that courts utilize the blood pressure test for gauging deception, and although Wigmore [14] in 1909 vigorously criticized too early application of the method, Marston [15] began some excellent investigations of the possibility of applying the test to everyday problem situations. To this work and that of subsequent investigators we will return later.

Observations in the Nineteenth Century

With the development of suitable apparatus for gauging emotions, many significant studies became possible, and there was a growing interest in the concrete problems of deception. The early years of the 19th Century, however, provided no startling innovations. In 1811, Mahon,[16] in a book on legal medicine, related that

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12 Erlanger, J., "A New Instrument for Determining the Minimum and Maximum Blood Pressures in Man," Johns Hopkins Hospital Rep. 12: 53 (1904).

13 Munsterberg, H., On the Witness Stand (1933) 118-133. First edition 1908.

14 Wigmore, J.H., "Professor Munsterberg, and the Psychology of Testimony," Ill. Law Review, 3: 399-445 (1909).

15 Marston, W.M., "Systolic Blood Pressure Symptoms of Deception," J. Exper. Psychol., 2 (2): 117-163 (1917); "Reaction-Time Symptoms of Deception," J. Exper. Psychol., 3 (1): 73-87 (1920); "Psychological Possibilities in the Deception Tests," J. Criminal L. and Crim. 2 (4): 551-570 (1921); "Studies in Testimony," J. Criminal L. and Crim. 15 (1): 5-31 (1924).

16 Mahon, P.A.O., Medecine Legale, et Police Medicale, 3 vols. (1811).

Galen, a Greek medical writer (131-201 A.D.), detected deceit in an individual who complained of a violent colic on being summoned to attend an assembly of the people. According to Mahon, Galen suspected feigning and prescribed "only a few fomentations, although this same person had not long before been cured of the same complaint by the use of philonium." In 1814, Hill,[17] a medical surgeon, wrote an essay "on the rules for detection of pretenders to madness." Although both Mahon and Hill were interested in simulation, they appear to be concerned only with subjective symptoms. So, too, was Beck,[18] an instructor in medical college, who, in 1825, referred to "a very curious work published at New Haven in 1817 under the title of 'The Mysterious Stranger, or Memoirs of Henry More Smith.'" Herein was described the case of a prisoner who contrived to seek attention and escape by striking his elbows on the cell floor to vary his pulse and thus trick the authorities by a simulated illness!

In the two decades between 1870 and 1890, both Galton and Wundt were very active in the development of "association" tests, and made brief references to the possibilities of their use in ascertaining emotions connected with deceit. Although these ideas led to some practical applications by other workers, we should first call attention to the significant work of Mosso, an Italian physiologist of that era.

Mosso, like many other workers in the field of the emotions, did not invent a "lie-detector." However, he, and others to be mentioned, did make many observations which subsequently formed the basis for detection techniques. (Lie detection came about through the application of a method or methods to a specific end; it was never a first act in the growth of an idea. Rather it should be considered the fruit of centuries of germination, some of which, indeed, was plucked before it was ripe.)

Mosso was encouraged in his studies of the emotions by Lombroso, his tutor and contemporary. His work is of unusual interest to the student of deception, particularly his studies of fear and of its influence on the heart and respiration. As early as 1875[19]

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17 Hill, G.M., An Essay on the Prevention and Cure of Insanity; With Observations on the Rules for the Detection of Pretenders to Madness (1814).

18 Beck, T.R., Elements of Medical Jerisprudence (2d.ed., 1825).

19 Mosso, A., Supra un nuovo metodo per scrivere i movimento dei vasi sanguigni nell'uomo (Turin, 1875).

Mosso demonstrated, by means of a "plethysmograph" (an instrument for measuring blood pressure and pulse changes) periodic undulations in man's blood pressure caused by the respiration cycle;[20] and his ingenuous studies of the circulation of the blood in the brain[21] opened up new avenues for the study of the influences of fear. In 1895 he described a new device[22] for measuring blood pressure, giving credit to Vierordt for first measuring man's blood pressure, from the outside, in 1855. Many of the current workers in the deception technique might well study some of the carefully recorded observations of this Italian physiologist. One, of especial interest, was made on a woman whose brain, as the result of a disease, had been partially exposed through an opening in the skull. We see here the disrupting nature of fear--specifically concern for one's own security:

> "In order to give an instance of the delicacy of the apparatus, and to prove the accuracy of our investigations, I mention the following circumstance. One day we were assembled in the laboratory of Professor Giacomini, intent on studying the brain of the patient, who was sitting in her arm-chair, and seemed absent-minded. There were a few spectators in the room, who were told to remain quietly behind the patient's back. In solemn silence we observed the curve marked by the cerebral pulse on the registering apparatus. Suddenly, without any external cause, the pulsations rose higher, and the brain increased in size. This striking me as strange, I asked the woman how she felt; the answer was, well. Seeing, however, that the circulation in the brain was very much altered, I examined the instrument carefully, to see whether it was all in order. Then I asked the patient to tell me most minutely what she had been thinking about two minutes before. She said that, as she had been looking absent-mindedly into a bookcase standing opposite to here, she had caught sight of a skull between the books, adding that it had frightened her by reminding her of her malady."[23]

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20 Mosso's research was preceded by that of K. Vierordt: Die Lehr vom Arterienpuls (1855); and Traube: Centralb. f. m. Wiss (1865).

21 Mosso, A., Sulla circolazione del sangue nel cervello dell'uomo (1879).

22 Mosso, A., "Sphygmomanometre Pour Mesurer La Pression Du Sang," Archives Italiennes De Biologie 23:177-197 (1895).

23 Op. cit. supra note 6.

One of the earliest of Mosso's observations of the effects of fear on blood pressure relate to a plethysmographic record made September 27, 1877, on a young man by the name of Bertino, whose brain had been made accessible for study by a large fracture. From the observations and records made in this case, Mosso concluded:

> "The variations which appear in the circulation of the brain during fear are far greater (than those resulting from the effect of mere noises and sounds). The reproofs and threats which I uttered to Bertino when he was hindering my experiments by moving his head or hands, the disagreeable things which I sometimes purposely said to him, were always followed by very strong pulsations; the brain-pulse became six, seven times higher than before, the blood-vessels dilated, the brain swelled and palpitated with such violence that physiologists were astonished when they saw the reproductions of the curves, published in the tables of my researches on the circulation of the brain."[24]

Since fear is an essential element of deception, that is, the fear of being detected, Mosso's pioneering work on this emotion should not be neglected. He not only performed many carefully controlled experiments on blood pressure and pulse in emotion, but his observations of pallor and blushing, of respiration, of trembling, of facial expression, and of maladies produced by fear are all of unusual significance to research in deception.

One of the most unusual and elaborate attempts ever made to measure the influence of fear was performed by Mosso when he devised his "scientific cradle." It was designed to measure the flow of blood as it became concentrated first in one part of the human body and then in another.

In reviewing his experiments with emotion and fear, Mosso stated that of two records of pulsations presented to him for analysis he could distinguish "that of one who is afraid and that of one who is tranquil."[25]

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24 Op. cit. supra note 6.
25 Op. cit. supra note 6.

Many experimenters in police laboratories, who investigate criminal suspects, no doubt have noticed that some individuals under strong emotions write on the polygraph records a respiration pattern which appears to echo the staccato beats of the heart. It seems that the unusually heightened blood pressure, or pulse amplitude, is reflected not alone in the blood pressure curves but in the respiration also. Mosso had observed this some time prior to 1896.[26]

Another early worker with an early type of sphygmomanometer was Kiesow.[27] Kiesow worked with Mosso and for awhile was in the psychological laboratory of Wundt in Leipzig.

Regarding the psychological influences on blood pressure Kiesow said:

> "The question may perhaps be formulated thus: Are the changes in blood pressure caused by purely intellectual activity, or are they produced by the excitation of the sense organs, or, again, are they to be considered simply as the effects of emotions and the accompanying sensations? According to my experience, it seems that the last alternative is the most acceptable."[28]

Today's lie detection experts are not the first to note that certain people are emotionally unresponsive. Kiesow wrote:

> "It is necessary to distinguish different types of people. Those whose emotions are readily expressed, show the most distinct changes (in blood pressure and pulse), which does not appear in people of calm disposition. In the first case, practice decreases the effect. The individual differences are explainable, not alone by temperament, but also by the different occupations of each person. A mathematician will be less emotional in mental problems which are common to his profession than one not permitted to employ himself in this matter."[29]

One of the outstanding criminologists of the era was, of course, Lombroso--Mosso's tutor. Although Lombroso's work cannot be fully accepted by current investigators, and although criminological

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26 Op. cit. supra note 6.

27 Kiesow, F., "Experiences avec le Sphygmomanometre de Mosso sur les changements de la pression du sang, chez l'homme, produits par les excitations psychiques." Archives Italienne De Biologie 23:198-211 (1895).

28 Supra note 27.

29 Op. cit. supra note 27.

schools still argue about the merit of Lombroso's many contributions, the fact remains that this one man did more than any of his contemporaries to put to practical application some of the observations made by predecessors. In fact, Mosso, Kiesow, Wundt, and practically all other physiologists and psychologists of the day were limiting their experimental work almost exclusively to laboratory investigations. Lombroso, however, several times assisted the police in identifying criminal suspects through the use of blood pressure-pulse tests. In his celebrated work, "L'Homme Criminal," (1895) he discusses the applications of a sphygmograph and a plethysmograph to the interrogation of criminals.[30] He also refers to some experiments with a hydrosphygmograph, and illustrates records obtained with the instrument.[31]

Further description of some of the apparatus Lombroso employed in the interrogation of criminals and others appeared in several works,[32] but for a brief review of his contributions one should consult the English translation of "The Criminal Man," by Lombroso's daughter, Gina L. Ferrero.[33] His daughter states:

> "My father sometimes made successful use of the plethysmograph to discover whether an accused person was guilty of the crime imputed to him, by mentioning it suddenly while his hands were in the plethysmograph or placing the photograph of the victim unexpectedly before his eyes."

She also related the use by her father of the plethysmograph for detecting deception in March, 1902. A girl six years of age had been murdered and a coachman by the name of Tosetti was suspected. The anthropological examination of this man by Lombroso indicated his innocence, but Lombroso went further:

> "To obtain stronger proof, my father adopted the plethysmograph and found a slight diminution of the pulse when Tosetti was set to do a sum; when, however, skulls and portraits of children covered with wounds were placed before him, the line registered showed no

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30 Lombroso, C., L'Homme Criminel (2nd French ed., 1895) 336-346. The first Italian edition of Criminal Man (1876) makes no reference to use of the sphygmomanometer or plethysmograph in the interrogation of criminals.

31 Lombroso, C., L'Homme Criminel. (Atlas) (2nd ed., 1895).

32 Lombroso, C., Arch. di psichiat. 23:539 (1902); Lombroso, C., La Perizia Psichiatrico-Legale (1905).

33 Ferrero, G.L., The Criminal Man (1911) 303-304; 262.

sudden variation, not even at the sight of the little victim's photograph. The results of the foregoing examination proved conclusively that Tosetti was innocent of a crime."

Lombroso himself refers to his use of the hydrosphygmograph in proving that a suspect while innocent of a robbery of 20,000 francs from a railroad was guilty of stealing certain documents and passports.[34] There was a fall of fourteen millimeters of mercury (indicating reduced blood pressure) when the latter theft was mentioned. The conclusion was later verified.

In the original work of Lombroso, "La Perizia Psichiatrico-Legale," is a discussion of the measurement of emotion, with a brief presentation of the hydrosphygmomanometer and the plethysmograph of Mosso and of Fik. Lombroso refers to the works of Dastre and Morat,[35] of Mosso,[36] of Binet and Courtier,[37] and of Patrizi.[38]

In 1891, Delbruck[39] in Germany and others elsewhere were becoming considerably interested in the psychology of the lie and of its psychopathic manifestations. In this country, in 1892, Harris,[40] who was not particularly interested in the psychology of the liar but rather in the law, developed an elaborate conception of kinds of liars as they could be observed on the witness stand giving deceptive testimony: witnesses who are flippant, dogged, hesitating, nervous, humorous, cunning, canting hypocrites, positive, etc. It is possible to analyze these types critically and to condemn the classification because the author makes a person's actions, by implication, always fit a certain temperament; thus, a flippant witness is just that, and not hypocritical. This is the common criticism of the characters devised by Shakespeare and by Dickens.

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34 Lombroso, C., Crime, Its Causes and Remedies (Translated by H.P. Horton, 1912).

35 Dastre and Morat, Recherches sur le systeme nerveux vasomoteur (1884).

36 Op. cit. supra note 21.

37 Binet and Courtier, "Circulation capillaire de la main dans ses rapports avec la respiration et les actes psichiques," Annee psychologique (deuxieme annee Paris, Alcan, 1895).

38 Patrizi, Riflessi vascolari, in Rivista sperimentale di freniatria (1897). For a further description by Lombroso of the Patrizi-Mosso hydrosphygmograph glove on criminals, see Archivio di Antropologia Criminale 23:539 (1902).

39 Delbruck, Die pathologische Luge und die psychisch abnormen Schwindler (1891).

40 Harris, R., Hints on Advocacy (1892) 65, 107.

Harris' scheme is neither logical nor psychologically sound. Those interested in further classifications of liars should refer to Robinson,[41] and Plowden.[42] We turn now to specific studies of deception.

Word Association

Just as there is "more than one way to kill a cat," so there are many ways to catch a liar. And the technique of word association is one of the most subtle of all. Probably no other one technique developed by psychologists has been so widely applied or so acclaimed as that of word association. The basic practice is to present, orally or visually to a subject, a group of words, each word sufficiently separated in time from the others so that the subject's responses to it may be noted. The subject may be instructed to reply orally to the word stimulus by calling out the first thing of which he is reminded; or, by giving a word which satisfies a prearranged relationship. In any examination to determine a person's criminal guilt, a large majority of the words used are chosen as neutral stimuli, a few words being inserted, among the others, which are pertinent to the crime situation. If the offender is normally conscious of his legal violations, and strives to reply to the stimuli with words which will seem to have no connection with the crime, certain evidence of mental conflict becomes apparent: delayed reaction time, quickened reaction time, repetitions of stimulus words, stereotyped or identical responses to several different words, blocking of response, informative nature of the response, or uncoordinated physical movements. The essential element in a typical word-association test is that one word or idea is reminiscent of another word or idea, and the expression of their association forms a meaningful picture.

The word-association test itself is a modern development, and we have no evidence that it was used among the ancients as they used the feeling of the pulse. In the Phaedo,[43] however, we find this idea: "Do you not know, then, that lovers when they see a lyre, or a garment, or anything else which their favorite

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41 Robinson, W.C., Forensic Oratory; A Manual for Advocates (1893) 126.

42 Plowden, A.C., Grain or Chaff; The Autobiography of a Police Magistrate (1903) 225.

43 Quoted by M.D. Eder in the translator's preface to C.G. Jung's "Studies in Word Association" (1919).

is accustomed to use, are thus affected; they both recognize the lyre and receive in their minds the form of the person to whom the lyre belonged."

No doubt Galton in 1879[44] was the first to record experiments on association of ideas. Wundt, in 1880, Wertheimer and Klein in 1904, Jung, in 1906 and 1910,[45] and others, later developed the principle in a variety of ways, especially applying it to the unconscious mental processes. Speaking of recorded word associations, Galton said: "They lay bare the foundations of a man's thoughts with curious distinctness, and exhibit his mental anatomy with more vividness and truth than he would probably care to publish to the world."[46]

Galton recorded his informal experiments with such conscientious care that many men were quick to see that in his method lay a new promise for psychology.[47] Gross and countless others have made many practical applications of the basic idea, and the following story which he related in his well-known book on "Criminal Investigation"[48] demonstrates the immediate value of the association principle.

> "The following anecdote told of Count Sandor, a person well-known for his jokes and eccentricities, proves how easy it is to get oneself arrested. About the year 1830 the Count made a bet with the Chief of Police of Vienna that he would get himself arrested without having done anything in the least reprehensible. He disguised himself as a vagabond and drank in a disreputable drinking shop a glass of brandy which he paid for with a genuine thousand gulden note; ten minutes afterwards he was arrested."

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44 Galton, F., "Psychometric Experiments," Brain 2:149-162 (1879); also, Inquiries Into Human Faculty and Its Development (1883) 182-203.

45 Jung, C.G., "Diagnostische Assoziationsstudien," Beitrage zur experimentallen Psychopathologie (1906); "The Association Reaction Method," Amer. J. of Psychol., 21:162-167 (1910).

46 Galton, F., "Psychometric Experiments," Brain 2:162 (1879).

47 Among the many early disciples of the association technique were (1) Edward Claparede, who wrote "L'Association des Idees" in Paris in 1903; (2) Charles Fere, author of "The Pathology of the Emotions" in 1899.

48 Gross, H., Criminal Investigation (1907) 685.

Thus it would appear that fifty years before Galton took his long walks by himself and made exact notes on the associated ideas which passed through his mind, a clever French nobleman was entertaining himself and his friends with practical association experiments. A contemporary Count Sandor would find it remarkably easy to get himself arrested by playing on police knowledge that a "n'er-do-well's" attire and thousand dollor bills do not make a logical association.

In 1908 Munsterberg[49] urged the practical application of the experimental methods of psychology, advocating the forensic application of the word association technique for diagnosing guilt. His efforts did much to stimulate further interest in the United States, and his published works are a source of much stimulation for all students of the lie. Indeed, in many ways his ideas for applying psychological principles have not been superseded.

About this same time in France, Duprat[50] made application of some of the principles of association to the psychology of the lie and the classification of lie suspects. But Duprat was not satisfied with employing word associations alone and neglecting the personality of the lie-suspect. He believed that types of associations should be looked for which would indicate the affective tendencies of the individual. That is, we all perceive only that which interests us, and we respond to a dominant tendency. Our mental syntheses, including our mendacious inventions, are determined by fixed desires or repulsions. Thus each lie is based on a tendency. He reminds us of Ribot's idea: "All forms of the creative imagination imply affective (emotional) elements." Then he showed that there is a connection between those cerebral regions serving the emotional life and those serving ideation and imagination.

From this idea Duprat proceeded to set up a "type" conception of liars. (We mention it here because, contrary to the types of Harris, Robinson, and Plowden, it makes possible a technique for detecting liars.) Not only is there relation between tendencies, emotions, belief, and ideation, but this is exemplified further when we see a person of a certain temperament led into certain kinds of lies, "in proportion as that trait or temperament is more favorable to excitation or depression. A mendacious denial is easy to people of calm, apathetic, or melancholy disposition, given to slow movements. A mendacious affirmation is easy to

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49 Op. cit. supra note 13.

50 Duprat, G.L., le Mensonge: etude de psychosociologie (2nd ed., 1909).

persons inclined to rapid movements--to an activity, if not disorderly, at least multifold and varied. Literature has often drawn the contrast between these two opposed temperaments--the calm, cold one, and the lively daring one; and almost always the latter has been taken as the type of the liar....But alongside of this temperament we must also point out its opposite, the smooth-tongued, soft-speaking personality, a radical enemy of truth, the type of hypocrites of all degrees."[51]

Although Jung, Binswanger, Freud, and a host of others[52] utilized the technique of word-association in the practical applications of psychotherapy and psychoanalysis, they were not concerned with its utility in criminological investigations. Some experimentation of a casual nature was carried on, largely as demonstrations in psychology classes in several universities in the United States, and in 1920 Langfeld of the Harvard University Psychology Laboratory published a paper which demonstrated the value of word-association reaction time tests of deception.[53] In the same year Marston, who had been busy for five years developing the "discontinuous blood pressure test," advanced the theory[54] of the "negative type liar" who may not react. Marston's careful work at this time did much to emphasize the practicality of several tests proposed earlier by his teacher, Munsterberg.[55]

In 1923 Goldstein[56] summarized her work in this field, and eight years later Crosland and Beck[57] described in elaborate detail

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51 For a more complete consideration of Duprat's treatment, refer to Wigmore, J.H., The Science of Judicial Proof (1937) 353.

52 See Bibliography in Jung, C.G., Studies in Word Association (1919).

53 Langfeld, H.S., "Psychophysical Symptoms of Deception," J. Abnorm. Psychol., 15:319-328 (1920).

54 Marston, W.M., "Reaction Time Symptoms of Deception," J. Exper. Psychol., 3:72-87 (1920).

55 Op. cit. supra note 13. See also Munsterberg, H., "Die Psychophysische Grundlage der Gefuhl," Proc. Int. Cong. of Exper. Psychol. (1892).

56 Goldstein, E.R., "Reaction Times and the Consciousness of Deception," Amer. J. Psychol., 562-581 (1923).

57 Crosland, H.R., "Measurements of Emotion by a Method Which Combines the Word-Association, Reaction-Time Technique With the Psychogalvanic Technique," Psychol. Bull. 28:575 (1931); Crosland, H.R., and Beck, L.F., "Objective Measurements of Emotion," Univ. of Oregon Publ., Psychol. Series 1 (3): 129-202 (1931).

their applications of the reaction-time experiment. Crosland was able to apply the association principle in concrete deception situations involving dishonesty of university students,[58] but the extreme complexity of his statistical calculations, involving forty criteria of guilt, was sufficient to frighten away most of the criminologists who were looking for objective measures of guilt. Although he showed the method to be statistically valid and reliable, he also demonstrated that there are other quicker means for determining the guilt of suspects. The continuous registration of blood pressure and pulse is especially suitable for police investigation, as indicated elsewhere, although Hunt, Landis and others have shown that an effective combination is the association experiment and the psychogalvanic skin response.[59]

Perhaps the most effective use of reaction-time is in the modern polygraph technique, wherein split-second records of verbal or manual responses constitute only one of several indicators of emotional tension.

Blood pressure, pulse, and Respiration Measures

A variety of techniques have been developed for measuring blood pressure and pulse characteristics, but investigators are not in agreement as to exactly what is responsible for the changes observed. Some workers rely on blood vessel dilation and contraction, recording volume changes in a water or air medium joined to an actuating and recording device. Volume changes of the finger tip, of the hand, or of the forearm, are thus obtainable without applying excessive air or water pressure to the parts. Other workers rely on stricture of the vessels, enclosing a limited area of the upper arm, leg, foot, or wrist, in a hollow rubber cuff inflated with an air pressure equivalent (usually) to a mean blood pressure--a point midway between the systolic (maximum) and the diastolic (minimum) blood pressure. Attempts are thus made to tap such varying factors as venous and arterial pressure, venous and arterial volume, and dilatation and contraction of the tissues involved.

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58 Crosland, H.R., "The Psychological Methods of Word-Association and Reaction-Time as Tests of Deception," Univ. of Oregon Publ., Psychol. Series 1 (1) (1929).

59 Hunt, W.A., and Landis, C., "Word-Association Reaction Time and the Magnitude of the Galvanic Skin Response," Amer. J. Psychol. 47:143-145 (1935).

Other cardiac measures include heat measurements of the blood as it courses through the veins or arteries, utilizing a thermocouple apparatus; electrocardiographic recordings; and tracings of the duration and latent periods of action currents of the heart.[60]

As we have already indicated, Munsterberg, Marston, and others have been recent workers in blood pressure tests for deception and their published works explain the criteria in use. A theoretical background for this work had already been prepared and the stage was set for practical application of existing tools, not only for examining blood pressure and pulse changes, but for tracing the significance of respiratory patterns.[61] Marston, following the leadership of Munsterberg, published in 1917 the results of his specific work on blood pressure symptoms of deception.[62] Marston's work was carefully done and his zeal led gradually to application of the technique by other workers. The "discontinuous" technique of reading the systolic blood pressure, which he long favored over others, involves the often repeated inflation of a pressure cuff to obtain readings at intervals during an examination for deception.[63] His early work is noteworthy, and readily accessible to the student. However, such careful work as that of his early years is no longer seen in his recent publications and activities.[64]

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60 Whitehorn, J.C., Kaufman, M.R., and Thomas, J.M., "Heart Rate in Relation to Emotional Disturbances," Arch. of Neurol. and Psychiat. 33:712-731 (1935).

61 Binet, A., and Vaschide, N., "Influence du travail intellectual des emotions et du travail physique sur la pression du sang," L'Annee psychol. 3 (1896); Lowinsky, V., "Zur Psychologie der wissenschaftliche Taueschung," Zeit. f. Angewandte Psychol. u. Psychologische Sammelforschung," 8 (1914); Benussi, V., "Die Atmungssymptome der Luge," Archiv. F. D. ges. Psychol. 31:244-273 (1914).

62 Marston, W.M., "Systolic Blood Pressure Symptoms of Deception," J. Exper. Psychol. 2 (2):117-163 (1917).

63 Marston, W.M., "Psychological Possibilities in the Deception Tests," J. Criminal L. and Crim. 11 (4):551-570 (1921); "Studies in Testimony," Ibid. 15 (1): 5-31 (1924).

64 Marston, W.M., "The Lie Detector Test" (1938). For a critical review of this book see the review by Inbau, F.F., J. Criminal L. and Crim. 29 (2): 305-308 (1938). The same issue of the Journal, on pp. 287-291, carries a critical survey of the legal admissibility of deception tests. The author is Jordan, H.W. For advertisements illustrating Marston's recent interests see Time Magazine (Oct. 17, 1938) 29, and Look Magazine (Dec. 6, 1938) 16-17.

Benussi[65] reported in 1914 partial success in detecting deception by the "inspiration-expiration" ratio; that is, he measured the recorded respiratory curves from a pneumograph and found that if length of inspiration were divided by length of expiration the ratio was generally greater before truth-telling than afterwards, and greater after lying than before lying.

Burtt, an earnest worker who early became interested in the work of Benussi, did considerable experimental work on respiratory patterns in deception. The publication of Benussi's study of inspiration-expiration ratios, led to partial confirmation by Burtt of Benussi's idea that deceit could be detected in patterns of respiratory inhibition or lack of inhibition. However, even though Burtt eventually devised mechanical means of speeding up the measurement of his graphs, he found that systolic blood pressure has a greater diagnostic value than breathing. In one series of simulated crimes, the interpretations of a lie about the crime were correct in 91% of the cases when blood pressure was the criterion; when breathing was the criterion the interpretation of a lie was correct in only 73% of the cases.[66] The two criteria were found to correspond appreciably more than half the time and when effort was made to quantify the measures the correlation was about 50%. In summary, Burtt's study of inspiration-expiration ratios was, according to his own terminology, "inconclusive."[67]

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65 Benussi, V., "Die Atmungssymptome der Luge," Archiv. f. d. ges. Psychol. 31:244-273 (1914).

66 In this connection see Klemm, O., "Ueber die Atmungssymptomatik bei Untersuchungsgefangenen," Neue psychol. Stud., 5 (1929). According to Ruckmick, Klemm worked "with six prisoners on trial, under well-controlled conditions, repeating Benussi's technique in connection with the ratio of respiration. His results do not confirm those of Benussi because the process of lying and truth-telling was overlaid with a variety of concomitant emotional attitudes which were equivocal in their total significance." See Ruckmick, C.A., Psychology of Feeling and Emotion (1936) 318.

67 He has since made several contributions to the polygraph technique in the study of deception. Burtt, H.E., "The Inspiration-Expiration Ratio During Truth and Falsehood," J. Exper. Psychol. 4:1-23 (Feb. 1921); "A pneumograph for inspiration-expiration ratios," Psychol. Bull. 15:325-399 (1918); "Further Technique for Inspiration-Expiration Ratios," J. Exper. Psychol. 4 (2) (April, 1921).

Larson, when a young medical student in the employ of Vollmer, Chief of the Berkeley, California, Police Department, read an article written by Marston on "Possibilities in the Deception Tests." This was in the spring of 1921. The blood pressure test excited his curiosity and he decided to do some pioneering work with it. He employed the test to discover losses in a girls' dormitory of the University of California, and his initial success in discovering the girl thief led him to carry the experiments into more detective work. Larson assembled a polygraphic apparatus in portable form and employed it extensively, under the enthusastic encouragement of Vollmer. But, of course, this cannot be considered as an invention of a lie-detector.

Larson's many published reports are more available than those of some workers and he should be credited with doing more than many later workers to inform the public of the application of the deception test.[68] The value of these various contributions, extensive as they are, is not to be disputed; like the works of Lombroso, one sees in Larson's earnest efforts an honest desire to place the facts before an interested public and to educate them to accept the principles of a new development. With a record of more publications than any other worker in the field, Larson has assumed a commanding position. His readers, nevertheless, are sometimes in doubt as to his own confidence in the applicability of deception tests and of their future possibilities. His technique of questioning, explained by himself and others, is readily accessible to the average reader, and will not be elaborated upon here.

The work of Blatz in 1925[69] is pertinent to laboratory investigations of deception, although fear was the emotion which Blatz attempted to isolate. The study, made under Carr in 1925,

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68 See especially the following: Larson, J.A., "Modification of the Marston Deception Test," J. Criminal L. and Crim. 12 (3): 390-399 (1921); "The Cardio-Pneumo-Psychogram and Its Use in the Study of Emotions, with Practical Applications," J. Exper. Psychol. 5 (5):323-328 (1922); "Lying and Its Detection," Univ. of Chicago Press (1932); "The Lie Detector: Its History and Development," J. Mich. State Med. Soc. (Oct. 1938).

69 Blatz, W.E., "The Cardiac, Respiratory, and Electrical Phenomena Involved in the Emotion of Fear," J. Exper. Psychol. 8 (2): 109-132 (1925).

was well-controlled and led to definite conclusions regarding simultaneous effects of sudden fear on heart, respiratory, and galvanic reactions. The technique was to drop a subject's chair suddenly backward, under varying conditions; the apparatus consisted in part of (1) a Hindle electrocradiograph, and (2) an electrical pneumograph. The latter was especially constructed with two magnets for separate measure of inspiration and expiration, and measured the beginning and duration of the two phases, but did not measure amplitude or latent periods. Time also was recorded. Blatz found that sudden arousal of fear, by falling, revealed (1) cardiac indices: immediate acceleration followed by decided retardation, then a less force of heart beat; marked irregularity of cardiac rhythm; (2) respiratory indices: immediately retarded rate in nine out of eleven records, an inspiratory stimulus during falling, in all cases; (3) electrical index: increased development of electromotive force. Other conclusions which he presents may interest the research worker, although some workers may wish to point out that later researches partially invalidate direct comparison between Blatz' fear criteria and the anticipatory fears involved in concealing the truth.[70]

Landis and his associates[71] have developed, through the methods of Benussi, Burtt, Marston, and Larson, control studies on the effectiveness of the various blood pressure and respiration methods in detecting deceit. They experimented also with electrodermal responses, reaction-time, hypnosis, and scopolamine, and although they found the measure of systolic blood pressure the most diagnostic

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70 A fundamental analysis is that of Darrow, C.W., "Differences in the Physiological Reactions to Sensory and Ideational Stimuli," Psychol. Bull. 26 (4):185-201 (1929).

71 Landis, C., and Gullette, R., "Studies of Emotional Reactions: IV. Systolic Blood Pressure and Inspiration-Expiration Ratios," J. Compar. Psychol. 5:221-253 (1925); Landis, C., and Wiley, L.E., "Changes of Blood Pressure and Respiration During Deception," J. Compar. Psychol. 6:1-19 (1926); Landis, C., "Detecting the Deceiver," Indust. Psychol. 244-249 (May, 1927); Landis, C., "Blood Pressure Changes in Deception--A Reply," J. Compar. Psychol. 10 (4):437-439 (1930).

of all methods, they were only moderately optimistic about the "experimental evidence that deception can be detected by heart and breathing changes." "Just at present," they state, "and probably for several years to come, the practical significance of this evidence will be of somewhat questionable importance."[72]

The controversy which developed between Landis and Chappell[73] led to a reanalysis of the nature of the blood pressure responses and a critical inspection of terminology. Chappell summarized his own findings as follows: "(1) The continuous method developed by Larson and later used by Landis does not record or indicate any known blood pressure; (2) The apparatus (of Larson and of Landis) is a high pressure plethysmograph and, as such, may cause venous rupture; (3) The volume and the pressure changes in the arm are relatively independent, and one may not be used as an index of the other."

In a personal communication to the author, Chappell recently stated that in an experiment made under his direction for a college thesis, comparisons were made of the so-called continuous method used by Larson and Landis, and simultaneous readings of the can type plethysmograph, with the result that there appeared no more comparison between the readings than he had previously found between lateral or systolic pressure and the continuous readings. Terminology, however, may safely be neglected at present and so long as we agree on the significant indices of deception.

Many investigators who use a polygraphic method for criminal interrogation insist that an exact indication of absolute systolic or diastolic pressure is not needed; that for all practical purposes it is the relative changes which occur as one proceeds from insignificant to crucial questions that are the criteria of deception. Nevertheless, Darrow, of the Institute for Juvenile Research of Chicago, who occupies a preeminent position in the polygraphic determination of physiological changes, including blood pressure,

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72 Supra note 71, "Detecting the Deceiver."

73 Op. cit supra note 71, "Blood Pressure Changes in Deception." Chappell, M.N., "A Comparison of Blood Pressure Methods," J. Genet. Psychol. 39:398-403 (1931).

has demonstrated a way of determining absolute readings which would eliminate the complicating factors of inflation and release of air pressure.[74]

Aside from argumentation about the value of absolute blood pressure readings in deception one of the outstanding deterrents to research in deception by academic workers is inaccessibility of criminal suspects. Bryan pointed this out in a master's thesis at Columbia University in 1930.[75] Due to the relative inaccessibility of this work, we present here some of the highlights of her research. She used a Tycos sphygmomanometer attached to a Becton Dickinson mercury manometer with a millimeter scale, together with a conical stethoscope. Employing the ausculatory method, she attempted to extend and check Chappell's work. Although she used only thirty-two young women as subjects, she shows an acute discernment of complicating factors. Feeling that Chappell had erroneously introduced an element of "rivalry" by deliberately stimulating some of his subjects to beat him at his own game, she decided to try to measure rivalry-free or "unemotional" deception. When she had finished she had to confess that she believed there may be no such thing as "unemotional lying," and therefore that not only her experiments but also those of Chappell and of Landis and Gulette, were unsuccessful in inducing deception. (Chappell reported 87% accuracy in blood pressure measures of deceit, and Bryan, 69% accuracy.) Those who are compelled to use an academic laboratory for research in deception, without the availability of criminal suspects as subjects, might be interested in first consulting Bryan's thesis, for she admirably illuminated some of the worst pitfalls.

The former Scientific Crime Detection Laboratory of North-Western University School of Law--now a unit of the Chicago Police Department--founded at the same time Bryan was writing her thesis,[76]

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74 Darrow's method for determining absolute pressure is described in his "Continuous Records of Systolic and Diastolic Blood Pressure," Arch. Neur. and Psychiat. 38:365-370 (1937). See also C.T. McCormick's review of some of the tests for deception current in 1927, for he calls attention impartially to certain inherent weaknesses in the methods. Infra note.

75 Bryan, Alice I., "Blood Pressure Deception Changes and Their Use as an Index of Personality," M.A. Thesis (Psychology Dept.), Columbia Univ. (1930).

76 A vivid description of the events leading to the foundation of this Laboratory in 1930, with photographs, is that of its first director, Calvin Goddard, in "The Valentine Day Massacre: A Study in Ammunition Tracing," Amer. J. Police Science 1 (1):60-78 (1930).

was fortunate in having an opportunity to try out current tests on hundreds of criminal suspects. Keeler, who had gained first-hand experience as a high school student with the polygraph interrogations of Larson in the Berkeley Police Department and who subsequently devised, with the assistance of Woolsey and Miles of Stanford University, an improved polygraph of his own, was then (1930) with the Institute for Juvenile Research in Chicago. He became a member of the staff of the Laboratory, and for eight years utilized the blood pressure, pulse, and respiration patterns for detecting criminal guilt.[77] He and his former associates, Wilson and Inbau, reported success in diagnosing deceit in experimental cases 85% of the time, and in obtaining confessions from criminal suspects in 75% of the cases in which the polygraph records indicated deception.[78]

Keeler, like Larson and others, did not invent a lie-detector. He modified existing apparatus to be applied to the discovery of emotional complexes. His position is that:

> "To begin with, there is no such thing as a 'lie-detector.' There are no instruments recording bodily changes, such as blood pressure, pulse, respiration, or galvanic reflex, that deserve the name 'lie-detector' any more than a stethoscope, a clinical thermometer, or a blood count apparatus with a microscope can be called an 'appendicitis detector.'"
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> "However, deception, guilt, or innocence can be diagnosed from certain symptoms just as appendicitis, paranoia, or any other physical or mental disorder can be diagnosed. In every case, the examiner must make his diagnosis from tangible symptoms, using whatever mechanical aids he has at his disposal."[79]

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77 Refer to section on the psychogalvanometer for review of the Laboratory's use of electrodermal reactions.

78 Keeler, L., "A Method for Detection Deception," Amer. J. Police Science 1 (1):42 (1930); Inbau, F.E., "The 'Lie-Detector,'" Scientific Monthly 40:83 (1935).

79 Keeler, L., "Debunking the 'Lie-Detector'," J. Criminal L. and Crim. 25 (1):153 (1934).

Keeler's instrument,[80] as did Larson's, records relative changes in blood pressure, pulse, and respiration patterns. The inked record issues continuously from a drum driven by a synchronous motor. Volume changes within a blood pressure arm-cuff and a pneumograph tube circling the chest of the subject are transferred in heavy walled rubber tubes to the flexible metal stacks constituting the tambours. Mechanical actuating devices connect the tambours to small fountain pens. The chief difference between Keeler's apparatus and that of Lee, described below, is in the tambour and actuating mechanism. Both instruments, now improved through several years of revision, are durable and adapted to continuous usage.

The contributions of Keeler to the psychological science of criminal-interrogation are of far-reaching importance. The training he has given students in his own technique of investigation constitutes an effective share in the contributions made to the field of new police science. Of particular importance is his method of rechecking the responses of suspects by one or more control tests. In any scientific endeavor control tests are now considered essential; for the field of criminal investigation, Keeler and associates have consistently employed, with suspects, such control tests (with the polygraph) as the card test and other "peak of tension" tests, designed to disclose otherwise unknowable factors of criminal guilt.

Physicians continue to make mistakes in diagnosing illness. They err sometimes in taking blood pressure readings. It is the same with operators of polygraphs. Mistakes, however, provided they be relatively few in number, deter neither the physician nor the lie expert.[81] In the former Scientific Crime Detection Labora-

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80 Keeler, op. cit. supra note 78. Keeler's was the first such instrument to make use of metal tambours; their use produced a pressure curve, the changes in which were proportional to the blood pressure changes of the body. This desired result could not be obtained with the earlier Marey tambours used in conjunction with rubber diaphragm pressure reducers.

81 The technique used in an early case is reported in detail by L. Keeler in "The Canary Murder Case," Amer. J. Police Science 1 (4):381-386 (1930); see also an article by a Wichita (Kansas) police investigator employing the Keeler Polygraph: Jaycox, T.H., "Scientific Detection of Lies," Scientific American 156:370-373 (June, 1937); and "Wichita's Use of the 'Lie-Detector'," American City 51:91 (Dec., 1936).

tory of Northwestern University, for example, 2171 subjects were examined on the polygraph between January 1, 1935, and June 1, 1938. Of this number twelve mistakes in diagnosis of innocence or guilt have been verified. Of this total, therefore, the errors amount to five hundredths of one per cent; if the errors were ten times this number, and eventually they may be found to be, they would still be a relatively small proportion of the total.

Lee, a former Captain of Detectives of the Berkeley, California, Police Department, was especially interested in the work of Larson and others and by 1936, after several revisions of apparatus (including experimentation with an electrical system for recording pulse waves), he was able to develop improved instrumentation for pneumatic transmission of pulse waves, blood pressure changes, and respiration. Although Lee is not in a position to carry on research in interrogation, several Lee Polygraphs are employed in routine investigations of deceit.

Lee's apparatus is employed by Lyon in his examination of juvenile delinquents at the Chicago Juvenile Detention Home, connected with the Institute for Juvenile Research. Lyon, long a staff member of the Institute, employs polygraphic tests for deception in conjunction with other psychological tests.[82] In his work, an exceptional and a unique situation exists, whereby the results of his tests for deception are considered by the judge of the Juvenile Court, along with all other evidence involving the delinquent child. (For this particular court the conventional rules of evidence do not apply and therefore no legal question arises regarding the admissibility of the test results.) In this manner, the evidence may include psychological tests, data gathered in informal interviews, medical and psychiatric examination.[83] Fifty per cent of Lyon's cases involve sexual delinquencies.

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82 Lyon, V.W., "New Deception Tests," Police 13-13 (Mar., 1935) 11; "Deception Tests With Juvenile Delinquents," J. Genet. Psychol. 48 (3):494-497 (1936).

83 Larson, J.A. (now of the Detroit, Michigan, Recorder's Court) is likewise engaged in many applications of the polygraph technique to delinquency, personality disorders, and crime. See Larson, J.A., Canty, A., and Broom, C., "La Verdad Acerca Del Indicador De Mentiras," Archivos Chilenos de Criminologia (1938) 58-65. See also, Selling, L.S., "The Medico-Legal Aspects of the Polygraph or 'Lie-Detector'," J. Mich. State Med. Soc. 37:897 (1938).

Many police departments throughout the United States now employ one polygraph or another in investigation of criminal suspects.

Wigmore, McCormick, and Inbau have commented upon the admissibility of "lie detector" evidence in court. Wigmore has pointed out that the legal status of such evidence is dependent upon the degree of recognition accorded the instrument and the technique in the field of science. In discussing the general application of psychology in law and legal proceedings, Wigmore states that "The courts are ready to learn and to use, whenever the psychologists produce it, any method which the latter themselves are agreed is sound, accurate and practical." But, "There must first be proof of general scientific recognition that they (the methods) are valid and are feasible."[84] We know, of course, that such recognition has not yet been accorded scientific methods for detecting deception. And, primarily for this reason, the courts have consistently refused to accept the results of tests of this nature.

McCormick, summarizing the results of a questionnaire he sent to eighty-eight members of the American Psychological Association in 1926, indicated that "The scientific view being still one of suspended judgement, the courts must obviously wait for further verification and wider acceptance of the validity of these tests before relying upon their results as evidence."[85] His review of the status of deception tests is one of the most open-minded and encouraging comments upon the current scene.

Inbau, a lawyer with scientific training and experience, who for five years was an associate of Keeler, and who is now Director of the Chicago Police Scientific Crime Detection Laboratory, has expressed the following opinion upon the subject:

> "The possible 'complications and abuses' constitute a constant source of concern on the part of those persons actively engaged in this field. They realize, from the data and information already at hand, that the results of a detection of deception test with a suitable instrument recording pulse wave, blood pressure and respiratory changes, and perhaps other physiological reactions, when conducted and interpreted by a competent and honest individual are worthy of consideration as evidence for or against the defendant in a criminal trial, but they also realize, and only too well, that once given

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84 Wigmore, J. H. Evidence (2d ed., 1923) 2:875. See also Wigmore, J. H., The Science of Judicial Proof (2d ed., 1937) 450.

85 McCormick, C. T. "Deception Tests and Law of Evidence." Calif. L. Rev. 15:484 (1927).

approval the entire field immediately lends itself to prostitution by unethical and incompetent examiners. The fact that the method is nothing more nor less than a diagnostic technique, the value of which depends to a very considerable extent upon the competency of the examiner, and certainly to the same degree upon his integrity, entirely justifies the conservative position taken by the courts. In this field, more than in any (other phase of scientific evidence), the remuneration for quackery is unlimited. With this consideration in view, it is proposed that there be only a conditional and restricted use of an instrument of this nature for court purposes--at least for the time being, and perhaps for quite some time to come. The prerequisite to the admissibility of such evidence should be a stipulation or agreement between counsel or prosecution and defense, made prior to the expert's examination, that the results and the expert's interpretation thereof are to be admitted without objection and regardless of whether they favor the cause of prosecution or defense. This, of course, presupposes an agreement between counsel upon the expert himself. In this way the probability of incompetent and unethical practices would be reduced to a minimum."[86]

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86 Inbau, F. E., "The Admissibility of Scientific Evidence in Criminal Cases," Law and Contemporary Problems (Oct., 1935) 502. The admission, as evidence, of deception, is well covered in the following papers by Inbau: "Scientific Evidence in Criminal Cases. II. Methods of Detecting Deception," J. Criminal L. and Crim. 24 (6):1140-1158 (1934); "Detection of Deception Technique Admitted as Evidence," Ibid. 26(2):262-270 (1935); "Self-Incrimination--What Can an Accused Person Be Compelled to Do?," Ibid. 28(2):261-292 (1937).

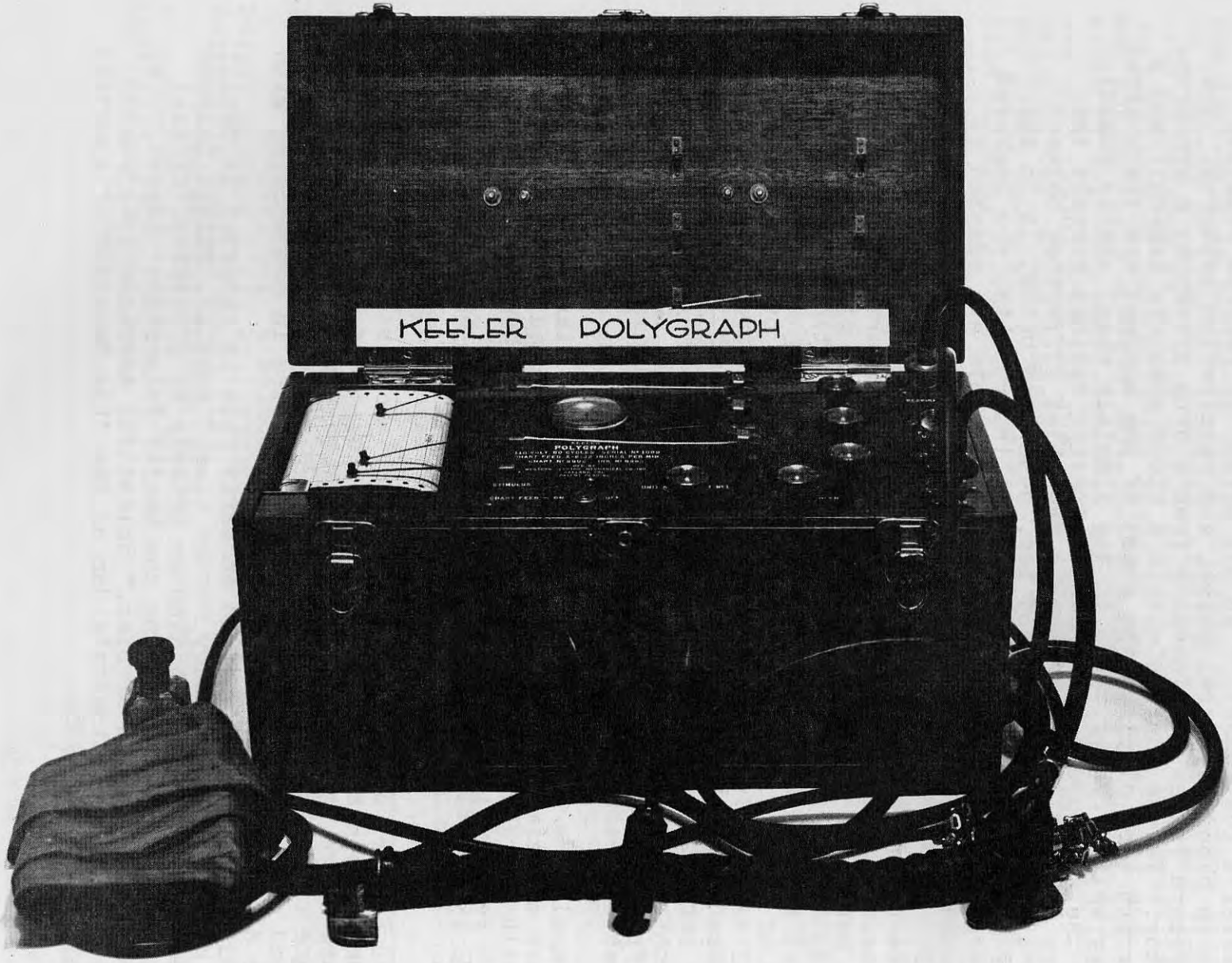

Photo courtesy of Berkeley Police Department

THE FEDERAL POLYGRAPH SCHOOL

by

Allan E. Stein

Located at Fort Gordon in sunny Georgia a short distance from Augusta, is the polygraph training center for the Department of Defense and other Federal agencies. Officially identified as the Polygraph Committee, Investigations Group, United States Army Military Police School, the polygraph school has trained a majority of the United States Government's polygraph examiners. As of April 1971, 1,439 examiners have been trained at the school. Also, examiners have been trained for the Governments of Pakistan, Philippines, Nationalist China, and Venezuela.

Begun in 1951, the basic examiner training course has been gradually increased from eight weeks to its present length of 14½ weeks. The course has an academic phase and a practical exercise phase. At the present time, the academic phase of five weeks includes classroom instruction in polygraph nomenclature, polygraph operations, pretest and post-test procedures, chart interpretation, test question construction, polygraph testing techniques, psychology, physiology, pharmacology, semantics, law, test graph markings and other related subjects. The practical exercise phase is 9½ weeks in duration. Felonies and intelligence incidents are simulated daily by soldiers assigned to various Fort Gordon units. For example, one or more soldiers will "steal" an automobile. As they are driving over a route previously designated, a pedestrian is "struck and killed" by the vehicle. The "thieves" have not been briefed on the accident with the pedestrian and are not quite sure if it is a part of the hypothetical problem or not. A number of possible "suspects," including those not involved in the offense, are examined concerning that incident. A recent study of the results of these examinations by our students conducted over the past 18 months disclosed that better than 80% of the deceptive soldiers are properly identified. During their 9½ weeks of practical work, the

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students are required to use each of the several techniques taught at the school. These include zone of comparison, peak of tension, general question (relevant-irrelevant), modified general question and personnel screening tests. Each day the students are individually critiqued at the conclusion of their examination by an instructor. Each student conducts a minimum of 40 specific polygraph examinations before he graduates from the course, and then is required to serve an apprenticeship under the direct supervision of a certified examiner before he earns certification as a polygraph examiner.

The Fort Gordon Polygraph School conducts three polygraph examiner training courses annually. A three week polygraph examiner refresher course is conducted twice annually as a seminar-workshop in the latest techniques, theories, and instrumentation. A maximum of 12 students can be enrolled for each basic or refresher course. For maximum effectiveness, a ratio of two students to one instructor is considered the optimum. More cannot be programmed because of recent modifications in the specially-built polygraph training facility. Instructor offices are located between examining rooms, permitting each instructor to observe two students at work each day; one-way mirrors and electronic listening equipment are used with the full knowledge of students and examinees, to facilitate instructor observation without placing him physically in the examining room.

The following instruments are used, and all students have an opportunity to use each instrument for an examination:

Keeler models 6303, 6308, 6317, and 6318.
Arthur II (Keeler model 6329).
Stoelting desk models 22498 and 22690.
Stoelting Deceptograph (Model 22500).
Stoelting Executive (Model 22532).
Stoelting Truth Verifier (Model 22536).
Stoelting Emotional Stress Monitor (Models 22600, 22601, and 22603).
Stoelting Instrument with Cardio Activity Monitor.

The instructor staff consists of certified polygraph examiners from the US Army Criminal Investigation Command, who have demonstrated their proficiency as polygraph examiners and have the ability to teach others, as demonstrated in a special three week instructor training course at the Military Police School. Volunteers for instructor duty are preferred.

The present staff:

Mr. Ronald E. Decker is presently instructional chief at the polygraph school; he has 17 years polygraph experience. Mr. Decker, a retired CID investigator, has been an instructor at Fort Gordon since 1966. He retired from the Army in 1969, then returned to the school to fill the newly-created civilian instructor position. Mr. Decker is also a certified polygraph instrument repairman. He has been a guest speaker on various subjects at numerous professional seminars and institution.

CWO Homer C. Tank, a veteran of 28 years active duty, an accredited criminal investigator and certified polygraph examiner, is presently senior military instructor at the polygraph school. He has been assigned at the school since 1970 and is also a certified polygraph instrument repairman. CWO Tank has 11 years experience as a polygraph examiner.

CWO James E. Moree, Sr., a veteran of 21 years service in the U. S. Air Force and U. S. Army, is an accredited criminal investigator and certified polygraph examiner. He has been at the school since June 1971 and is primary instructor for polygraph operations and test question construction. CWO Moree holds a Bachelor of Science degree in Law Enforcement and Corrections from the University of Nebraska. He has 11 years experience as a polygraph examiner.

CWO Allan E. Stein, a veteran of 18 years service, is an accredited criminal investigator and certified polygraph examiner. He has been at the school since 1970 and is primary instructor for polygraph pretest, semantics and regulations. CWO Stein holds a Bachelor of Science degree in Law Enforcement and Corrections from the University of Nebraska. He has been an instructor in Law Enforcement subjects at Palmer College in South Carolina, a guest speaker at Augusta College and the 1971 APA Seminar. He has five years experience as a polygraph examiner.

CWO Theodore P. Ponticelli, a veteran of 20 years in the U. S. Marine Corps and U. S. Army, is an accredited criminal Investigator and certified polygraph examiner. He has been at the school since 1970 and is primary instructor for polygraph techniques. CWO Ponticelli was a guest speaker at the 1971 APA Seminar and has six years experience as a polygraph examiner.

CWO Johnny W. Bagwell, a veteran of 20 years in the U. S. Air Force and U. S. Army, is an accredited criminal Investigator and certified polygraph examiner. CWO Bagwell, who recently returned to the school for his second tour of polygraph instructor duty, is primary instructor for in-test and post-test procedures. He has been a guest speaker at an APA Seminar and numerous educational institutions. He has seven years experience as a polygraph examiner.

Guest instructors appear on an unscheduled basis. Mr. Cleve Backster and Mr. Walter A. Van De Werken have been our most frequent guests in the past two years. Mr. Walter F. Atwood, Mr. Donald Presson, and Mr. Robert Brisentine have all appeared before a class during this same time. All instructors assigned to the school conduct polygraph examinations for CID units located in the Southeast United States to assist in maintaining proficiency.

Although not assigned to the school, other instructors are also on the staff. Physiology is taught by Frederick A. Trest, M.D., of the Medical College of Georgia. Normal psychology is taught by the Educational Advisor at the Military Police School, a scholar who holds a doctorate in education. Abnormal psychology is taught by Wade H. Dean, Ph.D., a practicing psychologist from Augusta, Georgia. Legal subjects are taught by lawyer-instructors on the Military Police School faculty.

Educational television and other modern teaching aids are used during examiner training and refresher courses. Experience over more than 20 years has reinforced the Military Police School conviction that instructors must be trained teachers as well as proficient polygraph examiners. The entire curriculum is student-centered and performance-oriented. Only experienced investigative personnel with advanced

education are admitted as students, and only those who demonstrate proficiency as polygraph examiners during their training are awarded the coveted diplomas.

Graduates of the school are employed by the following agencies:

Defense Intelligence Agency
Metropolitan Police Department, Washington, D. C.
National Security Agency
Police Department of Puerto Rico
U. S. Air Force O.S.I.
U. S. Army CID
U. S. Army Military Intelligence
U. S. Bureau of Narcotics
U. S. Coast Guard CID
U. S. Marine Corps CID
U. S. Naval Investigative Service
U. S. Postal Service
U. S. Secret Service

The Army is proud that its polygraph training center at Fort Gordon has been selected for certification as an approved training institution by the American Polygraph Association. Recognition of the graduates as professionally-qualified polygraph examiners by their colleagues of the American Polygraph Association continues to be important to instructors and students alike at the Military Police School.

SCREENING POLICE APPLICANTS

by Dean A. Fox
Chief of Police, Kalamazoo, Michigan

ABSTRACT

The process of screening police applicants is discussed. The costs and results of polygraph examinations and background investigations are compared. Admissions by applicants of criminal and other disqualifying activity is listed for the years 1960 through 1971. The admissions illustrate both the effectiveness of polygraph screening and the necessity for polygraph screening.

In police applicant pre-employment polygraph screening, we are faced with two questions: 1. What kind of information or results will stem from a police applicant pre-employment polygraph screening program that will assure a better police officer? 2. What savings might accrue from such a program?

The Kalamazoo Police Department instituted a police applicant polygraph screening program in 1960. Prior to this, background investigations were done in the conventional manner. Upon commencing with the program, the field investigation was completed by the investigator and the applicant was then sent to the polygraph examiner for testing. In 1960, the first group of thirty-three had the field investigation completed and twenty-six were recommended to go before the oral board. Seven were not recommended, based on information derived from the investigation. On completion of the polygraph examinations, ninteen, or 73% of those applicants who had passed the field investigation were rejected by the Chief on the basis of information obtained by the polygraph examiner.

A cost analysis was done on the group rejected by the polygraph. On the basis of time spent by investigative, secretarial, supervisory, and oral board personnel, it was determined that $3,000 had been spent needlessly on processing these applicants before their polygraph examination. The average investigation took 24 working hours to conduct. In view of this, the process was reversed for the next group of applicants. The polygraph examination was conducted before the investigation. Of twenty-two applicants in the group, sixteen, or 72% were rejected by the Chief after review of the information obtained during the examination. Again, the dollar savings were significant. However, it was apparent that the greatest value was the rejection of undesirable candidates who would have been hired if the polygraph was not used.

The Kalamazoo Police Department believes that the best way to predict future performance is to study the applicant's past performance. If the applicant has a history of criminal or irresponsible behavior, there is little chance that police work will change him.

The following information was obtained by the Kalamazoo Police Department polygraph examiners from the first 127 applicants who were subjected to the new program.

5 admitted to acts of arson
2 admitted to breaking and entering
3 admitted to auto thefts
6 admitted to serious cases of assault and battery
12 admitted to arrests not listed on their applications
1 admitted to an act of perjury in court
2 admitted starting false suits in court
1 admitted an act of bribery
42 admitted falsification of their application
35 admitted being fired from a previous job
11 admitted to serious physical defects and handicaps
7 admitted to having suffered from serious mental illness
74 admitted places of employment not listed
3 admitted garnishment of wages and excessive debts
19 admitted excessive debts
82 admitted 266 traffic violations not listed
95 admitted to 250 larcenies
63 admitted 119 traffic accidents not listed
7 admitted to having serious drinking problems
2 admitted to being involved with narcotic drugs
3 admitted to being involved in serious gambling
1 admitted to an act of abortion
1 admitted to an act of incest
1 admitted to an act of indecent liberties
1 admitted the rape of a two year old child
28 admitted to adult homosexual acts
33 admitted to abnormal sexual practices, such as bestiality
1 admitted to numerous cases of impersonating a police officer

During the period 1963 to 1967, the Kalamazoo Police Department polygraph examiners interviewed and tested 197 applicants. The following information was obtained:

1,698 larcenies
48 burglaries admitted to by 25 applicants
10 applicants admitted to stealing 37 automobiles
17 applicants admitted previous arrests not on their applications
34 applicants admitted passing 134 bad checks
266 traffic violations which were not listed by 54 applicants
19 had debts turned over to collection agencies
16 had other serious debt problems
30 admitted to deliberately falsifying their applications
24 admitted to being fired from jobs
7 applicants said they had serious drinking problems
5 applicants admitted to fostering illegitimate children
4 applicants admitted to use of narcotic drugs
91 applicants admitted to 161 unlisted traffic accidents
40 admitted to physical defects not on their application forms

2 admitted to receiving other than honorable discharges
2 admitted to incidents of indecent exposure
4 admitted to peeping activities
8 admitted to acts of bestiality
1 admitted to indecent liberties with a minor child
6 admitted to acts of statutory rape

During the period 1968 through 1971, the Kalamazoo Police Department conducted polygraph examinations on 324 applicants. The following information was obtained:

2,821 larcenies under $50 was admitted by 306 applicants
50 larcenies of over $50 was admitted by 27 applicants
41 burglaries admitted by 15 applicants
11 auto thefts by 8 applicants
1 act of arson in an apartment house
3 cases of serious assault and battery
7 cases of falsifying company records in reference to shortages
38 cases of destruction of property by 14 applicants
18 admitted arrests not listed on their applications
202 admitted to 581 additional unlisted addresses
33 admitted to 68 unlisted traffic violations
28 thefts of auto accessories admitted by 17 applicants
6 admitted to having excessive debts
24 admitted to having debts durned over to a collection agency
15 admitted to deliberately falsifying their applications
43 admitted to having been fired from 63 jobs
4 admitted they had serious drinking problems
4 admitted to fostering 5 illegitimate children
4 admitted to other than honorable military discharges
3 admitted connection with 7 subversive organizations
153 listed 395 additional places of employment
1 admitted to having paid for an abortion
1 admitted to an act of incest
1 admitted to an act of indecent liberties with a minor
58 applicants made admissions relating to fellatio
17 applicants made admissions of acts of sodomy
3 applicants made admissions relating to perverted acts
58 applicants made admissions relating to other homosexual acts
12 admitted to using drugs on 24 occasions
68 admitted to using marijuana on 436 occasions
4 admitted passing a total of 15 bad checks
57 listed 80 traffic accidents which were not on their forms
2 admitted physical defects not on their forms
21 admitted malingering on jobs
4 admitted to cheating on the written examination for the job on the police department

No applicant for employment with the Kalamazoo Police Department was rejected for a minor error on his application or other minor technicality. All those who were rejected were eliminated by their own admissions of matters of serious consequences, developed during the polygraph examinations.

By comparison, a large city in the state of Colorado advised Kalamazoo that during the years 1962 to 1964 they conducted applicant screening with the polygraph on 484 applicants. The following was obtained:

77.4% admitted thefts from employers, of which 12.5% were major or systematic thefts
30.5% admitted arrests not on their applications
22.7% admitted to adult homosexual acts
4.6% admitted they received less than honorable discharges from military service

Dr. G. H. Lawrence of the St. Louis University Medical School, who is familiar with pre-employment police applicant screening, has observed that this kind of information "cannot be derived from any other source such as the employment application, background investigation, psychometric testing, or psychiatric examination." No other technique is known which will provide the administrator with the necessary information to make effective evaluations and predictions of future performance.

A TEAM TESTING POLYGRAPH TECHNIQUE

A Preliminary Report

Edward J. Goutink
Kenneth Krassner
John Micena

Abstract

The article describes a technique used in cases of a serious criminal nature. There are two examiners present in the room, contrary to common parctice. Otherwise, the testing procedures are routine. The value is in the interrogation, not in the testing technique.

No applicant for employment with the Kalamazoo Police Department was rejected for a minor error on his application or other minor technicality. All those who were rejected were eliminated by their own admissions of matters of serious consequences, developed during the polygraph examinations.

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While at the May 1971 Seminar held at the National Training Center of Lie Detection in New York City, the authors conversed with polygraphists from the New Jersey State Police who described the employment of a "Team Testing" technique, a system which they reported they utilize. The N.J.S.P polygraphists, Louis Jasmine and John Toth demonstrated this technique for all in attendance.

Trial Application

Following the seminar, the authors, who are with the Nassau County Police Department polygraph section, began to employ this technique on a trial basis. Almost immediately, successful results were noted using this technique. As our success increased during the trial period, it became more apparent that the "Team Testing" technique was a distinct advantage when, in the opinion of the polygraphists, the subject was lying and an interrogation would ensue. It then became a rarity when utilizing this technique that the polygraph team did not obtain a statement of admission from a liar. It was found that with two examiners present in the room, a stronger, tighter common bond was formed with the subject by at least one of the polygraphists giving the team a psychological advantage which could then be usefully employed in gaining an admission. Gradually, as the technique was employed more and more, and each of the three polygraphists learned to work interchangeably as the teammate of the other two, the test flowed smoother and an atmosphere of complete sincerity was easier to produce. Each man learned to recognize the cues of the other and before long we found that the apprehensive subject was put at ease with greater speed and more easily conditioned to a proper testing attitude.

Preliminary Results

Holding true to the proverb that "two heads are better than one," the advantage that was found in using the "Team Testing" technique was in the subsequent interrogation of subjects who were found to be lying. Having been conditioned to the two polygraphists in the room during the test, the subject was found to be relatively at ease when later being interviewed. During an interrogation when

one man runs out of steam, the other man is cued and the interview continues smoothly along. Other advantages found were: the ability of at least one of the men to have the subject under constant observation at all times (including during the actual test), noting all gestures and movements, and consensus as to chart opinions, with the two men actually taking part in the entire testing procedures.

Preliminary Statistics

During the 200 Team Tests conducted by this section since the implementation of the technique, 65 subjects were found to be lying. Of these 65 liars, statements of admission were obtained from 50. A review of a similar number (65) of one-man tests where the subject was found to be lying (immediately prior to the date of this address), indicated that statements of admission had been obtained from only 29 liars. As a result of the implementation of the "Team Testing" technique preliminary indications are that this section has realized approximately a 72% increase in the number of statements of admission obtained from liars. Although this technique was primarily inaugurated for the purpose of increasing the effectiveness of polygraph testing in relation to homicide cases, only 20 Team Tests were conducted of homicide suspecrs of which only 3 were found to be lying. While statements of admission were obtained from all 3 of these subjects in comparison to no (0) statements being obtained from 5 liars of a similar number (20) of one-man tests of homicide suspects, it is felt that sufficient data has not yet been obtained in order to draw any definite conclusions with respect to homicide cases as a separate class of subjects. It is noted that in each instance cited above (20 Team Tests-vs-one-man Tests of homicide suspects), the tests of 7 suspects in each category were indefinite for various reasons.

Continued Application

As a result of the success noted above, the Nassau County Police Polygraph Section continues to use the "Team Testing" technique whenever polygraph personnel are available. With three trained polygraph examiners normally working the same shift, this occurs in many instances. Since we have only one instrument (a C. H. Stoelting Desk Model Deceptograph) in operation, during the normal work-day two tests are routinely

scheduled, with the exception of peak periods or when working on major crimes when 3 or 4 examinations may be given in a day.

A major drawback of utilizing a "Team Testing" technique is one of economics. The polygraph unit must have the personnel available in order to go into such a system. However, it is probable that some agencies have personnel readily available to implement such a system on a trial basis.

The Technique

The examination procedure used is the standard type of specific issue"Control Question/Known Lie technique" as taught at the National Training Center of Lie Detection, New York City, by Richard O. Arther. During the testing, responsibilities are shared between the two polygraphists. Basically, one man is the principal examiner and the other is the background man, doing most of the pre-test background interview. The principal examiner covers the question review and asks the actual test questions during the three "crime" tests which are normally given. The background man conducts the "Double Verification" test (card stimulation) alone, during which the principal examiner excuses himself and leaves the room. Normally, this test is conducted as the first test. Upon returning to the room, the principal examiner then verifies from the charts the card that the subject selected, and additional stimulation is achieved. During the remainder of the examination, including any interrogation, both men remain present in the examination room. Both men observe the subject, recording their observations, and during the "crime" tests the background man is available to give his undivided attention to this task. During the interrogation of a lying subject, the principal examiner normally leads off the interview, accusing the subject. As previously mentioned, the technique must be well-practiced between the teammates, to work from each other's cues, so that one man does not do all of the talking nor talk while the other is talking. This goal obtained, the technique flows smoothly and the ultimate results are excellent.

Canty's Elevated Elbow Cuff Technique

Mr. Henry L. Canty of Austin, Texas, reports that by elevating the elbow to approximately shoulder height, and by wrapping the blood pressure cuff around the elbow with the bladder on the inside, he is able to obtain a satisfactory cardiosphygmograph pattern at lower than ordinary pressure. He reports that the low pressure elbow pattern is stable for 15 minutes of chart. To support the elbow at the correct height, with the arm extended and the palm up, Mr. Canty employs a morgue head block. He reports that this technique consistently provides a pattern with greater amplitude. It is particularly effective on obese subjects.

In Figure 1, there is a brief section of conventional cardio recording (insufficient) at 140 mm., followed by an elbow cuff recording at 104 mm. The chart is from a criminal case, recorded on a Keeler 4 Channel Polygraph, Model 6328. Note the double pneumograph pattern.

In Figure 2, also a criminal case, the cardio pattern is recorded at 86 mm., from the elevated elbow position. This is the second chart in a test series. The first chart was recorded in the conventional manner, at 80 mm. On that chart the pulse amplitude was less than one-quarter of that in Figure 2, and the dichrotic notch was at the top.

In Figures 3 and 4, the blood pressure pattern was recorded at the elevated elbow position, using a 4 channel Keeler Polygraph, Model 6338. (The bottom tracing is a photoelectric plethysmograph. Unlike Figures 1 and 2, produced from a 6328, these charts have only a single pneumo pattern.)

In another test, Canty produced excellent elbow cuff charts from an 18 year old male, 5'3", 203 lbs., at only 78 mm. of pressure. In that case, his first chart using conventional techniques, required 88 mm. of pressure. The pattern was only one-third of the pulse amplitude which was obtained on the second chart, where he employed his elevated elbow technique.

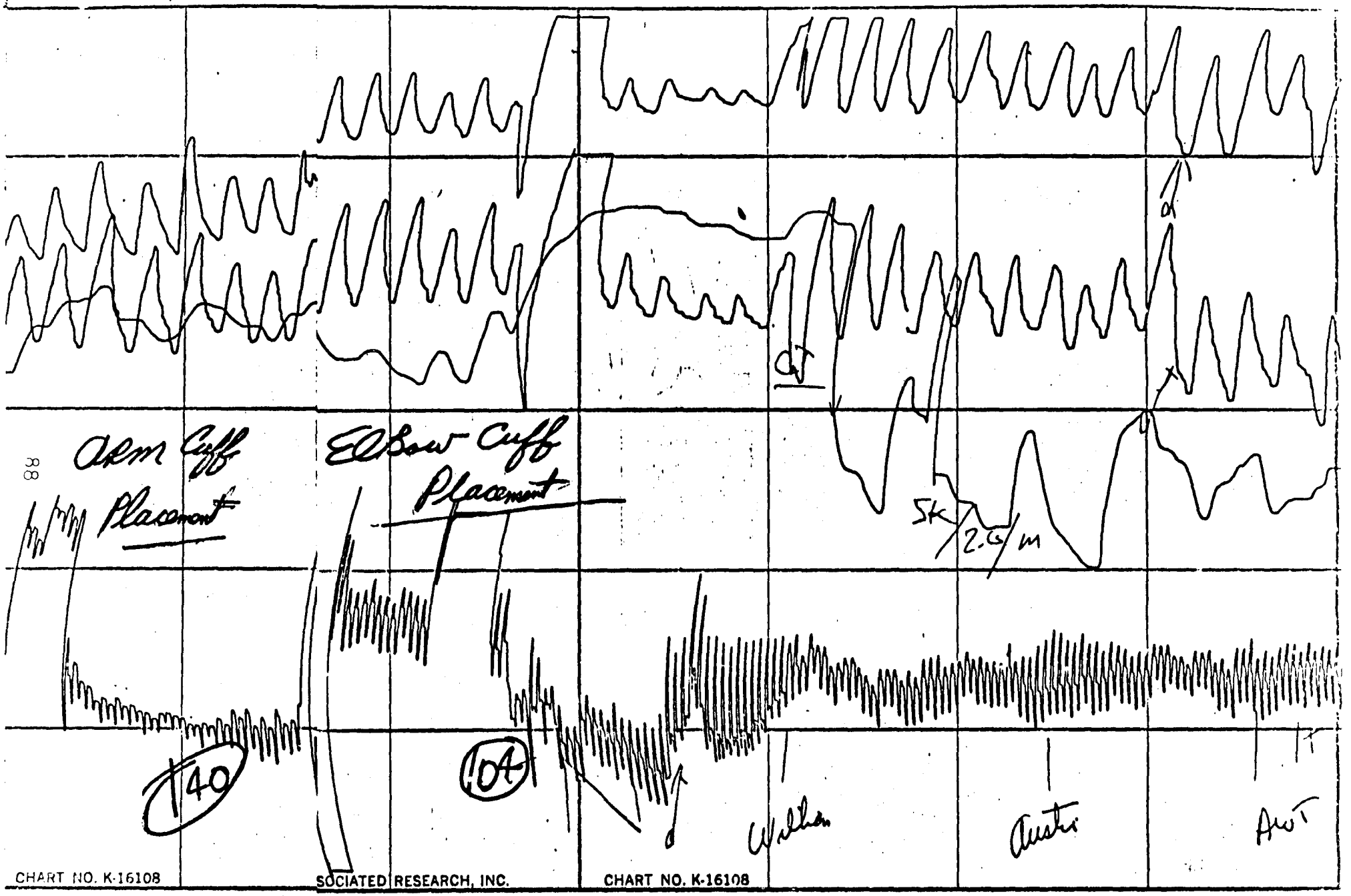

Figure 1

Shoplifting
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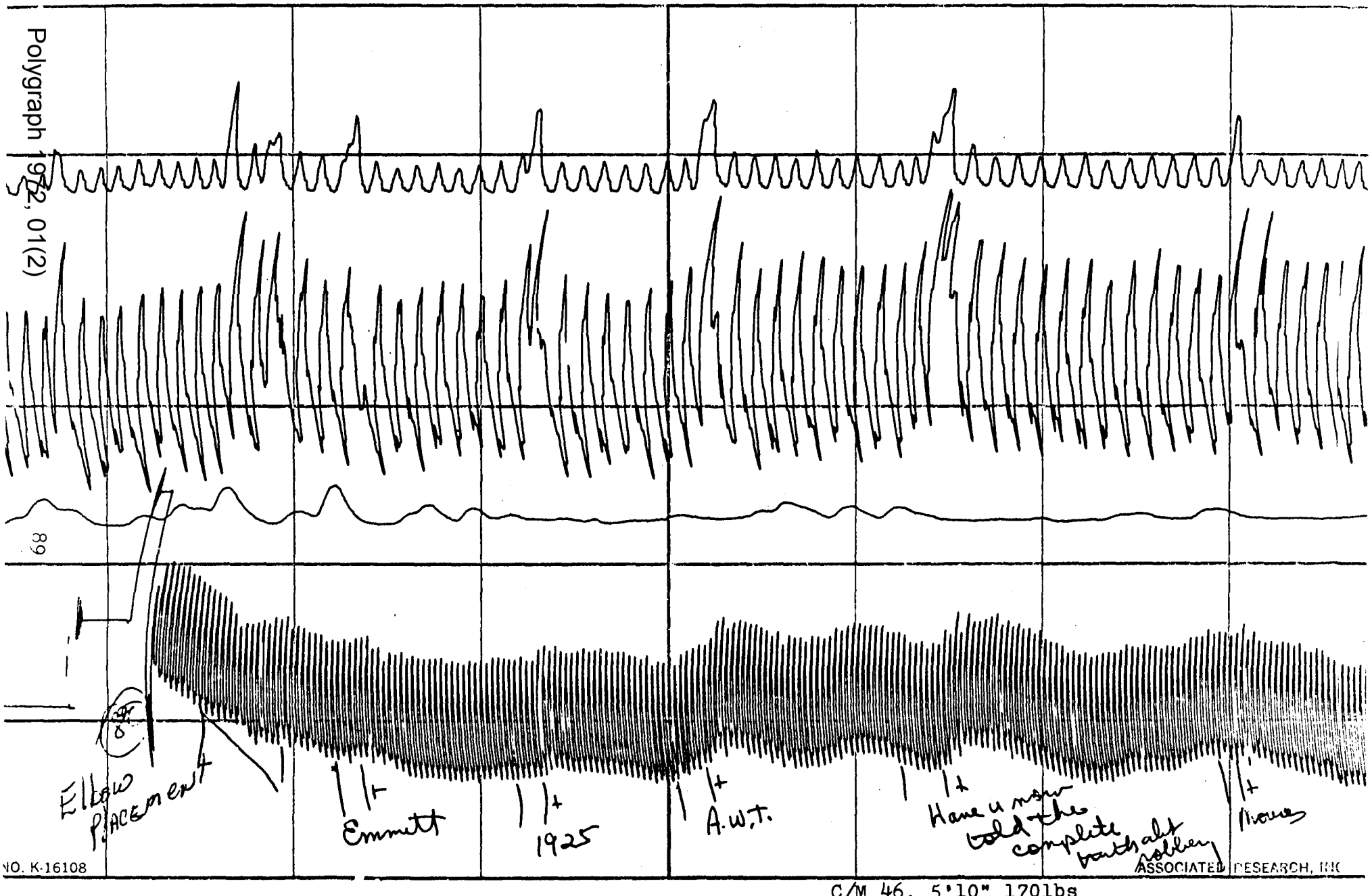
Polygraph 1972, 01(2)
89
Elbow Placement
Emmett
1925
A.W.T.
Have u now told the complete truth abt robbery
NO. K-16108
ASSOCIATED RESEARCH, INC
C/M 46, 5'10" 170lbs

Fig. 2

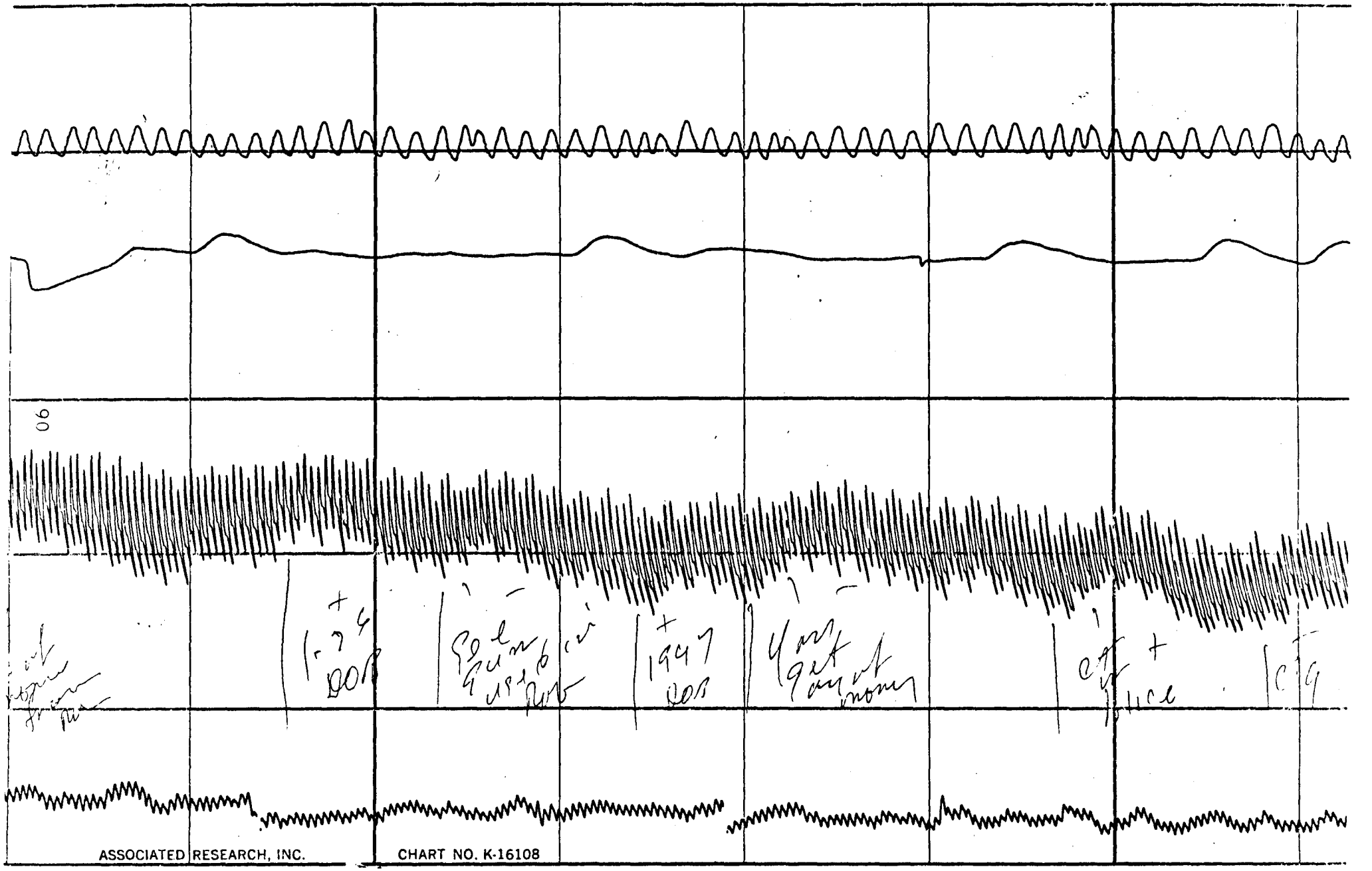

Fig. 3 5' 8" 275 lbs. C/M 25

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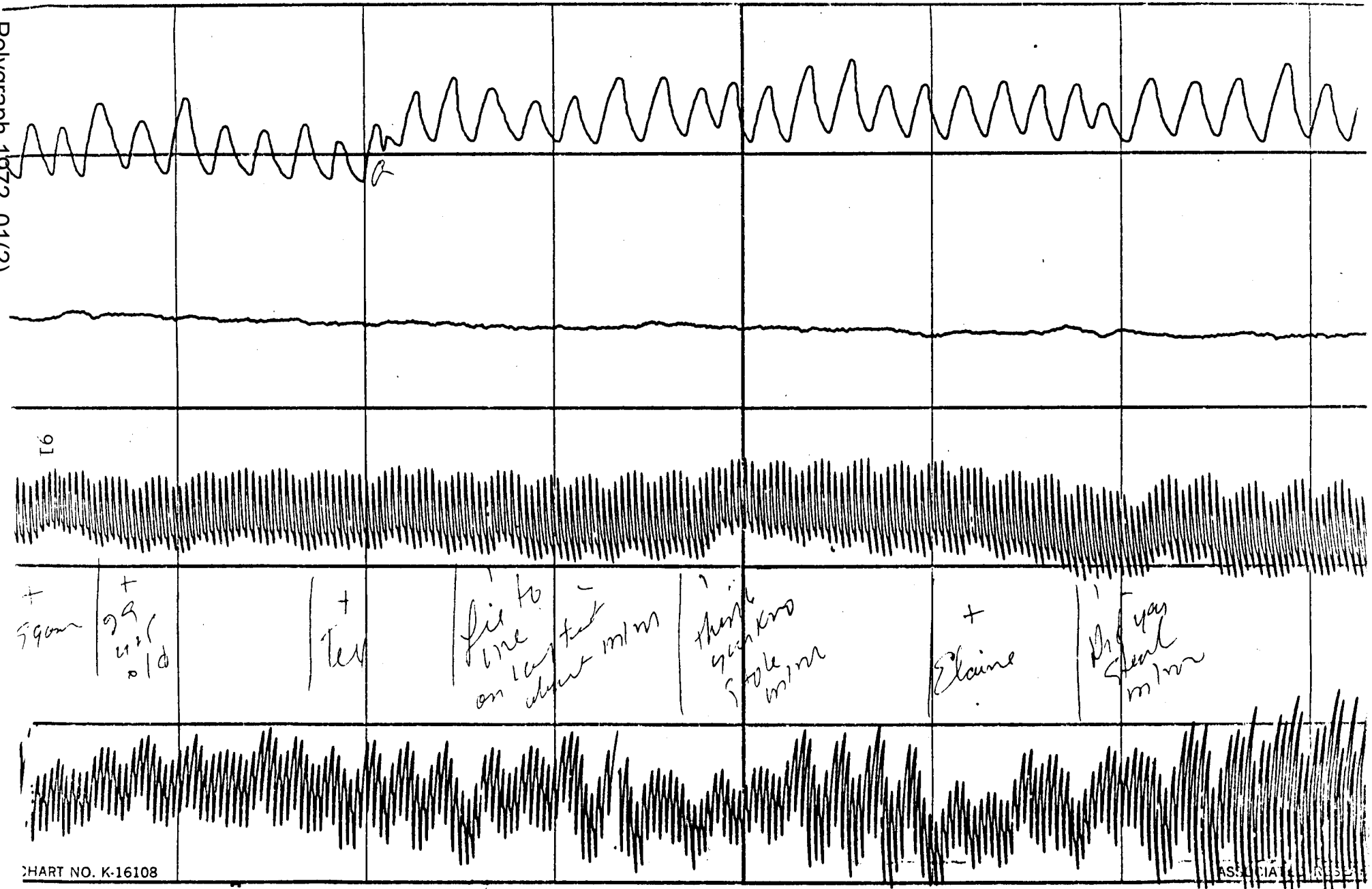

Fig.4 5'3½" 110lbs. W/F 28

A SUBJECT WITH POLIOMYELITIS

In response to a specific question from an examiner, Mr. C. B. Hanscom advised that the examiner should have no difficulty in conducting an examination on a subject who was the victim of poliomyelitis at the age of nine months and now, at age twenty-two, has marked atrophy in the right arm from shoulder to wrist. Mr. Hanscom explained that he had conducted a number of examinations at the University of Minnesota laboratory on subjects who suffered from extensive atrophy caused by poliomyelitis. There was no difficulty in obtaining satisfactory polygraph recordings, and reactions.

In explanation, Mr. Hanscom wrote that the characteristics of the poliomyelitis virus is its attack of the anterior horn cells of the spinal column, which often results in fractional paralysis of a body member, and when arrested, atrophy to that member with loss of strength and control of that member. Because polio effects the vasomotor center, it would have no relationship to the autonomic nervous system.

POLYGRAPH RESEARCH DOCUMENTS

The U.S. National Technical Information Service, Springfield, Virginia 22151 has several polygraph research documents for sale. These papers are the product of research financed and sponsored by the U.S. Air Force Office of Scientific Research. All of the research was done at the Hebrew University, Jerusalem, Israel. Mr. Akiva Ben-Ishai of the Israeli Police Headquarters, and an APA member, was involved in one of the projects.

S. Kugelmas, "Reaction to Stress." Order No. AD 702852.

Sol Kugelmas, Israel Lieblich, Akiva Ben-Ishai, Abraham Opatowski, and Maier Kaplan, "Experimental Evaluation of Galvanic Skin Response and Blood Pressure Change Indices During Criminal Interrogation." This report has also been published in the Jr of Crim Law, Criminol & Police Sci, Vol 59, No 4. Order No. AD 688322.

Sol Kugelmas and Israel Lieblich, "Relation Between Ethnic Origin and GSR Reactivity in Psychophysiological Detection." Order No. AD 677720.

HYPERVENTILATION AND HYSTERIA

by Thomas P. Lowry, M.D.
Springfield, Illinois: Charles C. Thomas, 1967

Reviewed by Althea M. I. Wagman, Ph.D.
Maryland Psychiatric Research Center
Baltimore, Maryland

The book is divided into eight chapters that range from a definition and description of hyperventilation through its physiology and relationship to the psychological condition of hysteria. Each chapter is written by a different author.

The second chapter was written by the editor, Thomas Lowry, and it concerns the development of the concept of hyperventilation. In that chapter, he reviews the history of the syndrome and its relationship to other circulatory-type problems, e.g. neurocirculatory asthenia. The causes of hyperventilation seem to be numerous. There can be purely psychological causes of hyperventilation, it can occur as a result of a conscious technique that the subject uses to repress the environment, it can occur in response to environmental temperature, and it can occur as a result of change in carbon dioxide tension level. A syndrome that is so multi-faceted is obviously of interest to people in the medical profession and those involved in psychological treatment of patients. It is also a very important syndrome for those individuals dealing with personnel recruitment, such as the Army or the Air Force. It is common practice in the United States Air Force for both pilots and flight medical officers to receive formal instruction and personal experience in the signs and symptoms and management of hyperventilation. Lowry makes the point that many patients that are seen for circulatory problems really are suffering from hyperventilation rather than something more critical. The hyperventilation syndrome produces very debilitating symptoms. The subject may feel a tingling sensation in his hands or may lose consciousness. Frued reports in 1890 about a young girl he met in the Alps. "She described to him a repetitive nervous attack in which she would have feelings of suffocation, pressure on the eyes, a heavy head, a buzzing in the ears, a giddiness, a crushing sensation in the chest, a squeezing sensation in the throat, a hammering sensation in the head and a feeling of impending death. In short, a classical hyperventilation attack." The chapter is concluded with an excellent reference list which includes several reviews of hyperventilation.

The third chapter deals with the physiology of hyperventilation, by Cone Johnson. It is the longest and most difficult chapter in the book. The reader who is more interested in the relationship of hyperventilation to psychological conditions might omit this chapter.

The analysis of the hyperventilation phenonema is exceedingly well done. The chapter is well organized and easy to follow. The naive reader might have some difficulties with the information, not because the information is poorly explained but because of the wealth of information that is compacted in the sixty pages.

The fourth and fifth chapters deal with a study of hyperventilation in military recruits, written by Thomas Lowry and Irving Gottesman. These authors found that within the military situation, there was a tremendously high proportion of individuals with hyperventialtion syndrome. Many of these men were found in sick bay, regardless of the rather excruciating procedures that the Army goes through to discourage people from going on sick call. The MMPI study of these hyperventilators did not indicate that there was any special personality profile for these patients. There were, within this group, a very high per cent (29) of the subjects that had malingering patterns on the MMPI. In addition, there were 31% of the subjects with marked tendencies toward psychophysiological disability, as indicated by the MMPI.

Chapter 6 is concerned with the psycho-dynamic aspect of respiration, written by Mardi J. Horowitz. This is a very short chapter and provides case reports of the relationship of hyperventilation to obsessive-compulsive syndrome.

The next chapter, written by Richard Rabkin, deals with the social maladaptation of conversion hysteria. The chapter basically deals with the phenomenology of hysteria. There is a review of the literature on hysteria and also a discussion of the treatment for hysteria. The relationship between the process of hyperventilation and development of conversion hysteria is also discussed.

The final chapter deals with the electroencephalogram and cerebral functioning during hyperventilation, written by Edward A. Davis. Davis starts out with a discussion of the relationship of the electroencephalogram to respiration and the hyperventialation effect. He then discusses the metabolic factors that would affect the EEG. Hyperventialtion is also discussed in its relationship to petit mal epilepsy and childhood breath-holding spells.

The general organization of this book is very easy to follow. Each chapter is amply sub-titled so that the reader can easily follow the material, regardless of his persuasion. Although the book is scholarly and oriented toward a reading public familiar with basic physiology and psychology, many other individuals will find the material interesting. Readers interested in the way one autonomic response system can modify others, or in the effects of stress anxiety upon autonomic reactivity will find this work most helpful.

ABSTRACTS FROM OTHER JOURNALS

These abstracts are reprinted as a guide to the research reported in other scientific journals. We are indebted to Dr. Albert F. Ax, Editor of the quarterly journal Psychophysiology, for permission to reprint abstracts from that journal. Two abstracts have also been reprinted from Crime and Delinquency Abstracts, published by the National Clearinghouse for Mental Health Information, U.S. Department of Health, Education and Welfare.

"Effects of Depth and Rate of Breathing on Heart Rate and Heart Rate Variability," by L. Alan Sroufe, Institute of Child Development, University of Minnesota. Psychophysiology, Vol 8, No 5, pp. 648-655.

"Effects of depth and rate of breathing on heart rate (HR) and HR variability were observed in two experiments. Respiration rate (RR) affected only cardiac stability, faster breathing produced more stable cardiac rate. Respiration depth (RD) affected both HR level and variability. Deep breathing produced faster, more variable HR, while shallow breathing had the opposite effects. A third experiment, in which Ss were trained to control HR using respiration, further illustrated the dramatic effects of respiration on cardiac rate. Implications of these results for experiments utilizing HR as a dependent variable and studies of autonomic control were discussed. DESCRIPTORS: Breathing rate, Breathind depth, Respiration, Heart rate, Heart rate variability." (L.A. Sroufe)

"Cardiac Responses to Self-Induced Thoughts," by Gary E. Schwartz, Harvard Medical School. Psychophysiology, Vol 8, No 4, pp. 462 - 467.

"A psychophysiological procedure is described for obtaining time locked autonomic responses to specific internal (thought) stimuli in the absence of different external (environmental) stimuli. The procedure is illustrated by a heart rate experiment in which 10 Ss silently generated numbers followed by letters or affect-laden words, all in synchrony with externally paced tones. The shape of the cardiac response was found to be a function of the specific thought sequence. The data are interpreted as demonstrating that specific thoughts can act as potential stimuli of autonomic responses. General implications of the finding and the procedure are considered. DESCRIPTORS: Heart rate, Thoughts, Self-generated, Time-locked." (G. E. Schwartz)

"The Information Content of the Recovery Limb of the Electrodermal Response," by Robert Edelberg, Department of Psychiatry and Behavioral Sciences, University of Oklahoma Medical Center. Psychophysiology, Vol 6, No 5, pp. 527-539.

"Recent observations suggest that skin conductance or resistance responses manifest, in the shape of the recovery limb, two components, a slow one associated with the negative skin potential response and sweating, and a faster one associated with the positive skin potential response and with the recently reported sweat reabsorption response. Part of the recovery limb has an exponential form, and its recovery rate is interpreted as a measure of the relative participation of these two components. Two simple manual methods, utilizing overlays, allow rapid determination of recovery half-time or time constant. Recovery rate is not determined by amplitude. It can differentiate between spontaneous responses during rest and during a task, between orienting responses to a light flash and responses to the same flash when it takes on signal properties, and between responses to an alerting signal and to an execution signal for a task. Individuals with fast recovery rates during a task also tend to show slower habituation of electrodermal responses. It is concluded that the reabsorption process represents an adaption for goal-directed behavior. DESCRIPTORS: Electrodermal activity, Skin conductance response, GSR, Skin potential response, Electrodermal recovery limb, Behavioral concomitants of electrodermal responses. (R. Edelberg)

"Heart Rate Derived from Blood Pressure and Other Physiological Signals," by David Krausman, Johns Hopkins University School of Medicine. Psychophysiology Vol 7, No 3, pp. 503-507.

"A device for providing a continuous on-line output of beat-by-beat HR in physiologic studies is described. The circuit eliminates the need for obtaining an EKG signal since it uses other vascular phenomena such as blood pressure, blood flow, or plethysmograph to produce an index of heart action to provide subsequent rate phenomena. Signal conditioning to produce the electrical analog of the vascular change is derived from either a pressure transducer, flow probe, plethysmograph, or other transducing device connected to the input of a Beckman-Offner, or Grass (Model 6) polygraph recorder. The output is in the form of a relay closure to provide initiating action to such devices as cardiotachometers, integrators, printers, counters, and many other instruments used in physiological studies. DESCRIPTORS: Heart rate, Physiologic signals, Cardiotachometers, Integrators, Detector. (D. Krausman)

"An Electroencephalographic and Psychiatric Study of Thirty-Two Insane Murderers," by Z. A. Sayed, S. A. Lewis, and R. P. Brittain. British Journal of Psychiatry, London, 115(527): 1115-1124, 1969.

"An electroencephalogram (EEG) and psychiatric study was carried out on 32 murderers classified legally as insane. Their EEGs which were read 'blind' were compared with a control (nonpatient) group and it was found that the patients had an incidence of EEG abnormality about 4 times that of the control group. None was found to contain a spike and wave abnormality. The study confirmed the general finding that approximately half the psychopaths had abnormal EEGs but the psychotic group had a much higher incidence. Brief comment is made on the value of electrencephalography for forensic psychiatry."

"The Polygraph Revisited: An Argument for Admissibility," by Albert S. Dabrowski. Criminal Law Bulletin, 6(2):63-80, 1970.

"The underlying rationale behind the seemingly continuous rejection of evidence based on polygraph examination is investigated. The present legal attitude reflects a position not materially changed since 1923. The polygraph has matured since then into a sophisticated process employing numerous physiological measurements. It is increasingly used by government, private industry, and law enforcement agencies. The judiciary, however, has not accepted it. The value of the technique, when properly used, warrants judicial recognition. The endorsement is limited strictly to the area when the examination has exhibited a high degree of reliability in the hands of a competent examiner under the proper test conditions. The results of polygraph examinations conducted by qualified competent examiners should be admissible, subject to the trial judge's discretionary power of exclusion where the probative value of the evidence fails to counterbalance its prejudicial character. 88 references.

BIBLIOGRAPHY ON HUMAN INTELLIGENCE

A Bibliography on Human Intelligence is available free from the National Institute of Mental Health, Publications Distribution Office, Room 6C03, Parklawn Building, 5600 Fishers Lane, Rockville, Maryland 20852. The bibliography was compiled by Logan Wright, Ph.D. Director of Psychological Services, Children's Memorial Hospital, University of Oklahoma Medical Center. The chapters include Historical Antecedents, Related Concepts, Theoretical Works, the Nature of Intelligence, Factors Influencing Intelligence, and Group Intelligence Tests. The bibliography is provided with an outlined index as well as a comprehensive topical index.

VALIDITY OF THE POLYGRAPH

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