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An Experimental Investigation of the Relative Validity and Utility of the Polygraph Technique and Three Other Common Methods of Criminal Identification

Although the polygraph ("lie detector") technique is frequently used for other purposes its major application is in criminal investigation and identification. In such applications even the harshest critics acknowledge the usefulness and potential of the technique [1]. Nevertheless, there is still considerable controversy with respect to practitioners' claims that the technique has a nearly perfect validity [2,3]. The research reported to date, although suggestive of very high validity, does not compellingly demonstrate that the validity, at least in field situations, is as high as practitioners claim [4,5]. None of that research, however, whether laboratory- or field-based, examined the validity and utility of the polygraph technique in comparison to other commonly used methods of criminal identification. The need for such a comparison was made explicit by Reid and Inbau [6, p. v] in their claim that the polygraph technique "possesses a degree of accuracy commensurate with, and even superior to, most of the presently approved forms of evidence, scientific as well as non-scientific, that feature in criminal and civil trials."

The purpose of the present study was to investigate the claim made by Reid and Inbau [6] and, specifically, to assess the utility and validity of the polygraph technique in comparison to fingerprint identification, handwriting analysis, and eyewitness identification. Although this study was carried out in a laboratory context, generally believed to decrease the effectiveness of the polygraph technique [4,5], that context ensured that "ground truth" was known and that the circumstances in which data were collected were similar in nature.

Method

Subjects

Eighty student volunteers, all enrolled in Jagiellonian University, Krakow, Poland, were recruited to serve as subjects. The age range for these subjects was from 19 to 24, with a mean age of 21. Forty-two of the subjects were males; 38, females.

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Procedure

Upon being recruited all subjects provided a confederate of the researcher with handwriting specimens, full-face photographs, and fingerprints. Handwriting specimens were obtained by requiring each subject to write ten times the phrase "I acknowledge the receipt," his own signature, and the date on an exemplar sheet. A photograph (approximately 6 by 10 cm) of each subject was made by reproducing the photograph on student identification cards. Finally, each subject's ten fingerprints were taken by a qualified research assistant on fingerprint cards on which the subject's name and experimental group assignment were indicated. The handwriting specimens, photographs, and fingerprints were to serve as exemplars for analysis of evidence collected in the research.

After collecting the exemplars the confederate assigned the subjects to 20 groups of four subjects each. Ten of the groups consisted of all male subjects; nine, of all females; and one, of two males and two females. Within each group one subject was randomly assigned the role of "perpetrator" in each of 20 similar "investigative cases" which were independently carried out. The remaining three subjects in each group were assigned the role of "innocent suspects." None of the four subjects in each case was made aware of the role assigned to the other subjects in that case.

The perpetrator was given a sealed envelope containing his instructions. He was required to open the envelope, read the instructions inside, and then carry out the assigned task. The task for all perpetrators consisted of collecting a parcel from one of two persons recruited to act as the doorkeeper of a local building. Upon arriving at the building the perpetrator gave the envelope and the instruction sheet to the doorkeeper, who, after obtaining the envelope, required the subject to complete a receipt form by signing "I acknowledge the receipt," along with a handwritten signature of a fictitious name. The doorkeeper then gave the perpetrator a parcel containing an imported cosmetic of small value. All perpetrators were told in advance that the receipt form was to be used as a means of identification and thus they were advised to try to deform their handwriting.

All subjects, whether innocent suspects or perpetrators, were told that they were to undergo a polygraph examination to determine their role in the cases. They were advised to maintain complete secrecy about their role until the experiment was over. In addition, each perpetrator was advised that if he could successfully defeat the polygraph examination he could keep the cosmetic item contained in the parcel secured from the doorkeeper. Innocent suspects were advised merely to appear innocent and to do nothing to mislead the examiner; they received no reward for their participation.

Upon completion of the assigned task, the perpetrator and innocent subjects in each case were given polygraph examinations. The examinations were carried out blind: the examiner was not aware of who had been assigned the role of perpetrator or of innocent suspect in any case, although he was aware of the four suspects who were assigned to the same case.

Examinations were done with a standard field-model polygraph, a four-channel Lafayette Model 76058, in accordance with Reid Control Question procedure [6]. That procedure essentially consists of a pretest interview and a series of polygraph tests. Because the interview, testing procedure, and evaluation of the physiological data have been adequately described elsewhere [6,7] they will not be detailed here. However, it should be noted that there was no attempt made to determine which physiological measure recorded by the polygraph (respiratory, cardiovascular, or electrodermal activity) was the most effective nor to determine the influence of the examiner's subjective impressions of the subjects' behavioral characteristics on his decisions of truthfulness and deception with respect to the subjects' roles. In all instances, the examiner conducted polygraph examinations on each of the four suspects in a case before he rendered a decision as to which suspect had been the perpetrator.

Independent of the polygraph examinations, three other methods of identification were carried out based on the evidence gathered in each of the 20 cases. First, a fingerprint expert (Criminalistics Department, Jagiellonian University, Krakow, Poland) applied the aerosol ninhydrin method to discover fingerprints on the envelope and the instruction sheet which each perpetrator had given to the doorkeeper. It was assumed that the procedure requiring each perpetrator to handle the envelope and contents would ensure the presence of the perpetrators' fingerprints on at least one of those documents. The expert's task, of course, was to select from the set of fingerprints of the four subjects in each case those which were the prints on the evidence. The expert was aware of the four subjects assigned to each case; he was asked to discover fingerprints on the evidence and then to determine, in each case, which of the four subjects' prints matched those on the evidence. In all instances the criterion for a match was a minimum of seven characteristic details.

Examination of the handwritten signature and the phrase "I acknowledge the receipt" on the form signed by each perpetrator when obtaining the parcel from the doorkeeper was carried out by a local (also at Jagiellonian University) handwriting expert. He, like the fingerprint expert, knew which four subjects were assigned to the same case and was given all exemplars of those subjects gathered at the outset of the research. His task, of course, was to match the handwriting on the receipt with the proper exemplar in each case.

The role of eyewitness was assumed by two doorkeepers, each of whom alternated in that role such that each saw and talked to ten perpetrators. Two days after the perpetrator collected the parcel the appropriate eyewitness was shown photographs of the four suspects in each case and was asked to identify the subject who had been the perpetrator. The eyewitnesses, of course, were both confederates of the researcher and had advance knowledge of their role in the research. It was assumed that each of them would be equally capable of identifying perpetrators from photographs after having talked to and observed the perpetrators for about 2 min.

Results

Table 1 displays the distribution of the decisions made in each of the identification methods for the 20 independent investigative cases. As shown, the number of correctly resolved cases (those in which the perpetrator and thus the three innocent suspects were correctly identified) was the greatest for the polygraph examiner, followed, in order, by the handwriting expert, the eyewitnesses, and the fingerprint expert; excluding inconclusive cases the percentage of correctly resolved cases was 95, 94, 64, and 100%, respectively. If inconclusive cases are included the percentage of correctly resolved cases was 90, 85, 35, and 20%, in order, for polygraph, handwriting, eyewitness, and fingerprint identification.

TABLE 1—*Distribution of case decisions made in each identification method.*^a

| Identification Method | Decisions | | |
|-----------------------|-----------|-----------|--------------|
| | Correct | Incorrect | Inconclusive |
| Polygraph | 18 | 1 | 1 |
| Handwriting | 17 | 1 | 2 |
| Eyewitness | 7 | 4 | 9 |
| Fingerprint | 4 | 0 | 16 |

^aNote: By using the binomial distribution and excluding inconclusive cases, the number of correctly resolved cases was significantly greater than chance ($P < 0.05$) for all identification methods.

By treating each case as an independent trial and excluding all inconclusive cases the number of correct case resolutions was significantly ($P < 0.05$) greater than chance for all identification methods (with the binomial distribution where probability of success = 0.25).

It is not appropriate to compare the case resolution for each identification method, particularly since the nature and availability of the evidence in each method was quite different. However, the utility of each method can be discerned from inspection of the inconclusive cases. In 16 cases the fingerprint expert was unable to discover any prints sufficient for the identification of the perpetrator in those cases. In 9 cases the eyewitnesses were unable to state with certainty who of the four persons in each case had been the perpetrator nor to eliminate definitely any of the innocent suspects. The handwriting expert was unable to match the perpetrator's handwriting with any of the exemplars in two cases. Finally, the polygraph examiner, yielding one inconclusive case, correctly identified two of the innocent suspects in that case. He was not able to determine which of the two remaining suspects was innocent and which was the perpetrator.

In each of the 20 investigative cases for each identification method an incorrectly resolved case indicated both a false positive error (classifying an innocent suspect as a perpetrator) and a false negative error (classifying a perpetrator as an innocent suspect). To determine the distribution of false positive errors for each identification method the ratio of the number of such errors to the total number of definite decisions made was calculated.

As indicated in Table 2, the percentage of false positive errors was greatest for eyewitness identification followed by handwriting analysis, polygraph examination, and fingerprint identification: 9.1, 1.4, 1.3, and 0.0% respectively. The result for the polygraph method reflects the two correct decisions made in the one unresolved case.

Discussion

Although it was possible to determine the validity of the decisions made in each identification method, comparisons between those methods, as well as interpretation of the results, are complicated by methodological and other problems. For instance, in spite of the fact that each perpetrator was required to handle the evidence, that procedure was not adequate to ensure that identifiable fingerprints would be found. In fact, the expert was unable to detect such fingerprints in the majority of cases. Moreover, because this research was laboratory-based, the results cannot necessarily be generalized to the real-life situation. It seems reasonable, however, to assume that of the various methods investigated the polygraph technique was the one most disadvantaged by the laboratory context. The physical evidence on which the handwriting and fingerprint experts and the eyewitnesses based their decisions was collected and analyzed in rather auspicious circumstances which would appear to work in favor of those methods, whereas it is generally recognized that

TABLE 2—*Distribution of false positive errors made in each identification method.*

| Identification Method | Definite Decisions Made, <i>n</i> | False Positive Errors, % |
|------------------------|-----------------------------------|--------------------------|
| Polygraph ^a | 78 | 1.3 |
| Fingerprint | 16 | 0.0 |
| Handwriting | 72 | 1.4 |
| Eyewitness | 44 | 9.1 |

^a Includes two correct classifications of innocent suspects in the one unresolved case.

the polygraph technique is less effective in laboratory situations than in real-life circumstances, apparently because of the lesser "fear of consequences" in the former situation [4,5].

For the reasons expressed above, as well as for the other obvious reasons, our findings must be viewed with considerable caution. Nevertheless, several important points deserve mention. First, with respect to the accuracy of the polygraph examiner's decisions our results were generally consistent with those reported in most previous research [4,5]; the polygraph examiner's decisions were highly accurate. In fact, the examiner's accuracy in this study was somewhat higher than that which has been reported in most previous laboratory-based studies. The most likely explanation of this finding is that a closed trial method was used in this study. The polygraph examiner, as well as each of the other experts, was presented with four suspects in each case; only one of those suspects was known to be guilty, that is, a perpetrator. That method, which is not typically analogous to the real-life situation nor to the typical method used in previously reported research dealing with the polygraph technique, probably facilitated decision-making and enhanced the examiner's accuracy.

Second, with respect to the accuracy of the fingerprint and handwriting experts and the eyewitnesses, only a very parsimonious discussion is in order. Although all three of those methods yielded reasonable accuracy rates, our results suggest that eyewitness identification was not, and probably is not in real life, a particularly effective means of identification. In this study, unlike the real-life situation, the eyewitnesses had advance knowledge of their role, made identifications based on contemporary photographs, were relatively uninfluenced by emotional involvement in a criminal offense, and made identifications within a reasonable time following the "offense." Yet the success of the eyewitnesses in making definite decisions was not impressive. In short, as has been commonly acknowledged, eyewitness identification is probably quite limited in usefulness and effectiveness [8-10].

Third, although it is inappropriate to make direct comparisons of the accuracy rates in each of the identification methods, our results, considered along with previous research, do at least suggest that the accuracy of the polygraph technique compares favorably to that attained by the other methods investigated. Moreover, it is evident from the case resolution rates that the polygraph was particularly useful relative to the other methods: the polygraph technique yielded a relatively low number of unresolved cases and a high number of correct decisions. Although that result was probably not uninfluenced by the closed trial method used, it is reasonable to suspect that that advantage is peculiar to the polygraph technique not only in this research but also in the real-life situation. The other identification methods investigated in this study, and those most frequently used in real-life situations [11], are generally dependent on the discovery of some form of physical or other evidence (such as a fingerprint or an eyewitness) which may either inculcate or exculpate a suspect. The polygraph technique is not necessarily dependent on such evidence, even though it may be helpful [6]. Thus, what our results suggest is that in comparison to certain other common methods the polygraph technique is a unique and relatively valid method of criminal investigation and identification.

In summary, it is important to emphasize again that in actual criminal investigations it is seldom that one of a given group of suspects is known to be guilty, and thus the closed trial method used in this research was not necessarily similar to the real-life situation and its use probably stacked the odds for correct detection in favor of the experts. Nevertheless, our findings do support the claim of practitioners that relative to other methods the polygraph technique is particularly valuable for resolving criminal investigations. Further, we believe that the comparative approach taken in this study is especially useful for assessing the applied value of the polygraph technique. More thorough and sophisticated research consistent with that approach would be both desirable and fruitful.

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