Credibility Assessment for Public Safety Background Screening

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Introduction

Most Public Safety agencies in the United States conduct background investigations on their applicants. Polygraph and Computerized Voice Stress Analyzers are commonly used as part of the investigative process to determine if applicants have lied about prior drug use, serious crimes, and/or disciplinary actions at another agency.

This paper describes a new, scientifically proven technology that detects deception with greater consistency and reliability because it is completely computer administered and scored. No wires or cables touch the body, and no human bias or errors are possible because no examiners are in the room with the examinee.

The Scientific Discovery

Scientists have known for decades that deception takes more mental effort than telling the truth.[1] Deceptive individuals use more mental resources to fabricate lies, remember the specifics of their lies, and portray to others that their lies are believable. Deceptive individuals also try to control their emotions; they do not want to "leak" any facts or information that could cause their deception to be discovered[2].

Scientists refer to this mental effort as cognitive load. This document discusses the scientific discovery of how cognitive load and its correlation to certain eye behaviors can be measured and analyzed to improve the ability to detect deception. This discovery enhances the science of deception detection.

In the spring of 2002, Drs. John Kircher and Doug Hacker, scientists at the University of Utah, were hiking at Mt. Rainer with Don Krapohl. Don was the top polygraph program director for the CIA and eventually became the Deputy Director of the National Center for Credibility Assessment (or NCCA).

Dr. Kircher is one of the world's leading experts in credibility assessment. In 1991, he and colleague Dr. David Raskin invented the first computerized polygraph. Dr. Kircher has also published more than 50 scientific articles on credibility assessment and consulted with / conducted research for the U.S. Department of Defense, National Science Foundation, CIA, U.S. Secret Service, National Institute of Justice, Department of Homeland Security, National Science Foundation, National Research Council, Royal Canadian Mounted Police, as well as other organizations.

Left to right: Dr. Kircher, Don Kraphol and Dr. Hacker at Mt. Rainier, circa spring 2002.

While hiking, Dr. Hacker mentioned the adage, "The eyes are the windows to the soul." Dr. Kircher suggested that it would be interesting to conduct core research to determine if there were markers in the eyes of deception. He proposed a research concept to the CIA and was given a grant to buy the latest eye-tracking hardware to conduct a study.

[1] Johnson, Barnhardt, & Zhu, 2005; Kircher, 1981; Vrij, Fisher, Mann, & Leal, 2000.
[2] Kircher, 1981

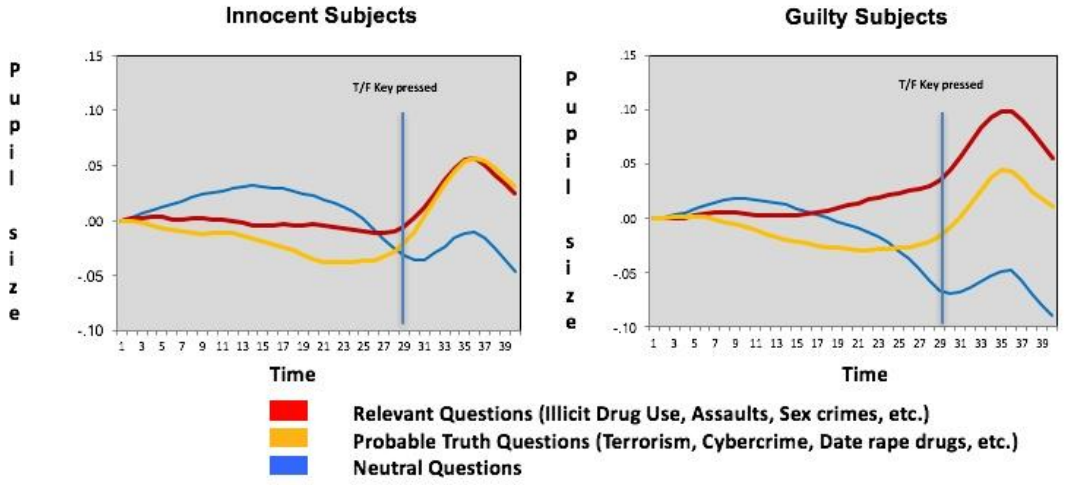
Drs. Kircher and Hacker purchased the best eye trackers available at the time:

Applied Sciences Laboratory Tracker

Arrington Research Tracker

They began with a "mock crime" laboratory experiment on campus. One hundred study participants were instructed to steal a $20 bill from a department secretary's purse when she turned her back and another 100 participants, as part of a control group, did not steal any money. The scientists offered an extra $20 to those that had stolen money from the purse if they could avoid detection by the eye tracker.

Drs. Kircher and Hacker discovered that when questioned about the theft, guilty participants showed an increase in pupil dilation and innocent participants did not. They repeated the experiment multiple times and saw the same patterns in the data. Dilation of approximately 1/10th of a millimeter occurred in guilty subjects a few milliseconds prior to telling a lie and it persisted for 3-4 seconds afterwards. (See below.)



The image on the left, labelled "Innocent Subjects" shows the pupil dilation pattern of 100 truthful people. The red line (relevant questions) and yellow line (probable truth questions) are similar, which implies that there is no additional pupil dilation for relevant questions.

The image on the right, labelled "Guilty Subjects," shows the pupil dilation pattern of 100 deceptive subjects. The difference in red and yellow lies indicates more pupil dilation for relevant questions than probable truth questions. In an actual test, the gap between the yellow line and red line is measured and analyzed by the decision model and a "credibility score" between 1 and 99 is given. A score of 1 is the least credible and a score of 99 is the most credible.

Kircher and Hacker knew they were witnessing a scientific breakthrough and asked other scientists to help with the research. Drs. David Raskin, Dan Woltz and Ann Cooke soon joined the research team. Since that time, this core group of five scientists have worked to perfect the science. They have researched ocular-motor deception testing since 2003 (more than 14 years at the time of this document).

Scientific Validation

As the research advanced, pupil dilation remained the leading indicator of deception. But at the same time, other useful eye behaviors were discovered to be diagnostic. The scientists observed that deceptive individuals blink less often, respond faster, make fewer eye fixations, and spend less time reading and re-reading statements about activities in which they have engaged—but lied about.

In 2012, the peer-reviewed article "Lyin' Eyes: Ocular-motor Measures of Reading Reveal Deception"[3] was published in the *Journal of Experimental Psychology: Applied* with the initial findings of the science team. Since that time, the science team has conducted additional research to determine if the same eye behaviors are consistent among test subjects in other languages and cultures. Lab and field studies have been conducted in Mexico and the Middle East recently. The Mexico study, "Generalizability of an ocular-motor test for deception to a Mexican population," was published in January 2016 in the *International Journal of Applied Psychology*. A lab study conducted in the Middle East (Arabic) and a field study conducted in Mexico (Spanish) will soon be published.

Other Studies

Additional lab and field studies have been conducted (see summary data below.) For a single-issue specific crime in which ground truth is verifiable by other means, the accuracy for guilty individuals (true positives) averaged 82.9%, and the accuracy for innocent individuals (true negatives) averaged 89.3%.[4] The mean accuracy was 86.1%.

Experiment	Factors	N	n_G	n_I	Guilty	Innocent	Mean	$Validation_G$	$Validation_I$	Mean
Osher 2	Issues; serial format	40	20	20	85	85	85.0	85	70	77.5
Webb	Sex; motivation; difficulty	112	56	56	82.1	89.2	85.7	89.3	80.4	84.9
Patnaik 1	Direct interrogation	48	24	24	83.3	95.8	89.6	83.3	83.3	83.3
Monterrey	Language; culture	145	82	63	84.1	87.3	85.7	81.9	87.5	84.7
Patnaik 3	Distributed; pretest feedback; post-response interval	80	40	40	82.5	90	86.3	80	90	85.0
Middle East 1	Language; culture	112	51	61	80.4	88.5	84.5			
Middle East 2	Language; culture	101	52	49				75	85.7	80.4
Standard Protocol	weighted by n		325.0	313.0	**82.8**	**89.0**	**85.9**	82.1	81.7	81.9
Standard Protocol	unweighted				**82.9**	**89.3**	**86.1**	82.4	82.8	82.6

EyeDetect tests are consistent due to the standardization and automation. EyeDetect eliminates the "human factors" of bias, temperament, and training which decrease the accuracy of alternative credibility assessment tests which are administered by a human examiner.

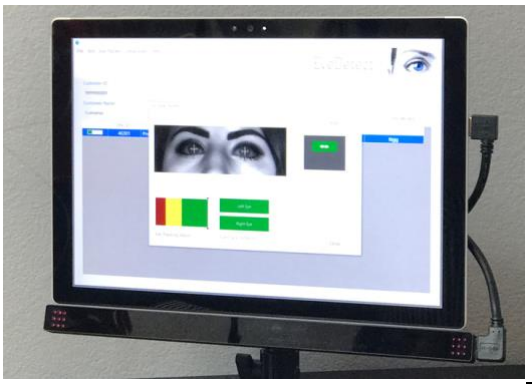
[3] "Lyin' Eyes: Ocular-motor Measure of Reading Reveal Deception," Journal of Experimental Psychology: Applied, 18(3), 301-313, 2012.
[4] Cook et al., 2012; Patnaik, 2013.

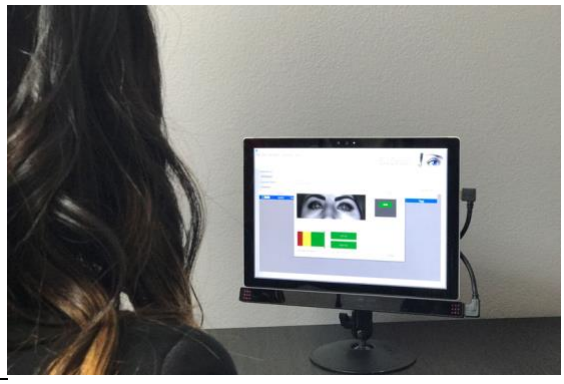
Converus

Alta Ventures, a venture capital fund located in Salt Lake City, Utah, formed a company to bring this technology to the market. The company, later to be known as Converus, acquired the technology from the University and signed agreements with the scientists to continue their research and development.

Alta Ventures also hired an experienced executive team for Converus to commercialize the science, now branded as EyeDetect®. Converus investors now include three venture capital funds, company executives, scientists, and other notable technology investors (Mark Cuban). Converus is the first venture-backed technology supplier to enter the credibility assessment market.

EyeDetect Hardware





EyeDetect is a hardware and software solution. The hardware is an Intel NUC7i5BNK mini-PC with Windows 10. A high-definition, infrared eye-tracking camera is mounted along the bottom of the monitor. This eye tracker takes 60 measurements per second of each eye with measurements as small as 1/100 of a millimeter.

EyeDetect Software

The software for administering tests, monitoring examinees, scoring and viewing test results includes:

1) **EyeDetect Software** – allows tests to be downloaded from the cloud to be administered on the tablet; it also uploads the test data to a cloud-based server.
2) **EyeDetect Manager** – allow the test proctor to observe examinees remotely; it runs on any Windows computer that is on the same Wi-Fi network with the tablet.
3) **EyeDetect Dashboard** - a web portal providing access to test results and reports that reside on cloud-based servers; test reports can be viewed from any web browser.
4) **EyeDetect Administrator** – allows one tablet to be configured for a variety of organizations or agencies, to keep test results separated and confidential.

Tests are created by Converus and are downloaded via the Internet onto the tablet. Examinees read true/false statements onscreen and respond to True/False questions by pressing mouse buttons (left/green is true and right/red is false).

Currently, there are over 700 unique tests in 13 different languages in the Converus test library. Tests are localized for different countries to ensure that test topics are well understood and local language is used. For example, tests in Spanish have been localized for Mexico, Colombia, Panama, El Salvador, Guatemala, Peru and the Dominican Republic.

Tests cover a wide variety of topics, including drug use, serious crimes (including sex crimes), theft, bribery, divulging confidential information, ties to gangs/cartels, espionage, terrorism, and hiding prior disciplinary actions. Tests are completed in about 30 minutes. EyeDetect tests begin with a pre-test explanation of topics using an audio-visual presentation on the screen. Afterwards, two short practice sessions are given to familiarize the examinee with the testing process. Finally, the test is administered.

The examinee responds to 318 statements per test. If an examinee doesn't answer quickly enough, the statement will "time out." This is part of the science; it is more difficult to lie under rapid questioning. Once the test is completed, the eye tracker data is uploaded to a secure web server and a Converus Credibility Score (between 1 and 99) is calculated within 5 minutes.

Test reports are available in PDF or HTML format, and a "Guidance Category" is given for each examinee. The most common guidance categories are "Credible" (Truthful) and "Not Credible" (Deceptive). There are no inconclusive EyeDetect tests. The subject is identified as truthful or deceptive, with no gray areas. The software includes a pop-up window to record confessions and admissions at the end of the test.

Testing Process

Public Safety agencies can easily administer EyeDetect tests in-office in 30 minutes. Test results are available within 5 minutes after the test concludes. Applicants that fail should be encouraged to disclose information that might explain a low Converus credibility score. Any admissions or confessions are captured, notarized, scanned and attached to an applicant's electronic record.

Countermeasures

Countermeasures are actions taken by examinees to counteract testing procedures. Websites like polygraph.com that teach people how to beat a polygraph are common, as are YouTube videos that have millions of views.

EyeDetect has been tested by Dr. Charles Hontz, a researcher at Boise State University. Dr. Hontz is a leading expert on polygraph countermeasures, and with his help Converus has developed the following countermeasure detection tools:

1) To determine if an examinee is using drugs or eye dilation drops, EyeDetect administers a 45-second "light test" to ensure that the examinees' pupils are reacting normally when the screen goes from light to dark. The pupils should dilate normally when light is removed.
2) Examinees may close their eyes or squint when responding to questions. This is easy to detect because EyeDetect software tracks data loss, which directly corresponds to these conditions.
3) Some examinees answer all questions the same way (true or false), fail to answer questions, or answer randomly to avoid thinking about responses. EyeDetect alerts the test proctor when an examinee is using these countermeasures and delivers guidance categories such as: (1) Indeterminate, (2) Insufficient Data from Eye Scanner, (3) Not Credible/Too Many Timeouts or (4) Not Credible/Random Responses or Low Comprehension.

Dr. Charles Honts also stated:

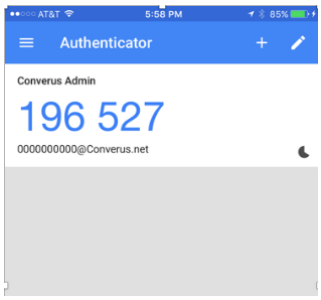
> "The countermeasures that are used to beat a polygraph invoke autonomic responses over a relatively long period (20 seconds). Simply put, polygraph can be beaten because the examinee has enough time for the countermeasures to work. Unlike Polygraph, EyeDetect test questions are

delivered rapid fire (every 3-4 seconds), so examinees must pay close attention and stay mentally involved to answer the questions correctly. Also, the response mechanisms in the pupil are faster than the systems measured by the polygraph. The rapid response of the pupil makes it very difficult to mask a deceptive response to a question.

Countermeasure designed to produce responses to control questions would take longer to evoke pupillary changes than the innate response to questions being answered deceptively. Moreover, the rapid questioning in an EyeDetect examination would make it extremely difficult for an examinee to attempt a countermeasure designed to produce a pupillary response and still maintain accurate responses the in test. For these reason, I do not currently see any immediate active countermeasure threats to EyeDetect."[5]

Security

The EyeDetect tablet uses Microsoft BitLocker to encrypt test responses and eye measurements stored temporarily on the tablet. Once the test data is synchronized with the Converus data center, it is deleted from the BitLocker drive.



Access to test reports online requires a two-step (two-level encryption) login process from any web browser. After a person provides their user name and password, a unique 6-digit number is required. This unique number is created by a mobile app such as Google Authenticator on a smartphone (right). Only authorized users can access the test results on the Converus dashboard.

Converus web servers store and process eye measurements and test responses collected during testing. Access to these servers is controlled by a firewall and incoming web traffic is monitored for threats. All servers are housed in a private, locked rack in a certified data center. Access to the data center is controlled by key card and biometric scanners and is monitored 24/7.

Some EyeDetect customers may not want personal information uploaded to Converus' web servers. In those cases, you may assign a unique number to each examinee to remove all personally identifiable information. Only the test responses and eye measurements would be uploaded.

Training

With EyeDetect, the Microsoft Surface Pro tablet is the test administrator and examiner. Extensive training is not required to administer a test. Converus offers the following two training courses via YouTube, free of charge:

1. **Test Proctor training – (79 minutes)** Instructs how to set up the EyeDetect Station, calibrate the eye tracker, start a test, and upload test data. Also includes how to setup and use EyeDetect Manager for monitoring examinees. If desired, there is a Test Proctor certification exam. Upon successful completion of that test, the proctor is awarded a certificate from Converus.

2. **Dashboard Administrator training – (71 minutes)** Instruction on how to access test results from the Dashboard. Administrators also learn how to add users and manage test licenses.

[5] Email correspondence between Dr. Honts and Converus on January 12, 2017.

EyeDetect Test Library. EyeDetect tests cover a wide variety of illegal activities, including:

- Theft
- Drug use
- Divulging confidential information
- Ties to gangs or organized crime
- Bribery
- Document fraud
- Drug trafficking
- Other fraud (financial)
- Money laundering
- Sex-based crimes
- Corporate espionage
- Fuel theft
- Counterfeiting money
- Cyber crimes
- Identity theft
- Terrorism
- Document fraud
- Violent crimes
- Sexual abuse
- Athlete doping
- Unauthorized financial transactions
- Use of date rape drugs
- Parole violations
- Theft of car parts
- Sports event fixing

Public Safety Screening Applications

Pre-employment screening tests for illegal drug use, serious crimes and work-related disciplinary actions are common at U.S. public safety agencies. In fact, public safety credibility assessment screenings are often mandated by state laws and local administrative codes.

EyeDetect tests can be administered 1 hour after a physical fitness test. This allows agencies to complete many screening tests in one day and eliminate the need to wait days or weeks for the results of a polygraph test. Applicants that pass and EyeDetect test can be given a conditional offer while additional background investigative work continues. Nationally, law enforcement agencies find disqualifying behaviors in 30 – 35% (on average) of their applicants.

Unlike a single-issue specific crime test, it is impossible to verify the accuracy of a public safety screening test with scientific certainty because ground truth is not available on multi-issue screening tests. The accuracy rates quoted in this document are for single-issue specific crime tests where ground truth is available, and cannot be extrapolated to multi-issue screening tests. Polygraph and CVSA screening tests share this limitation –accuracy rates cannot be validated with scientific certainty due to the inability to know ground truth on all the target behaviors being explored.

EyeDetect's major advantage over other screening tests is to improve the diagnostic value by eliminating the human bias and errors by removing the examiner from the process. Applicants or employees that fail EyeDetect tests often self-select out of the recruitment process or make spontaneous confessions and admissions when advised of their test results.

However, candidates should not be rejected solely on the results of an EyeDetect test. If no admissions or confessions are made and a candidate insists they are being truthful, they should be referred to background investigators to verify the disqualifying activities through traditional techniques.

Because EyeDetect is a low-cost, quick test, it is typically administered early in the recruitment process. One EyeDetect test proctor can perform up to 10 EyeDetect tests per day. EyeDetect maximizes the efficiency of the screening process by allowing background investigators to do more in less time at a significantly lower cost.

EyeDetect Limitations

To take an EyeDetect test, the examinee must read at least at a 7th grade reading level. Also, there are certain eye diseases or conditions that may impact an EyeDetect test:

Eye Diseases	EyeDetect is OK	Potential Problems w/ EyeDetect	Notes
• Amblyopia		Yes	
• Astigmatism	Yes		OK with glasses
• Blepharitis		Yes	
• Blepharospasm		Yes	
• Cataracts		Yes	
• Allergic conjunctivitis		Yes	
• Color blindness	Yes		
• Macular degeneration		Yes	
• Entropion and Ectorpion		Yes	
• Strabismus		Yes	
• Glaucoma		Yes	
• Hyperopia	Yes		OK with glasses
• Lagophthalmos	Yes		
• Tearing	Yes		
• Myopia	Yes		
• Dry eye	Yes		
• Presbyopia or tired eye	Yes		OK with glasses
• Eyelid ptosis		Yes	
• Keratitis		Yes	
• Keratoconus	Yes		OK with glasses
• Diabetic retinopathy		Yes	
• Hypertensive retinopathy		Yes	

Summary

EyeDetect is a new and useful credibility assessment tool that can quickly, noninvasively, and cost-effectively verify credibility. Converus continues to improve the EyeDetect decision model (algorithm) as more tests are administered and analyzed with ground truth data. Computer algorithms learn as they ingest additional data sets, therefore Converus hopes to improve the accuracy rates on single-issue specific crime tests when ground truth is verifiable by other means.

EyeDetect, when used in conjunction with other background investigation techniques, is a useful tool to verify the truthfulness of applicants whose backgrounds are qualified for serving in public safety positions.

Additional References

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