The Polygraph:

A Study of Its Effectiveness as a Screening Tool

In the Fire Department Hiring Process

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THE USE OF THE POLYGRAPH IN THE FIRE SERVICE

Certification Statement

I hereby certify that this paper constitutes my own product, that where the language of others is set forth, quotations marks so indicate, and that appropriate credit is given where I have used the language, expressions, ideas, or writings of another.

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Abstract

The fire service, like most public agencies, is held to a higher level of scrutiny than the private sector due to the use of taxpayer monies as the principal source of funding. Many fire departments have developed a thorough application processes to ensure potential applicants meet the physical and moral character demanded of the job by the public. In an attempt to better screen applicants, the fire service has often turned to the polygraph to uncover past indiscretions and current problems that an applicant may not have disclosed in his or her application. No research has been done on the validity of the polygraph as a screening tool for the fire service. Because this issue contains both a scientific and legal component in relation to its practical application; a combination of quantitative research results and legal review were used in this paper.
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Introduction

In the last several years, the Greater Cincinnati area has suffered a series of high profile criminal incidents involving firefighters. (Appendix A-4) These incidents adversely affect the trust the public has placed in the profession, and are very damaging to the image of the offender’s department. It is normally the case in criminal incidents involving firefighters; that the term firefighter is used in the headlines. With so much at stake for departments, it is worthwhile to investigate how a department can better screen prospective applicants, and how to apply the results of this screening to employment decisions.

Career fire departments spend a vast majority of their budgets on personnel and staffing cost. The cost to hire and train a firefighter is a significant investment for most municipalities that can quickly escalate up into the tens of thousands of dollars depending on the various levels of certification required for the department. This large upfront initial investment, in conjunction with the public and high profile nature of the work performed has led municipalities to screen their applicants for a high degree of moral character. The polygraph or “lie detector” test is heavily relied upon by the majority of career fire departments (Appendix A-1) to be an effective screening tool of prospective candidates within a hiring process. The polygraph is often used in lieu of or in conjunction with a psychological assessment to screen out individuals that may not function well within the department, or potentially cause the department and municipality a costly lawsuit or embarrassment in the future.

1 NFPA (2003) Organizing for Fire and Rescue Services pg 113
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The polygraph has been in existence for over one hundred years and has been used by the fire service and other government agencies for decades; however, the science behind the polygraph is still controversial and continues to be scrutinized by both science and the legal system. The primary purpose of this paper is to review the effectiveness of the polygraph as a screening tool in pre-employment testing through the use of empirical data and legal case studies, and construct a recommendation on how its results should be applied to the employment process.

**Background**

The term polygraph is derived from Greek for “many writings.” The modern polygraph was invented in 1921 by psychiatrist Dr. John Larson, and recorded a subject’s blood pressure, pulse, and respirations. This machine was used for years by the Berkley, CA police department during interrogations. Later a psychologist named Leonard Keeler added a fourth component known as the “galvanic skin response” to create the polygraph machine as we know it today. The polygraph machine quickly found its way into the legal system. In 1923 the United States Supreme Court heard the case of Frye versus the United States to decide if the polygraph was admissible as evidence in court. The Court ruled that the polygraph did not meet the standard of scientific proof stating in their decision:

> "Just when a scientific principle or discovery crosses the line between the experimental and demonstrable stages is difficult to define. Somewhere in this twilight zone the evidential force of the principle must be recognized, and while courts will go a long way in admitting expert testimony deduced from a well-recognized scientific principle or discovery, the thing from which the deduction is made must be sufficiently established to have gained general acceptance in the particular field in which it belongs."

2 http://law.jrank.org/pages/12871/Frye-v-United-States.html
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The inadmissibility of the polygraph in court was reaffirmed by the Supreme Court in 1998 in the decision of the United States versus Scheffer.

The Polygraph has a long history in pre-employment screening in the public sector, and is still heavily used in law enforcement and national defense agencies. A 1983 examination of the polygraph’s validity by the Office of Technology Assessment found the United States Government conducted over 22,597 polygraphs in 1983 with the NSA comprising the largest number. The polygraph’s use significantly declined in the private sector following the passage of the Employee Polygraph Protection Act (EPPA) in 1988 by Congress. Although the polygraph is an old technology, it has evolved into the digital age with most analog units being replaced by an updated digital displays. The polygraph is also facing increased competition from recent technological innovations including Voice Stress Analysis (VSA), biometric software, and infrared technology.

Literature Review

The polygraph has been studied extensively since its invention with stringent scientific testing beginning in the 1940’s (Bitterman and Marcuse “Cardiovascular Response of Innocent Persons to Criminal Interrogation 1947) with extensive studies being conducted in the 1960’s such as Ben-Ishai 1962 “Remarks on Polygraph Research, and Bersch “A Validation Study on Polygraph Examiner Judgements” 1969. However, a bulk of the research was completed in the 1980’s, with a culmination of the Congressionally sanctioned 1983 report by the Office of Technology Assessment which compiled decades of polygraph research in an effort to examine its validity and reliability for government use. This process of research compilation was repeated again in 2002 by the National Research Council at the

behest of the Department of Energy following the DOE’s implementation of the polygraph for research scientist in the wake of the Wen Ho Lee espionage trial.

**The Science Behind the Polygraph**

Although the polygraph is used by many public agencies, the science behind it is often not clearly understood. The polygraph has been given names such as “the lie detector” or the “deception detector”; however, this is in fact a misnomer. The polygraph machine cannot determine a truth from a lie as its nicknames would suggest. What the machine measures is the reaction of the body’s autonomic nervous system in response to stressors, sometimes termed biofeedback. This feedback is purported to be “involuntary” by supporters of the polygraph industry, however, studies have shown these “involuntary reflexes may be subject to manipulation.” The machine generally measures four distinct areas of biofeedback. The first measuring device is a blood pressure cuff which measures blood pressure and pulse. The changes in pressure create sound which displaces air in tubes that are connected to bellows which then move the pen on the graph paper. In digital polygraphs this movement is converted to an electronic signal via transducers. The theory is that when a body becomes stressed it will activate the sympathetic nervous system releasing adrenalin and catecholamine which then increases the heart rate and correspondingly the blood pressure will rise; this is often termed the Fight-or-Flight Response. The examiner may interpret this change as a marker for deception. The second measuring device used in the polygraph is two pneumographs. The pneumograph is a rubber

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tube that attaches around the abdomen and chest to measure the respirations of an examinee in the same manner as the blood pressure cuff, with the idea that stress will change the respirations of a person being deceptive. The last component of a tradition polygraph machine is the galvanometer which measure electro-dermal activity or galvanic skin resistance (GSR). GSR is simply a measure of how much the body is perspiring. The perspiration of the finger creates a stronger electrical contact at the sensor than a dry finger; with the theory a deceptive person is under stress therefore sweats more than a calm, non-deceptive individual. It is important to note that the polygraph can only determine if the subject taking the test is feeling stressed at a given point during the exam; it takes a subjective judgment to determine that the stress is due to guilt and not another emotion or general anxiety.

While these three components are the mainstay of the polygraph, there are other variations that include sensors to register arm and leg movement. Regardless of what the machine measures, it is up to the subjective judgment of the examiner to determine if a person has been truthful or deceptive. In a study by the OTA (1983) it was determined that the examiner has the ability to influence validity and reliability in exam by choosing how and in which order he or she asks the questions.5 Generally the examinee is asked a series of control questions to gauge their body’s reaction to a simple non-stressful question. These questions are then followed up by the actual exam questions. It is the general practice of most examiners to begin extracting information before the machine is ever turned on.

Countermeasure

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Various studies sanctioned by the United States Government have concluded that the polygraph is susceptible to the use of countermeasures (OTA 1983, NRC 2002). Countermeasures are the purposeful manipulation of biofeedback in an attempt to appear non-deceptive on the polygraph. These measures generally attempt to illicit a strong reaction to control questions thereby establishing a high baseline of comparison for future questions. When an individual is asked a question that he or she intends to be deceptive on, the stress levels will appear normal as compared to the control questions. These measures can be as simple as placing antiperspirant on the fingers to reduce sweating and tightening the sphincter muscle to illicit changes in pulse and blood pressure; to elaborate measure such as placing a tack in shoe and deliberately altering breathing rates. The use of sedatives has also been shown to influence polygraph results. The information on how to employ countermeasures is widely available on the internet at such internet sites as antipolygraph.org

Results

In studying the polygraph the two most critical factors of its effectiveness are validity and reliability. Validity refers to the ability of examiner to accurately identify deception based on the machines readings. Key to this issue is the number of false positives (truths labeled lies) and false negatives (lies labeled truths). It is important to note that these studies were all conducted around single critical instances such as a criminal act or theft. There has been no conclusive clinical study done on the effectiveness of the polygraph as a screening tool. This was noted in a 2002 NRC report to Congress “Because the studies of acceptable quality all focus on specific incidents, generalization from them to uses for screening is not justified”. The American Polygraph
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Association (APA) states that the polygraph as a screening tool has not been conclusively studied. Therefore, the validity of the polygraph research is only theoretically applicable to screening. With regards to validity, the 1983 OTA Report found that in analyzing a compilation of research studies the polygraph was able to reduce the error of a chance prediction by 65%. The report also showed correct guilty detection varied from as low as 70% in Bersch (1969) to as high as 98.6% in a study by Wicklander and Hunt (1975) Correct innocent detections varied even more widely between 12.5% (Barland and Raskin 1973) and 94.1% (Bersch 1969). The OTA Report also states false negatives run between 0 and 29.4% (Bersch 1969). The OTA report also found false positives to range between 75% (Barland and Raskin 1973) to 0% in two other studies. These varied results indicate that reliability is a problem when studying the polygraph. The 2002 NRC report charted these studies to show the variation in results collected from polygraph studies. (Appendix A-2) One of the few polygraph screening studies was an analog study conducted by Correa and Adams (1981) and consisted of intentionally having college student be deceptive during a simulated employment screening. They found they were able to detect deception with 75% accuracy.

Discussion

Various reports sanctioned by the polygraph’s largest user, the United States Government have concluded the polygraph, while producing results that exceed chance, are generally not reliable for criminal and pre-employment screening. (OTA 1983, NRC 2002) The research conducted has not been focused on pre-employment screening. The exception to this being the single Correa and Adams (1981) study, however, this study has serious flaws that included the

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6 http://www.polygraph.org/faq
narrow demographics chosen, the students motivation to be deceptive, and the failure by the researchers to state the criteria by which veracity was measured. None withstanding the construction of the study, an error rate of 25% occurred in the study which cast doubt on the ability of the polygraph to achieve precise results.

Given the large range of study results reported on the polygraph, it can be safe to assume that the polygraph’s validity is difficult to measure in a clinical setting. This can readily be attributed to the large variables of the person being examined, the skill and manner of the examiner, and the circumstances surrounding the examination. With regards to the person being examined the 1983 OTA Report and the 2002 NRC Report concluded various factors may influence polygraph results including a person’s intelligence and willingness to use countermeasures. Other factors include a person’s attitude and beliefs about the polygraph machine, ethnicity, and emotional status. The basis for the polygraph’s measurements requires a feeling of guilt or fear which has been shown that individuals with sociopathic tendencies lack.\footnote{http://www.sciencedaily.com/releases/2004/03/040311072248.htm}

There has been no conclusive research into the effects of gender on the polygraph.

The reports also concluded the training and demeanor of the examiner may also affect the results of the polygraph. Kentucky sets forth the requirements to become a polygraph examiner (KRS 329.010) and Ohio uses a certifying body composed of polygraph examiners (OAPE). However, there is little oversight of the industry. Examiner experience has been demonstrated to influence the validity of the test (Horvath and Reid 1971). The 2002 NRC Report also concluded that the method of questioning can also influence validity, including the
number, order, and relevance of questions asked. Even the presence of the machine as a prop has been shown to influence results. It can be debated that the main point of the polygraph is for the examiner to pressure or compel applicants into truthful self-admissions about their personal history, with the machine offering visual evidence of alleged deception. The 2002 NRC Report concluded that there is anecdotal evidence surrounding the polygraph’s ability to act as a deterrent, keeping individuals out of the process to begin with. The report stated the deterrence factor is only valid if the individual believes in the abilities of the machine. There has been no research conducted on this subject, however, a US Army study has shown that the threat of detection by random drug testing has lowered drug use (National Research Council, 1994). The NRC study also noted the ability of the polygraph to elicit confessions. Indeed a research study conducted was able to demonstrate a confession rate of 65% when a person believed they were on a polygraph machine versus 5% when they did not believe they were being polygraphed. (Quigley-Fernandez and Tedeschi, 1978) The polygraph machine was never turned on for the experiment demonstrating the psychological value of the machine as a prop

Legal precedent for the use of the polygraph in court is poor. The polygraph is allowed for use in some state and circuit courts, however, numerous Supreme Court decisions have found the reliability and validity of the polygraph to be insufficient as scientific evidence (Frye vs. The United States, The United States vs. Scheffer). The ACLU also published a brief in 1996 condemning the polygraph as unreliable. Legal precedent for the polygraph’s use in pre-employment is solid in the public sector. The EPPA of 1998 does not apply to governmental

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8 http://www.polygraph.org/faq
agencies and certain defense contractors. The government is generally immune to lawsuits regarding the use of polygraph via the 11th Amendment. It has been the accepted policy of the FBI and other Federal Agencies to reject employment applications based on a refusal to sit for the polygraph.

How individual agencies use the polygraph results also varies. Most municipal governments interviewed for this paper were reluctant to state failing the polygraph would eliminate a candidate from the employment process. Much like FBI and Secret Service, they state that failure to submit to a polygraph could lead to dismissal from the application process. Most stated that polygraph results are reviewed during candidate selection in an application process. The City of Cincinnati’s HR department stated the polygraph is not “pass or fail”, however, the admission of contradictory information then that which was listed on the application will result in expulsion from the hiring process.

The appeals process to contest a polygraph varies depending on if the municipality is a city, township, or what state it is in. The exam itself is expensive if it is outsourced, and if conducted in house it is very time consuming (2-3hrs) for the detectives that administer it. For these reasons, a retest is usually not an option. In a city such as Cincinnati which adheres to civil service law, the appeal would be made to the civil service board. In a township government, the appeal would be made directly to the fire department. In cases of polygraph disputes after an employee begins work, a state labor board may hear the case depending on the state’s policy. Again the right for municipal governments to use the polygraph both before and after hiring has
been well established in the court system. (Appendix A-3) Public employees do not enjoy the same protections their counterparts in the private sector under the EPPA of 1988.

**Conclusion**

With the quantitative results of research into the polygraph being inconsistent at best, it is important not to view the polygraph’s results as reliable scientific data. There are multiple reasons an applicant could fail a polygraph not related to intentional deception, and it is worth noting an intentionally deceptive person can still pass the test using countermeasures. Failure of the polygraph should not be a valid reason to eliminate an individual from a hiring process; however, an explanation of the results from that individual along with a thorough background check is advisable. The polygraph works best when the individual being examined believes the machine is infallible and offers a self-admission of guilt. The coupling of the polygraph with a more scientific screening tool such as the Minnesota Multiphasic Personality Inventory (MMPI) may yield a more thorough employment screening. The polygraph has a strong history in the public sector and has survived numerous legal challenges, (Appendix A-3) resulting in a strong legal precedent that newer technologies such as VSA do not currently enjoy. Above all the ability of the polygraph to possibly deter undesirable candidates and extract self-confessions is what gives it value in a screening process; and why its continued use in the fire department application process is still recommended.
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Recommendations

- The polygraph continues to be an effective screening tool for the fire department hiring process by virtue of its reputation
- The goal of the polygraph should be self-admissions of guilt, it is impossible to truly determine deception without a confession.
- Removal of a good candidate because of a failed polygraph shouldn’t be automatic, and an appeals process should be available

References


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NFPA (2003) *Organizing for Fire and Rescue Services*. Quincy, MA pg 113


The Office of Technology Assessment. (1983) *Scientific validity of polygraph testing a research review and evaluation*. Washington, DC


## Appendix

A-1

Table 1. Polygraph Use in Greater Cincinnati Fire Departments

<table>
<thead>
<tr>
<th>Department</th>
<th>Career Members</th>
<th>Polygraph</th>
</tr>
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<tbody>
<tr>
<td>Cincinnati FD</td>
<td>785</td>
<td>yes</td>
</tr>
<tr>
<td>Springfield TWP FD</td>
<td>30</td>
<td>yes*</td>
</tr>
<tr>
<td>Anderson TWP FD</td>
<td>64</td>
<td>no</td>
</tr>
<tr>
<td>Colerain TWP FD</td>
<td>56</td>
<td>yes*</td>
</tr>
<tr>
<td>Saint Bernard FD</td>
<td>26</td>
<td>yes</td>
</tr>
<tr>
<td>Norwood FD</td>
<td>46</td>
<td>yes*</td>
</tr>
<tr>
<td>Covington FD</td>
<td>117</td>
<td>yes</td>
</tr>
<tr>
<td>Newport FD</td>
<td>37</td>
<td>no</td>
</tr>
<tr>
<td>Mason FD</td>
<td>23</td>
<td>yes</td>
</tr>
<tr>
<td>Fort Thomas FD</td>
<td>19</td>
<td>yes</td>
</tr>
<tr>
<td>Delhi FD</td>
<td>18</td>
<td>no</td>
</tr>
<tr>
<td>Green TWP FD</td>
<td>33</td>
<td>no</td>
</tr>
<tr>
<td>West Chester FD</td>
<td>40</td>
<td>yes</td>
</tr>
<tr>
<td><strong>Total Career FF</strong></td>
<td><strong>1294</strong></td>
<td></td>
</tr>
<tr>
<td>Total given the polygraph</td>
<td><strong>1142</strong></td>
<td>88.25%</td>
</tr>
<tr>
<td>Total no polygraph</td>
<td><strong>152</strong></td>
<td>11.75%</td>
</tr>
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* = VSA in lieu of polygraph
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*graphs obtained from 2002 NRC study

* authors note: diagonal line is the probability of chance
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A - 3 POLYGRAPH: CASES UPHOLDING MANDATORY USE

Information obtained from: http://www.aele.org/law/Digests/empl157.html

Federal appeals panel sustains the demotion of a police lieutenant who refused to submit to a polygraph examination as part of an internal investigation. The panel rejected her First Amendment objections to the test. "It is clear in this case that the plaintiff’s ‘speech’ was of no public concern whatever and, therefore, is not protected by the First Amendment."

Luty v. City of Saginaw, #07-2035, 2009 U.S. App. Lexis 2674 (Unpub. 6th Cir.).

Appellate court dismisses the appeal of a police applicant that was rejected because his polygraph examination indicated deception concerning his involvement with illegal drugs and narcotics. Management did not act irrationally or arbitrarily in relying on the results of their own polygraph test as well as a secondary review conducted by the Vermont state police. Mullen v. County of Suffolk, #2006-03220, 2007 N.Y. App. Div. Lexis 9671 (3rd Dept.).

Town did not violate state polygraph statute by requiring police officer, accused of sexually molesting two minors, to submit to test to determine whether he should be disciplined after he was granted immunity from prosecution. Furtado v. Town of Plymouth, #06-P-892, 69 Mass. App. Ct. 319, 867 N.E.2d 801, 2007 Mass. App. Lexis 663, 26 IER Cases (BNA) 401.

Appellate court in Missouri refuses to overturn an officer's termination for excessive force and lying because the Police Board considered testimony that he had failed a polygraph examination. There was sufficient other evidence to believe the charges. Kendrick v. Bd. of Police Cmsrs. of K.C. Mo., 945 S.W.2d 649, 1997 Mo.App. Lexis 948. [1998 FP 91-2]

Wisconsin's Fair Employment Act has been amended to allow a state law enforcement agency to administer the test to prospective employees, effective 5/16/97. FEP Manual (BNA) 458:8661 {N/R}
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Use of the device was job-related because it "allowed the city to make a more informed choice about its hiring decisions; there was uncontradicted testimony at trial the polygraph "intimidated many applicants to reveal further information about their background." Tye v. City of Cincinnati, 794 F.Supp. 824 (S.D. Ohio 1992). [1993 FP 27-8]


Ohio Supreme Court upholds the right of a police chief to order subordinates to take a polygraph examination when they are under suspicion of misconduct. It is unnecessary for the department to have a rule requiring such exams. City of Warrensville Heights v. Jennings, Ohio St 3d 206, 569 N.E.2d 489 (Ohio 1991).

U.S. Labor Department has proposed to fine and employer a record $315,000 for violations of the 1988 Employee Polygraph Protection Act. U.S. Dept. of Labor Wage & Hour Div. v. WH of KC, Inc., Employee could not sue polygraph examiners who "negligently" interpreted his lie detector test results, which were furnished to his employer. Hall v. United Parcel Service, 544 N.Y.S.2d 250 (A.D. 1989).


Federal appeals court rules that use of polygraph test in pre-employment screening did not violate the equal protection clause or violate an applicant's substantive due process rights. Anderson v. City of Philadelphia, 845 F.2d 1216 (3rd Cir. 1988).

City jail officer who "transferred" to county payroll had to take a polygraph exam required of new employees. Stone v. Chelan Co. Sheriff's Dept., 110 Wash.2d 806, 756 P.2d 736 (Wash. 1988).

Federal EEOC concludes that polygraph tests are non-biased; finds no race, sex, age or national origin bias. EEOC Notice N-915 (2/2/87).

Federal Appeals Court upholds exam and control questions asked firefighters in drug investigation. Hester v. Milledgeville, 777 F.2d 1492 (11th Cir. 1985).

Police dept. can require applicants to take polygraph as part of the screening process. Porto v. Town of Harrison, 474 N.Y.S.2d (A.D. 1984).
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Federal appeals court upholds termination of public employees who refused to take a polygraph test. Gulden v. McCorkle, 680 F.2d 1070 (5th Cir. 1982). [83 FP#101 12]


Accused public employee must reply as to whether he has taken a polygraph examination; refusal to answer is insubordination. Nieukirk v. Board of Fire & Police Cmsnrs. of Peoria, 423 N.E.2d 1259 (Ill.App. 1981).

Missouri appellate court sustains termination of officer who refused polygraph; results inadmissible however. Sorbello v. City of Maplewood, 610 S.W.2d 375 (Mo.App. 1980).


Cincinnati Firefighters Investigated for YouTube Videos

Cincinnati Firefighter Among Group Charged In Marijuana Ring

Posted: 12-21-2007

Cincinnati Firefighter Involved In Standoff with SWAT Team

Reported by: Jennifer Moore
Email: Jennifer.Moore@wcpo.com
Last Update: 2/28 7:11 pm