



Credibility Assessment for Public Safety Agencies



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Introduction

Public Safety agencies in the United States routinely administer credibility assessment tests to job applicants and suspected criminals. For job applicants, credibility assessment tests investigate areas of interest such as past drug use, serious crimes, and disciplinary actions at a prior employment. These past acts may be considered “disqualifiers” and may be withheld from a potential employer. For suspected criminals, credibility assessment tests are administered to determine if a suspect is being truthful or deceptive about their involvement or knowledge of a specific crime.

This paper describes a scientific discovery that led to a new credibility assessment technology called the Ocular-Motor Deception Test (ODT). The ODT is a non-interview test that is fully automated, computerized and scored. No wires or cables touch the body. Examiner bias and errors are eliminated because there are no examiners present during a test and the test is scored using a computer algorithm.

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 to avoid discovery². Scientists refer to this mental effort as “cognitive load”. Cognitive load (and its correlation to certain eye behaviors) can be measured and analyzed to improve the ability to detect deception.

In early 2002, University of Utah researchers Drs. John Kircher and Doug Hacker met with Don Krapohl. At the time, Don was a credibility assessment researcher and polygraph program director for the U.S. Central Intelligence Agency and eventually became the Deputy Director of the U.S. National Center for Credibility Assessment (NCCA).

Dr. Kircher is one of the world’s leading experts in credibility assessment. He has published more than 50 scientific articles on the topic and consulted with the National Science Foundation, the CIA, the U.S. Secret Service, the National Institute of Justice, the U.S. Department of Homeland Security, the National Science Foundation, the National Research Council, the Royal Canadian Mounted Police, and many other organizations.

In the meeting with Don, Dr. Hacker mentioned the adage, “The eyes are the windows to the soul.” Dr. Kircher suggested that it would be interesting to conduct basic research to determine if there were measurable markers in the eyes during deception. He proposed a research concept to the CIA and they gave him a grant to buy the latest eye-tracking hardware to conduct a study (shown below).

Applied Sciences Laboratory



Arrington Research

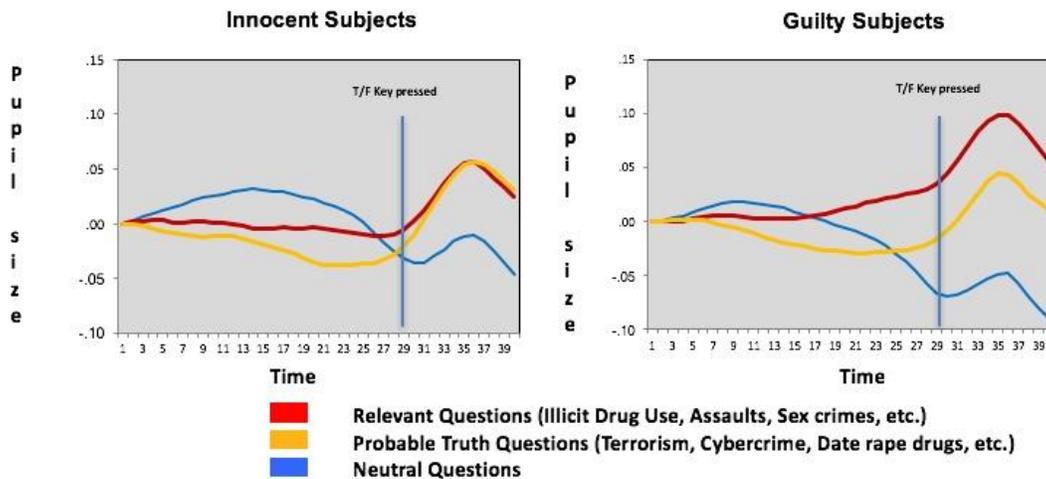


¹ Johnson, Barnhardt, & Zhu, 2005; Kircher, 1981; Vrij, Fisher, Mann, & Leal, 2000.

² Kircher, 1981

The University of Utah researchers began with lab experiments on campus using a “mock crime.” One-hundred study participants were instructed to steal \$20 from a department secretary’s purse when she turned her back. Another 100 participants were tested as part of a control group and did not steal any money. The scientists offered a \$20 bonus to participants involved in the theft of \$20 if they could pass the ocular-motor deception test appearing as “innocent.” The data for these tests was gathered by eye tracker.

In the studies, the guilty participants showed a relative increase in pupil dilation when answering questions about the theft. The innocent participants did not show marked changes. Dilation of approximately 1/10th of a millimeter occurred in the guilty subjects and it persisted for 3-4 seconds afterwards. (See below.)



The image on the left labelled “Innocent Subjects” shows the pupil dilation pattern of truthful people. The red line (relevant questions) and yellow line (probable truth questions) are similar, which means their eyes did not dilate differently on the relevant question (i.e., Did you steal the money?)

The image on the right, labelled “Guilty Subjects,” shows the pupil dilation pattern of deceptive subjects. The red line indicates more dilation for relevant questions than probable truth questions. This gap between the yellow line and red line is measured and analyzed by a computer algorithm and a “credibility score” is given.

Kircher and Hacker realized these results were a scientific breakthrough and asked other scientists to assist 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 improve the computer algorithm as they have conducted additional lab and field studies.

Scientific Validation

Pupil dilation is a leading indicator of deception. But other eye behaviors are also diagnostic. Deceptive individuals blink less often, respond faster and make fewer eye fixations. In 2012, the peer-reviewed article “Lyn’ 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 team has



³ “Lyn’ Eyes: Ocular-motor Measure of Reading Reveal Deception,” *Journal of Experimental Psychology: Applied*, 18(3), 301-313, 2012.

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 Latin America and the Middle East.

In 2016, Kircher conducted field studies with the support and assistance of three groups in the Mexican federal government and published new data that showed the mean accuracy of ODT to be 86% for screening tests using the Relevant-Comparison Test (RCT) protocol. The data was published in December 2016 in “Laboratory and Field Research on the Ocular-motor Deception Test” in the European Polygraph Journal.

In 2018, Kircher and Raskin reviewed field data on a small sample of tests using the Directed Lie protocol, which is primarily used for diagnostic or single-issue testing. That data showed the mean accuracy of that protocol to be over 90%. More data will be gathered prior to any publication.

EyeDetect tests are consistent due to the standardization and automation. EyeDetect eliminates many potential “human factors” such as bias, temperament, and competence, which can decrease the accuracy of human administered credibility assessment tests.

Converus

Alta Ventures, a venture capital fund in Salt Lake City, Utah, formed a company to bring this technology to market. The company, now called Converus, acquired the rights to ODT from the University of Utah 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. After years of product development, ODT science was released as EyeDetect® in 2014. Converus investors now include three venture capital funds, company executives, scientists, and other well-known technology investors. Converus is the first venture-backed technology supplier to deliver new tools to the credibility assessment market.

EyeDetect Hardware

EyeDetect is a hardware and software solution. The hardware is an Intel NUC mini-PC with Microsoft Windows 10. A high-definition, infrared eye-tracking camera is mounted on the bottom of the monitor and 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 and it uploads 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 individual test 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 2,000 unique tests in 30 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, hiding prior disciplinary actions, and many other issues. Tests are completed in 15 to 30 minutes. EyeDetect tests begin with an automated 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 approximately 300 questions per test. If an examinee doesn't answer quickly enough, the statement will "time out." This is part of the science, as it is more difficult to lie under rapid questioning. Once the test is completed, the eye tracker and other data is uploaded to a secure web server and a Converus Credibility Score is calculated in less than 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 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 screening tests in 30 minutes and diagnostic tests in 15 minutes. Test results are available in less than 5 minutes after the test concludes. Applicants or suspects that fail should be encouraged to disclose information that might explain the Not-Credible score. Credible applicants or suspects can be forwarded to the next phase of testing or interviews to validate the EyeDetect results. Any admissions or confessions can be captured, notarized, scanned and attached to an applicant's electronic record.

Countermeasures

Countermeasures are actions taken by examinees or suspects to counteract testing procedures. There are Web sites and YouTube videos that teach people how to defeat credibility assessment tests. To identify and interrupt countermeasures, Converus has supplied EyeDetect and contracted with Dr. Charles Honts, a researcher at Boise State University. Dr. Honts is a leading expert on 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: (a) Indeterminate, (b) Insufficient Data from Eye Scanner, (c) Not Credible/Too Many Timeouts or (d) Not Credible/Random Responses or Low Comprehension.

Also, Dr. Honts stated:

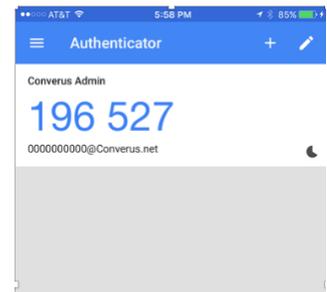
“The countermeasures that are used to beat other credibility assessment tools invoke autonomic responses over a relatively long period. Simply put, tests can be beaten because the examinee has enough time for the countermeasures to work. EyeDetect test questions are delivered rapid fire (every 3-4 seconds), 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 other credibility assessment tools. 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.”⁴

Security

EyeDetect hardware uses Microsoft BitLocker to encrypt test responses and eye measurements stored temporarily on the computer. 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 (see image). 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.

⁴ Email correspondence between Dr. Honts and Converus on January 12, 2017.

Training

With EyeDetect, the computer is the test administrator and examiner. Extensive training is not required to administer a test. Converus offers the following two, free training courses on YouTube. Also upon successful completion of a test, a certification is awarded.

1. **Test Proctor training – (45 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.
2. **Dashboard Administrator training – (45 minutes)** Instruction on how to access test results from the Dashboard. Administrators also learn how to add users and manage test licenses.

Public Safety and Law Enforcement Applications

Agencies can complete up to 14 screening tests in one day with one EyeDetect Station. One test proctor can manage up to 3 stations. This puts the testing capacity at about 40 tests per day, per test proctor.

Applicants that pass an EyeDetect test can be moved on in the hiring process while additional background investigative work continues. Nationally, law enforcement agencies find disqualifying behaviors in +/- 35% of job applicants. Using EyeDetect early in the process helps identify disqualified applicants. This process saves time and effort by focusing investigative resources on candidates who are likely more qualified.

Unlike a single-issue specific 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. Alternative credibility assessment screening tests share this same limitation. Accuracy rates cannot be validated due to the impossibility of verifying ground truth for all the target behaviors being explored.

EyeDetect's major advantage over alternative credibility assessment tests is the consistent diagnostic value when human bias and errors are removed. As with other credibility assessment tools, applicants or suspects that fail EyeDetect tests often make spontaneous confessions and admissions when advised of their test results.

Job applicants should never be rejected solely on the results of an EyeDetect test, or any credibility assessment test for that matter. 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 and other investigative means.

Because EyeDetect is a low-cost, quick test, it is typically administered early in the recruitment process. EyeDetect maximizes the efficiency of the screening process by allowing background investigators to do more, in less time, at a significantly lower cost.

Examinee Suitability for EyeDetect Testing

The following are basic guidelines to indicate the characteristics of suitable examinees.

- 1) As with any other psychophysiological test, examinees should get a good night's rest and have a meal prior to testing.
- 2) Functional maturity as it relates to reading and comprehension skills are considered more important than age. Examinees must be able to read and comprehend standard test questions. Note: Examinees with reasonable reading skills as young as 11 years old have been successfully tested.
- 3) Examinees must be able to see well enough to read a computer monitor unassisted or with single magnification glasses, including readers. Bifocal and trifocal lenses should not be used as they may cause a mismeasurement of pupil size by the eye tracker. We also recommend that progressive lenses be avoided, if possible, to reduce the likelihood of misreading.
- 4) Examinees observed to be impaired by alcohol or drugs should be asked to return at a later date for testing.
- 5) Examinees that have used eye drops such as tropicamide, an antimuscarinic drug that produces short-acting pupil dilation, should be asked to return at a later date for testing. If such examinees are tested, the eye tracker and algorithm will more than likely determine their pupils are reacting atypically and will be given a failing EyeDetect test score for use of a countermeasure.
- 6) Examinees with excessively dry eyes related to the use of antihistamines, age, or other eye conditions may be difficult to test due to calibration issues with the eye tracker. However, lubricating eye drops have been shown to resolve the issue sufficiently for testing. As long as the EyeDetect software calibrates to the eyes during the process, testing may proceed.
- 7) Examinees wearing excessive mascara, eye liner, or false eyelashes may be difficult to calibrate with the eye tracker. However, removal of such make-up usually resolves the issue.
- 8) EyeDetect does not measure heart rate, respiration, blood pressure, or skin conductance and conditions that affect those physiological measures do not generally impact EyeDetect test results.

As a matter of information, the following conditions should not negatively impact examinee suitability as long as the condition does not have a significant or dramatic impact on examinee mental acuity or physical functionality.

- 1) Attention Deficit Disorder (ADD)
- 2) Post-traumatic Stress Disorder (PTSD)
- 3) High functioning autism or Asperger's Syndrome
- 4) Mild atrial or ventricular arrhythmia or premature ventricular contraction (PVC)
- 5) Asthma or other breathing disorder
- 6) Hyperhidrosis (excessive sweating)
- 7) Mild anxiety
- 8) Pregnancy
- 9) Typical use of medications such as antidepressants
- 10) Examinees as young as 11 years old have been successfully tested

The following eye or vision-related conditions may impact testing. The table below indicates the condition and possible impact, as well as potential remedies (see “Notes.”)

Condition	EyeDetect is OK	Potential Problem	Notes
• Amblyopia		Yes	
• Astigmatism	Yes		OK with glasses
• Blepharitis		Yes	
• Blepharospasm		Yes	
• Cataracts	Possible		Depends on severity
• Allergic conjunctivitis		Yes	
• Color blindness	Yes		
• Macular degeneration		Yes	
• Entropion and Ectropion		Yes	
• Strabismus		Yes	
• Glaucoma		Yes	
• Hyperopia	Yes		OK with glasses
• Lagophthalmos	Yes		
• Tearing	Yes		
• Myopia	Yes		
• Dry eye	Yes		Use lubricating drops
• Presbyopia or tired eye	Yes		OK with glasses
• Eyelid ptosis		Yes	
• Keratitis		Yes	
• Keratoconus	Yes		OK with glasses
• Diabetic retinopathy		Yes	
• Hypertensive retinopathy		Yes	
• Sjogren's syndrome	Yes		

Summary

EyeDetect is a valuable credibility assessment tool to quickly, noninvasively, and cost-effectively screen applicants or suspects for past “bad acts” or specific crimes. Converus continues to improve EyeDetect as more tests are administered and analyzed with ground truth data (computer algorithms learn as they analyze more data).

EyeDetect can help weed out applicants that have disqualifying behaviors in their past, and verify deception by criminal suspects. Law enforcement can eliminate unqualified applicants early in the process so background investigative resources are used more efficiently. Detectives can focus their investigations on suspects that EyeDetect identifies as deceptive.

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