EyeDetect Peer-Reviewed Research

MARK Handler

mhandler@converus.com

Copyright © Converus Inc. 2022

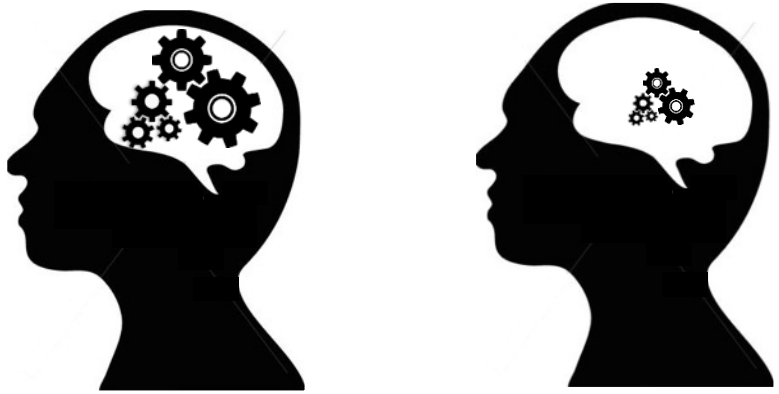
Test Formats

Format	Purpose	Issues	Questions per Issue	Duration (minutes)
Relevant Comparison Test (RCT)	Screening	2	80	35
Multiple-Issue Comparison Test (MCT)	Screening	3-4	60	30
Audio Multiple-Issue Comparison Test (AMCT)	Screening	3-4	40	30
Directed Lie Comparison (DLC) Test 2.0	Investigation	1	9	20
Hybrid Multiple-Issue Comparison Test (HMCT)	Screening	3-4	32	50
Hybrid Directed Lie Test (HDLC)	Investigation	1	24	20

Copyright © Converus Inc. 2022

Theoretical Assumptions

- Deception requires more cognitive effort than being truthful



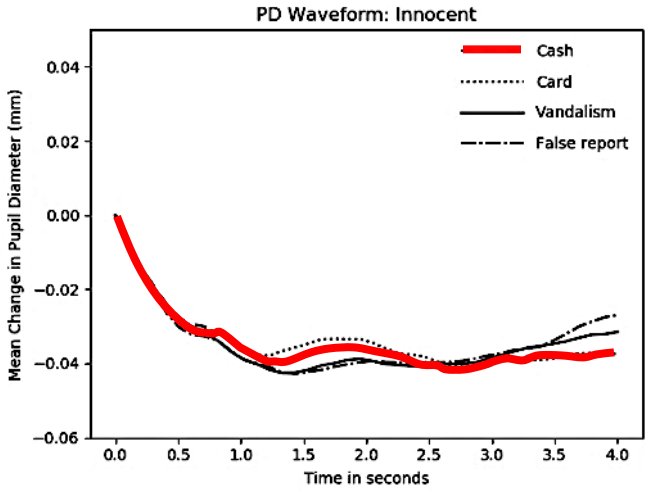
- Deception is associated with emotional arousal

Copyright © Converus Inc. 2022

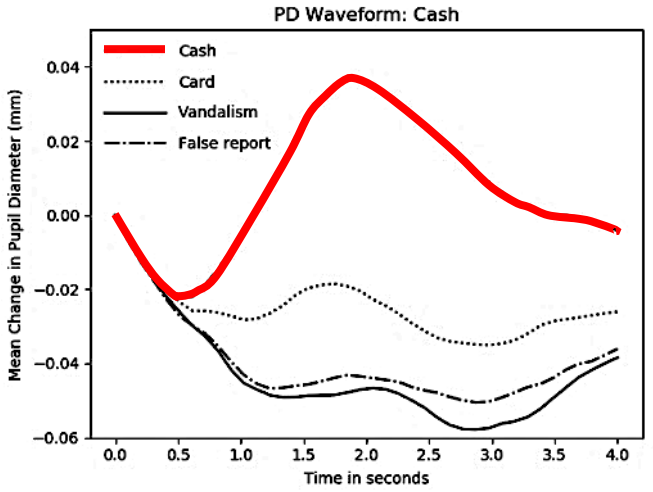
Predictions

- Truthful people will react similarly to questions about different relevant issues

- Deceptive people will react with greater strength to questions answered deceptively

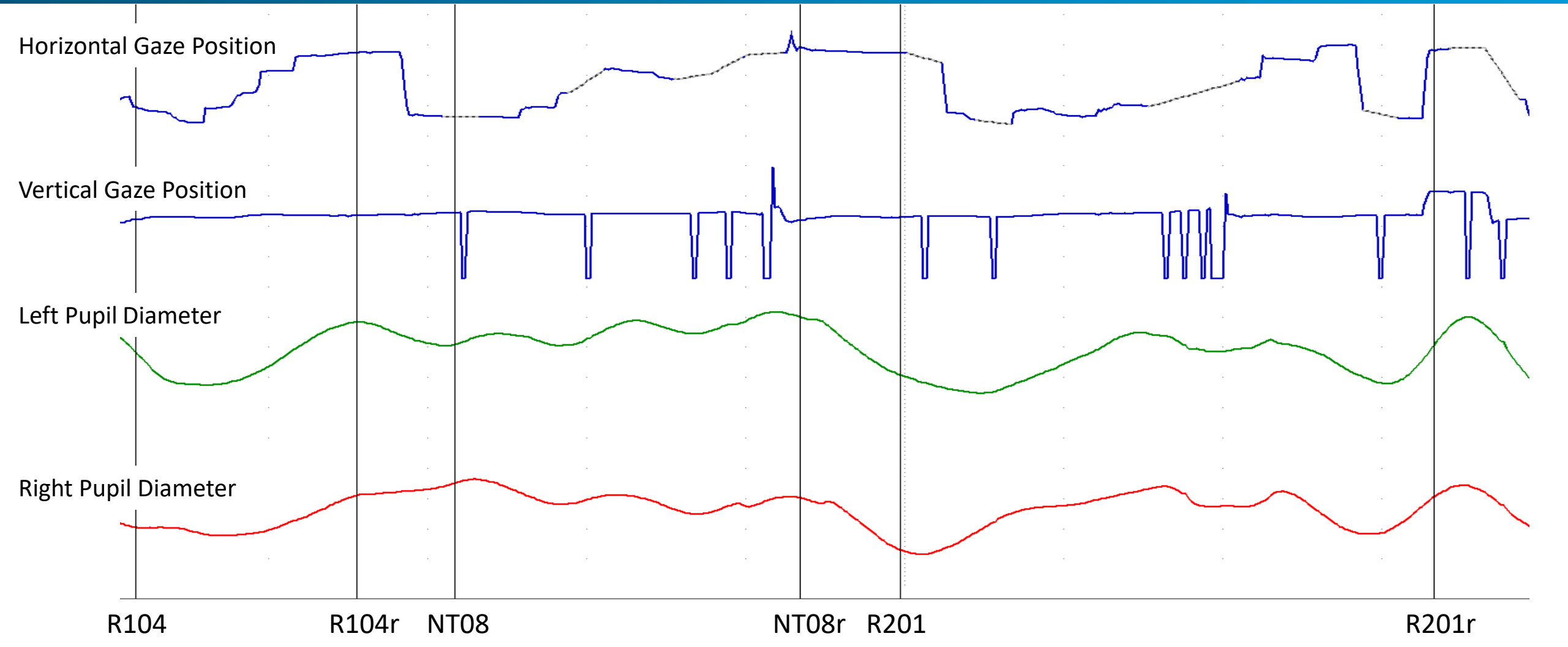


Potts Dissertation



Copyright © Converus Inc. 2022

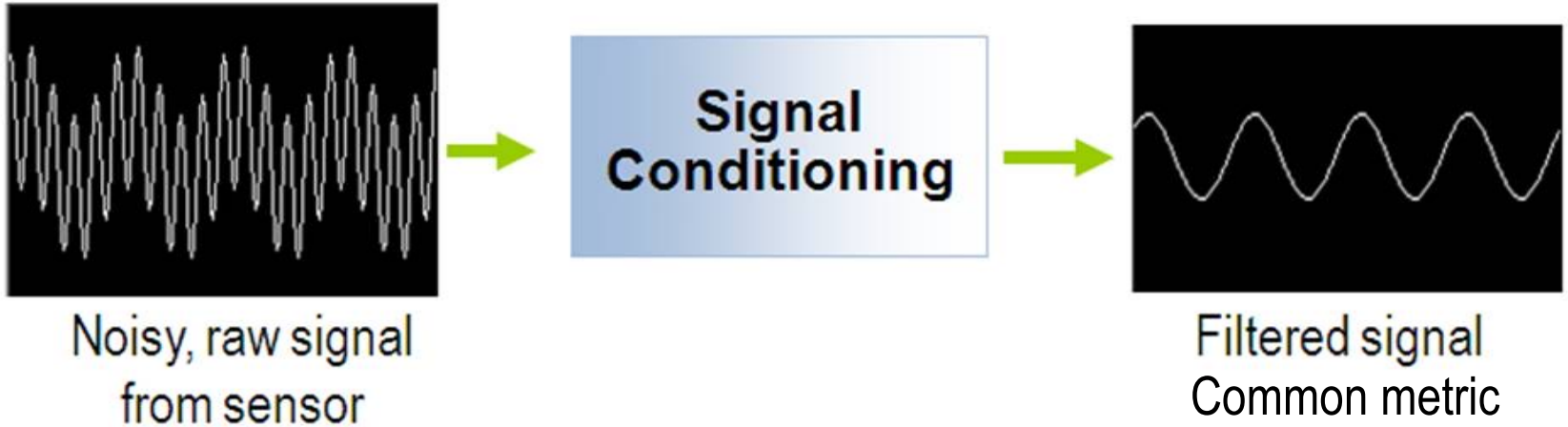
Ocular-motor Polygraph (9 sec)



converus
Copyright © Converus Inc. 2022

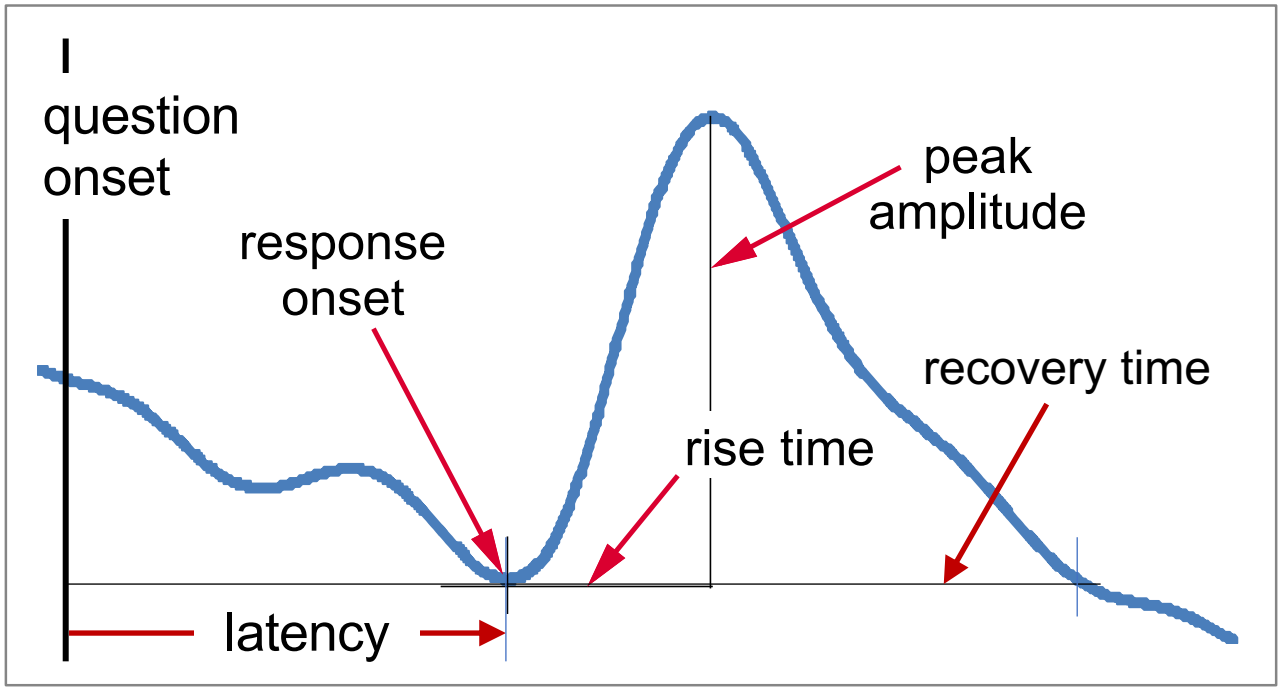
Signal Conditioning

- Remove artifacts
- High- and low-pass filtering
- Smoothing
- Standardization



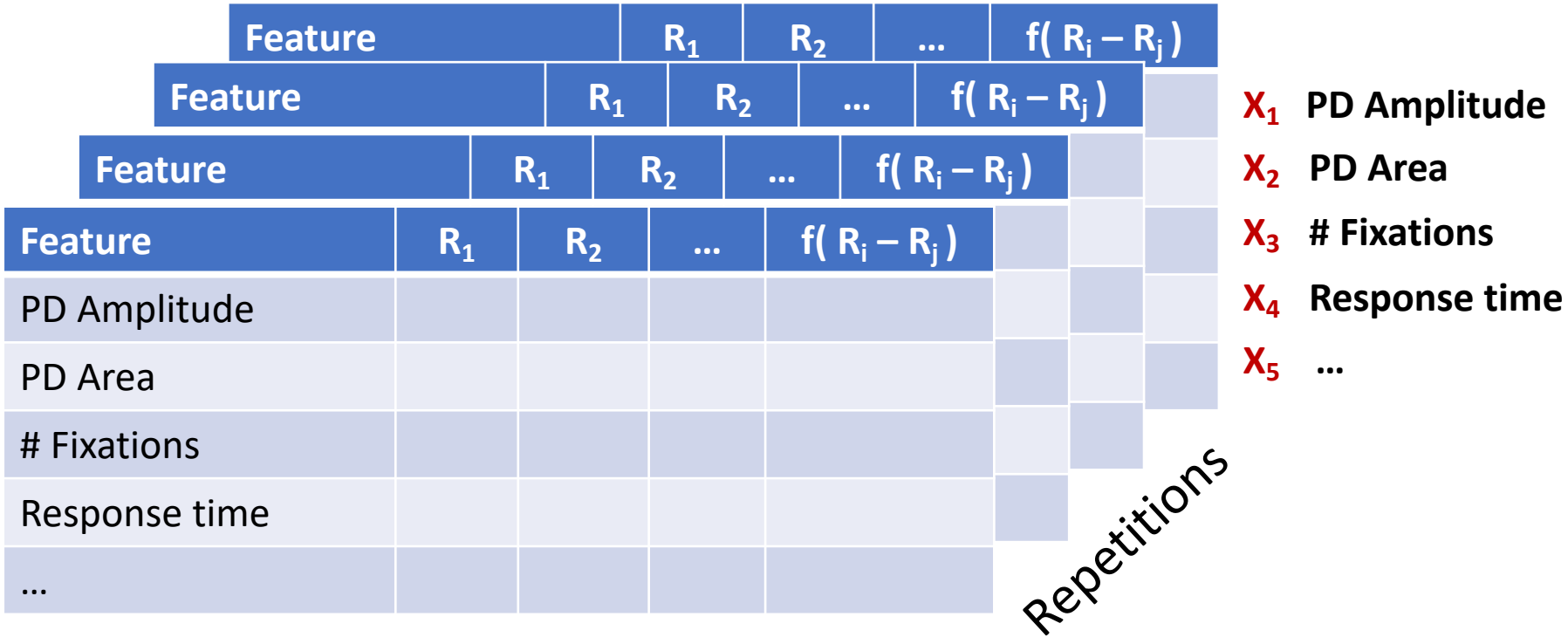
Copyright © Converus Inc. 2022

Feature Extraction



Copyright © Converus Inc. 2022

Data Matrix to Feature Scores



Copyright © Converus Inc. 2022

Decision Making

Binary logistic regression model:

$$\Pr(\text{Truthful}) = 1 / (1 + \exp(b_0 + b_1X_1 + b_2X_2 + \ldots + b_kX_k))$$

where,

X_j = feature

b_j = weight

Credibility score = Pr(Truthful) X 100

If credibility < 50, then “deceptive.” Otherwise, “truthful.”

Copyright © Converus Inc. 2022

Accuracy (% correct)

Test Format	# Studies	# Subjects	Truthful	Deceptive	Mean
RCT	13	1262/674	88.1	84.0	86.0
MCT	2	360	86.7	89.1	87.9
Audio MCT	1	180	88.2	81.4	84.8
DLT	2	118	86.4	83.1	84.7
Hybrid MCT	1	180	92.2	90.0	91.1
Hybrid DLT	1	120	87.1	85.5	86.3

Copyright © Converus Inc. 2022

Other Findings

Finding	Authors
Test accuracy depends on reading ability	Kircher, Malagon, & Vallejo (2012)
Motivation to pass the test improves accuracy	Webb (2008)
Higher accuracy is achieved with direct than indirect interrogation	Patnaik (2013)
Accuracy does not depend on biological sex	Webb (2008); Patnaik (2015); Potts (2020)
Accuracy may be higher for Western than Middle Eastern languages/cultures	Converus (2016)
Accuracy does not depend on working memory capacity	Patnaik (2015)
Accuracy does not depend on language (Spanish/English) and culture (Mexico/USA)	Patnaik et al. (2016)
Accuracy is similar in laboratory and field studies	Kircher & Raskin (2016)
Accuracy is higher in MCTs when the examinee is deceptive to only one relevant issue	Potts (2020); Converus (2021)
Ocular-motor measures increase accuracy of automated polygraph tests by 5%-10%	Handler & Nacházelová (2021)
Pulse transit time is diagnostic independent of EDA, pupil size, and respiration	Converus (2021)
Accuracy was unaffected by suggestions about how to defeat it	Nacházelová (2022)

Copyright © Converus Inc. 2022

19 Research Articles - 11 peer-reviewed

- **Eye Movements and Pupil Size Reveal Deception** (2009). Neuroergonomics & Operational Neuroscience
- **Effectiveness of Pupil Diameter in a Probable-Lie Comparison Question Test for Deception** (2010). Legal & Criminal Psychology
- **Evoked Pupil Responses Habituate During an Oculomotor Test for Deception** (2011). Society of Psychophysiological Research
- **Lyin' Eyes: Ocular-motor Measures of Reading Reveal Deception** (2012). Journal of Experimental Psychology
- **Detecting Deception Using Ocular Metrics During Reading** (2014). Credibility Assessment: Scientific Research and Applications
- **Effects of Direct and Indirect Questions On The Ocular-Motor Deception Test** (2019). Polygraph & Forensic Credibility Assessment
- **Ocular-motor Detection of Deception in Laboratory Settings** (2015). American Psychology and Law Society
- **Laboratory and Field Research on the Ocular-motor Deception Test** (2016). European Polygraph Journal
- **Generalizability of Ocular-Motor Test for Deception to a Mexican Population** (2016). International Journal of Applied Psychology
- **Ocular-Motor Deception Test** (2018). Detecting Concealed Information and Deception
- **Hybrid Polygraph and Ocular-Motor Deception Tests for Screening and Specific Incident Investigations** (2021). Psychology Applications & Developments VII.

- **Multimethod Assessment of Deception** (2006). D. Osher Doctoral Dissertation
- **Effects of Motivation & Item Difficulty on Oculomotor & Behavioral Measures of Deception** (2008). A. Webb Doctoral Dissertation
- **Ocular-motor Methods for Detecting Deception: Direct Versus Indirect Interrogation** (2013). P. Patnaik Master's Thesis
- **Oculomotor Methods for Detecting Deception: Effects of Practice Feedback and Blocking** (2015). P. Patnaik Doctoral Dissertation
- **EyeDetect Audio Multi-Issue Comparison Test** (2020). Development and Validation Summary
- **Ocular-Motor Methods for Detecting Deception in a Multiple-Issue Screening Protocol** (2020). A. Potts Doctoral Dissertation
- **EyeDetect Hybrid Directed-lie Comparison Test Development and Validation Summary** (2021). J. Kircher
- **EyeDetect Hybrid Multi-Issue Comparison Test Development and Validation Summary** (2021). J. Kircher

Copyright © Converus Inc. 2022

What is Peer Review?

Peer review is the evaluation of work by others with similar competencies as the producers of the work.

It functions as a form of self-regulation by qualified members of a profession within the relevant field.

Despite criticism about the integrity of peer review, most researchers believe peer review is the best form of scientific evaluation.

Copyright © Converus Inc. 2022

Purpose of Peer Review

Peer review is designed to assess the validity, quality and often the originality of articles for publication.

Its ultimate purpose is to maintain the integrity of science by filtering out invalid or poor-quality articles.

Copyright © Converus Inc. 2022

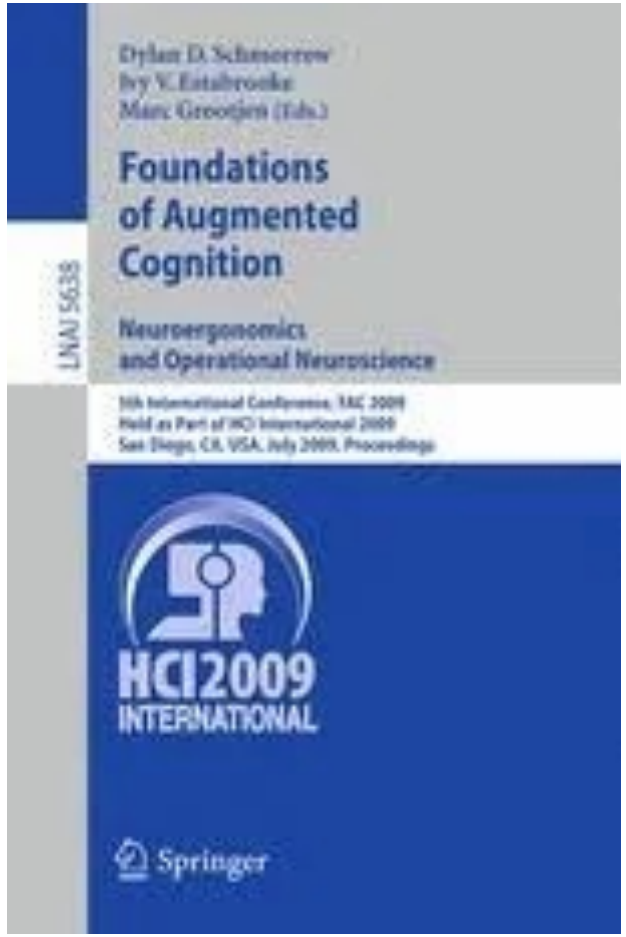
Eye Movements and Pupil Size Reveal Deception in Computer Administered Questionnaires

Webb, Hacker, Osher, Cook (2009)

Conclusions:

(1) Pupil diameter and reading behaviors are diagnostic of deception.

(2) Ocular-motor measures may supplement or be an alternative to the polygraph or self-report measures.



Copyright © Converus Inc. 2022

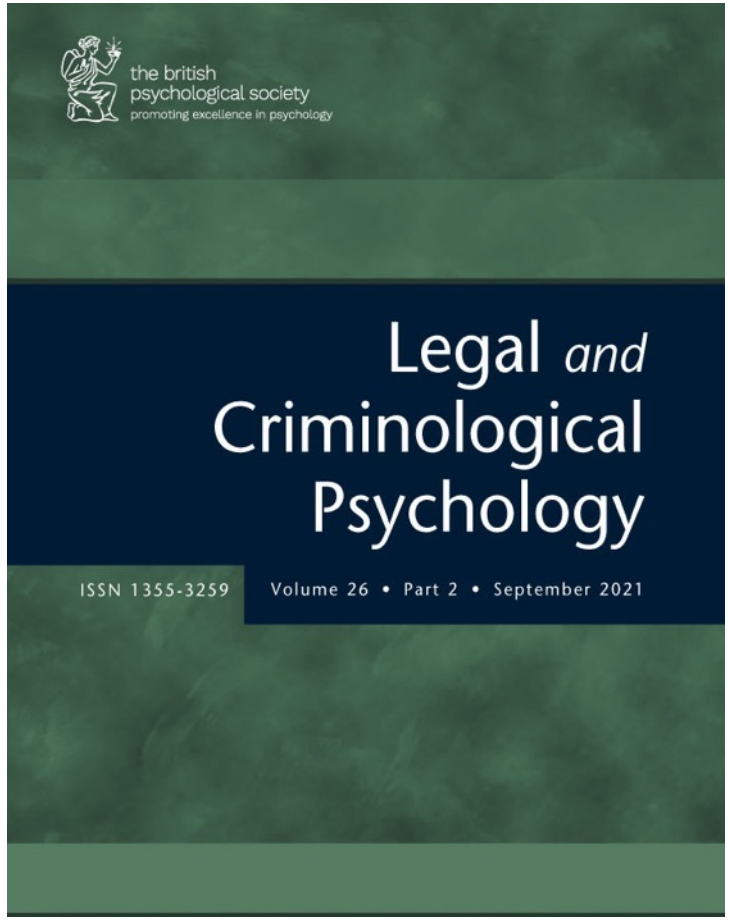
Effectiveness of pupil diameter in a probable-lie comparison question test for deception

Webb, Honts, Kircher, Bernhardt, Cook (2010)

Conclusions:

(1) Pupil diameter is a significant predictor variable for deception.

(2) Pupil diameter may be a possible replacement for the traditional relative blood pressure measure.



Copyright © Converus Inc. 2022

Evoked Pupil Responses Habituate During an Oculomotor Test for Deception.

B. Brian Kuhlman, Andrea K Webb, Pooja Patnaik, Anne E. Cook,
Dan J. Woltz, Douglas J. Hacker, & John C. Kircher
University of Utah

Society for Psychophysiological Research (2011)

Conclusions:

(1) Pupil reactions decrease in amplitude over repetitions of test questions (habituate).
(2) The diagnostic value of pupil reactions to different types of test items does not change over repetitions of test questions.

Copyright © Converus Inc. 2022

Lyin' Eyes: Ocular-Motor Measures of Reading Reveal Deception

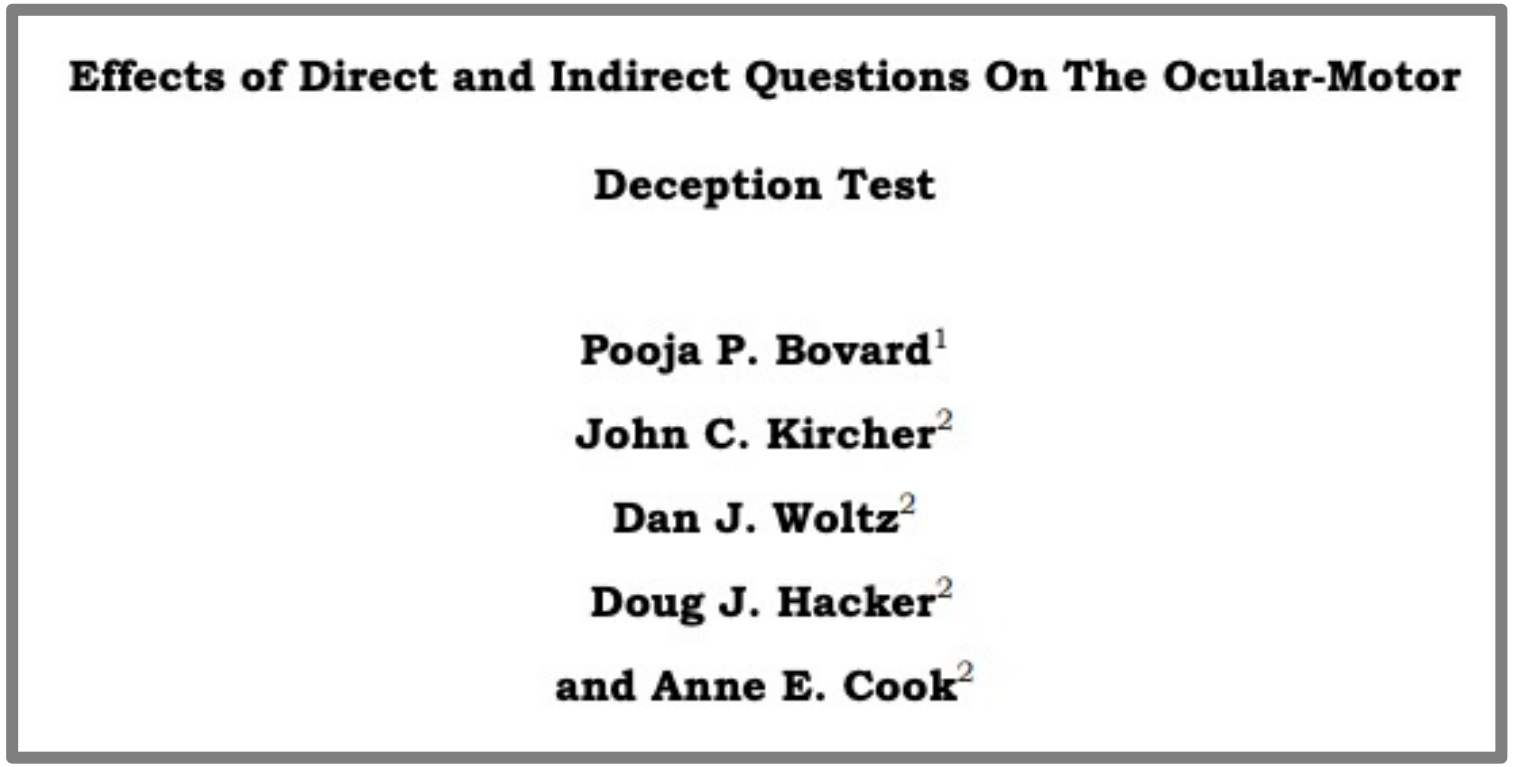
Cook, Hacker, Webb, Osher, Kristjansson, Woltz, and Kircher (2012)

Conclusions:

(1) Reading behaviors may be used to detect deception and may supplement or provide an alternative to the polygraph or self-report measures in some field settings.

(2) RCT Accuracy 85%

Copyright © Converus Inc. 2022



Polygraph & Forensic Credibility Assessment, 48(1), 40-59

Conclusions:

1. Accuracy using direct questions is greater (83%) than using indirect questions (60%).
2. Accuracy improves when direct questions are asked using unpredictable transitions between question types rather than in blocks.

Copyright © Converus Inc. 2022

Detecting Deception Using Ocular Metrics During Reading

Hacker, Kuhlman, Kircher, Cook, Woltz (2014)

Conclusions:

(1) Ocular-motor tests for deception were 85% accurate in lab experiments and 78% accurate in a field study.

(2) Ocular-motor tests were ineffective for participants with poor reading skills.

Copyright © Converus Inc. 2022

American Psychology and Law Society

Conclusions:

(1) Accuracy rates on cross-validation were about 80% for guilty and innocent groups in lab experiments using discriminant analysis.

(2) Accuracy rates on cross-validation were about 84% for both groups using logistic regression analysis.

Copyright © Converus Inc. 2022

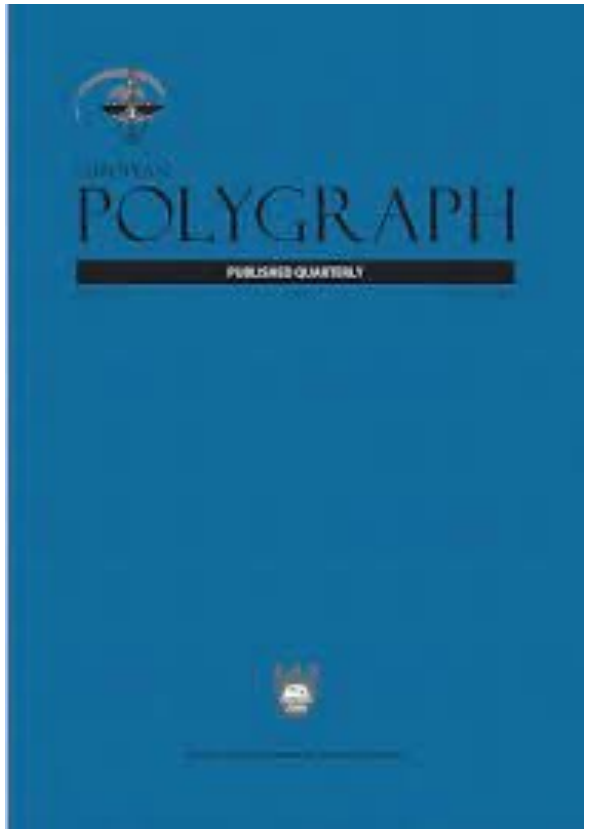
Laboratory and Field Research on the Ocular-motor Deception Test

European Polygraph Journal

Kircher & Raskin (2016)

Conclusions:

(1) The RCT may contribute to pre-employment & periodic screening programs, particularly in government agencies concerned with law enforcement & national security.
(2) Countermeasures are unlikely to affect outcomes.
(3) Results generalize to US, Mexico, & Middle East populations.
(4) RCT Accuracy is about 86%.



Copyright © Converus Inc. 2022

Generalizability of an Ocular-Motor Test for Deception to a Mexican Population

Patnaik, Woltz, Hacker, Cook, Ramm, Webb & Kircher (2016)

Conclusions:

(1) RCT accuracy was 86% in a large sample of students at a Mexican university.

(2) Effects of deception on ocular-motor measures were similar in Mexican and U.S. populations.

Copyright © Converus Inc. 2022

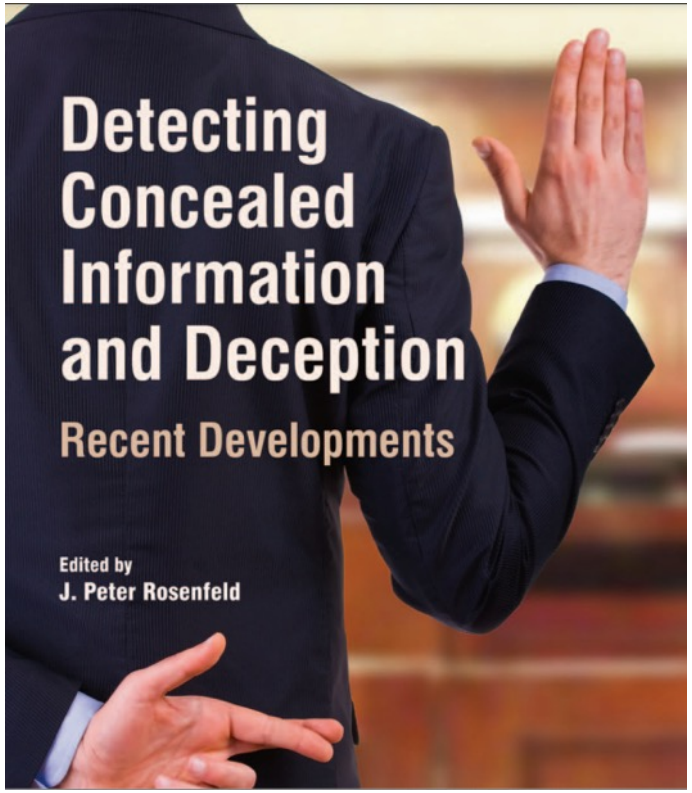
Ocular-motor Deception Test

Kircher (2018)

Conclusions:

(1) RCT accuracy ranges from 80-86%.

(2) Effects on ocular-motor measures are similar in lab and field settings.



Copyright © Converus Inc. 2022

Hybrid Polygraph and Ocular-motor Deception Tests for Screening and Specific Incident Investigations

Handler & Nacházelová (2021)

Conclusions:

(1) Ocular-motor + polygraph: 86-91% accurate.
(2) Ocular-motor: 85-87% accurate.
(3) Pulse transit time is diagnostic of deception.
(4) Pupil reactions are more diagnostic of deception than traditional measures in automated polygraph examinations.

Copyright © Converus Inc. 2022

Others

Ocular-motor Methods for Detecting Deception in a Multiple-issue Screening Protocol

Doctoral Dissertation - Potts (2020)

Conclusions:

(1) Multi-issue Comparison Test has greater practical utility than RCT.
(2) Age and intelligence do not affect the diagnostic validity of behavioral or ocular-motor measures.
(3) MCT Accuracy 88%

Copyright © Converus Inc. 2022

Hybrid Multi-Issue Comparison Test (HMCT) Development and Validation Summary

Kircher (2021)

Conclusions:

(1) Hybrid MCT combines ocular-motor deception testing with polygraph.

(2) Pulse Transit Time (PTT) components effectively replace the use of the blood pressure cuff.

(3) HMCT Accuracy 91%.

Copyright © Converus Inc. 2022

Hybrid Directed Lie Comparison Test (HDLC) Development and Validation Summary

Kircher (2021)

Conclusions:

(1) Hybrid MCT combines ocular-motor deception testing with polygraph.

(2) Pulse Transit Time (PTT) components may replace the use of the blood pressure cuff.

(3) HDLC Accuracy 89%

Copyright © Converus Inc. 2022

APPLIED COGNITIVE PSYCHOLOGY

Ocular-motor Deception Testing in Civilly Detained Sexually Violent Persons: An Alternative to Post-Conviction Sex Offender Polygraph Testing?

Ambroziak, Smith, and Mundt (2021)
Sand Ridge Secure Treatment Center

Conclusion: Results support use of ODT methods with at least 80% accuracy as a potential alternative to post-conviction testing of sex offenders.

Copyright © Converus Inc. 2022

converus®