APA MAGAZINE

The Magazine for the Polygraph Professional

November/December 2017

Volume 50,6

American Polygraph Association

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Submissions and/or technical questions regarding your ad should be sent to editor@polygraph.org. Please note that submission deadlines are posted on the first page of Membership News section on each issue.

Upgrading Membership Classifications from Associate to Full Member

If you have a baccalaureate degree or higher, you have served as an Associate of the APA for 24 months, you have completed a minimum of 200 polygraph examinations, you have attended at least one APA Annual Seminar, and have completed 60 hours of CEH in polygraph, request that your membership classification be upgraded from **ASSOCIATE** to **MEMBER.**

In order for the Board of Directors to act upon your request, it will be necessary for you to:

Provide a copy of your transcripts, a ***notarized*** statement from your supervisor ***or*** knowledgeable colleague, who must be a Member of the American Polygraph Association (APA), attesting that you have completed a minimum of 200 polygraph examinations, and proof of your 60 hours of continuing education in the field of polygraph within the last 36 months.

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If you have any problems or questions regarding your membership, please call the National Office Manager at 800/272-8037 or 423/892-3992.

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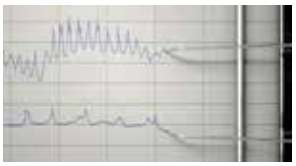

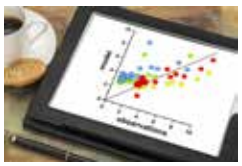

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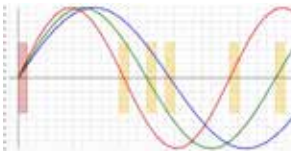

AMERICAN POLYGRAPH ASSOCIATION
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(Application for the Certificate of Advanced and Specialized Training will be granted only to those that have completed thirty-six (36) hours of approved advanced and specialized training during the past three (3) years.

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Deadlines

This issue closed on November 30, 2017

Deadline for January/February issue: January 31, 2018

Submission of Articles

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Advertising and Editorial address is editor@polygraph.org. Subscription address is: APA, P.O. Box 8037, Chattanooga, TN 37414-0037. The *APA Magazine* is published six times per year and is available in electronic format only. Address and e-mail changes/updates should be sent to: APA, P.O. Box 8037, Chattanooga, TN 37414-0037, or manager@polygraph.org. E-mail notification is sent to subscribers when the latest publication is available. The APA webmaster is not responsible for issues not received because of improper address information. Submission of polygraph-related articles should be sent to: Mark Handler, editor@polygraph.org.

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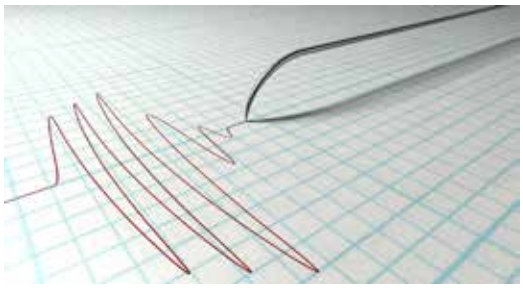

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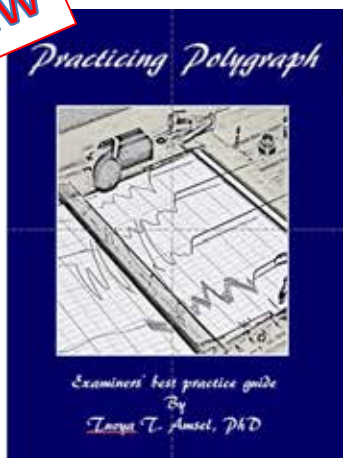
Practicing Polygraph - Examiners' Best Practice Guide by Tuvya T. Amsel, PhD

Confronts and covers some of the critical essentials practitioners face, as Dr. Amsel experienced in his over 40 years of practice and tenth of thousands of tests. Amongst the many topics discussed in the book are:

- Polygraph Examinations' Contaminating Factors
- Polygraph-Test Anxiety
- Examiner's Approach and its' Affects on the Test's Outcome
- Sliding from the RQ to the CQ
- On Testing Sex-Related Alleged Offenses
- Bridging the Language Barrier (Testing Foreigners)
- Chart Anomalies
- Contradictory Psychophysiological Responses
- Answering Adversaries
- Comparative Review of the Polygraph with Other Diagnostic Tools and Methods

NEW



Readers' comments:

"Practicing Polygraph is an educational masterpiece as it relates to forensic psychophysiology"

"This book is a "Must Have" for any examiner who is serious in keeping sharp and up to date."

"The tips in this book will prove invaluable to those seeking the gold standard of operation."

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Polygraph Examiner Training Schedule

American Polygraph Association

Continuing Education Seminar Co-Sponsor New Mexico Polygraph Association
February 1-3, 2018
Albuquerque, NM

PEAK Credibility Assessment Training Center

Basic Examiner's Course (Cape Coral, FL)
January 8 - March 16, 2018
May 7 - July 13, 2018
September 4 - November 9, 2018

Advanced Examiner's Course
March 26 - 30, 2018 (Cape Coral, FL)
July 23 - 27, 2018 (Cape Coral, FL)

2018 A.S.I.T. Courses

Polygraph 101 Basic
March 5 – May 11
September 24 – November 30
Guatemala: Contact school for dates

Attention School Directors

If you would like to see your school's course dates listed here, simply send your upcoming course schedule to editor@polygraph.org

Post Conviction (PCSOT)
May 14- 18; December 3 - 7

Advanced Polygraph
July 23 – 24

Advanced PCSOT
July 25 - 26

Forensic Assessment Interviewing and Integrated Interrogation Techniques

March 12–16; October 1 - 5 Philadelphia

Morgan Interview Theme Technique (MITT) Contact school for dates

National Polygraph Academy

Basic Polygraph Courses:
January 29 - April 6, 2018 Moyock, NC
June 4 - August 10, 2018 Amarillo, TX
September 5 - November 9, 2018 Columbus, OH

Basic PCSOT Courses:
April 9-13, 2018 Moyock, NC
April 23-28, 2018 Baton Rouge, LA
August 13-17, 2018 Amarillo, TX

Advanced Continuing Education (ACE) Courses:
August 10, 2017 (1-day) Amarillo, TX
November 12-16, 2018 Columbus, OH

AMERICAN POLYGRAPH ASSOCIATION (APA)
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CUTOFF DATE for hotel reservations is **1/10/18** Individual departure dates will be reconfirmed upon check-in. (5 DAY CANCELLATION notice required)

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TOPICS

Donnie Dutton – APA Past President
The Dark Web
Route Maps
Examinee Resistance
Counter Measures

CONTINUING EDUCATION HOURS
When you attend this seminar, you receive up to 20 CEHs (Continuing Education Hours) approved by the American Polygraph Association and the Federal Certification Program for Continuing Education and Training.

Tax Deductions:
All expenses of continuing education (including registration fees, travel, meals and lodging) taken to maintain and improve professional skills are tax-deductible subject to the limitations set forth in the Internal Revenue Code.

(The registration fee includes professional instruction, seminar materials, AM and PM Refreshment Breaks)

APA Cancellations Refund Policy:
Cancellations received in writing prior to **1/10/18** will receive a full refund. Persons canceling **after 1/10/18 will not** receive a refund but will be provided with the handout material

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CES-Albuquerque, NM (Feb. 1-3, 2018) We can not possibly reach everyone who would be interested in taking part if this seminar. Please help us by making copies of the page for your co-workers and business associates. Thank you for your assistance.

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President's Message

Jamie McCloughan

I will keep my report to you short and try to summarize what has transpired with the Board since my last report and what we will be working on in the future.

The Board has taken the first step to minimize duplication of work by combining the Education Accreditation Committee (EAC) with the Professional Development Committee (PDC) and there is now just the EAC that handles the functions of both committees. As both committees primary role is education, it made perfect sense that they be combined to allow congruence in our promotion of education for our members and the profession. We are currently looking at how we might streamline other committees in the future, such as the Post Conviction Sex Offender Testing Committee and the Standards and Specialized Testing, so feedback from you regarding this topic is appreciated.

The Board has also approved for the continuing education requirements of PCSOT to mirror that of APA member and associate requirements. This means that those practicing PCSOT can choose continuing education that best suits their need to grow in professional knowledge.

The Board is currently working on a conflict policy that allows for better transparency and helps to ensure that there are no inherent conflicts of interest in those carrying out business for the APA. It is also working on updating the organizational model for the APA. Other nonprofit organizational models are being reviewed and compared to the APA's to see if our current model still best suits us or if we should make corrections to better serve our members.

There are a number of projects committees are beginning to work on, but I will save this for next time, as they have just started.

If you have any questions or suggestions, please feel free to contact me. As al-

ways, may those who are fighting for our freedom against threats, both foreign and domestic, be safe, and have Godspeed in their return to friends and loved ones.

Board of Directors' Reports

Steve Duncan
President Elect

Hello, APA Members. As we enter the holiday season, things are still quite busy within the APA. Your APA Office Staff and Board of Directors are still working on a number projects.

Our joint seminar with the Virginia Polygraph Association was very successful with excellent attendance and participation from the members. Thanks to the APA Office Staff and the Virginia Polygraph Association Board for their hard work.

The Ethics and Grievance Committee is still hard at work. As I mentioned previously, the number of complaints we are receiving appears to have declined combined with the number unfounded is a good sign that our examiners are following the by-laws and proper procedures. I urge you, as a member, to follow the Standards of Practice in order to protect our profession. Work continues with the committee policy.

I have been working with other board members on several Projects to keep the APA moving forward. President McCloughan has made assignments to board members to facilitate several advances in making the APA function more smoothly and efficiently.

As a board member, I have continued to assist members with issues as requested and I am here to help with problems if I can. I have continued working on projects with other board members on quality assurance, elections and other issues.

As always, feel free to call or email me if I can be of assistance to you.

Patrick O'Burke
Chairman of the Board

The holiday season is upon us and I hope that you have ample opportunity to make time with your families. I have settled into the role of board chair and have been working closely with our new president on pressing issues. The board continues to work towards having polygraph embraced as a forensic science. We continue our participation with the American Academy of Forensic Science and encourage our members to enroll as a member of AAFS. The board has also

appointed a full-time person to coordinate the accreditation of polygraph schools which is a crucial step forward as members of the Association of Specialized and Professional Accreditors (ASPA).

The need for standardization is well-documented in our profession and the board has attempted to address this with our adoption of a model policy for quality assurance. The board has also added a Standard of Practice that requires the use of a computer scoring algorithm for any polygraph that meets the definition of being evidentiary. Using a computer scoring algorithm is a highly charged emotional issue for many examiners who believe they are better at visually scoring a polygraph than allowing a computer to assist. Unfortunately, human beings can be highly subjective and influenced by cognitive bias. This influence of cognitive bias is not limited to polygraph, most professions must struggle and wrangle with the issue.

I recently reviewed two significant research projects that address cognitive bias in forensic science. In case you are not aware, other forensic sciences have their own problems with bias and accuracy. In March 2004, Brandon Mayfield was arrested for the bombing of a train in Madrid, Spain. The FBI had made a fingerprint "match" that facilitated Mayfield's arrest. Following his arrest, Mayfield's defense team asked to examine the fingerprint evidence. The defense's own experts concurred with the FBI's quality control review that the prints "matched". However, the Spanish police conducted their own review and correctly linked the prints to Ouhhane Daoud, the real bomber. The FBI paid out two million dollars to settle the claim. "Match" is now an incendiary issue for fingerprints - pun intended!

Kassin, Dror, & Kukucka (2013) discuss the 2009 NAS report that was a scathing review of forensic science. The NAS report urged science to develop rigorous protocols for subjective forensic science interpretations. Kassin et al (2013) noted that with wrongful convictions, 38% contained flawed serology testimony and 22% contained flawed hair comparison testimony. Kassin noted that in forensics the human examiner is the main instrument of analysis and that experts are often far over-confident in their abilities. Do you think that this applies to polygraph?

Kassin, Dror, Kukucka (2013) also described a significant problem with confirmation bias in forensic exam-

ination. Kassin theorize that forensic science examiners are biased from receiving contextual information such as the opinions of detectives, other criminalistics evidence analysis, and suspect confessions. Kassin and others have suggested that forensic scientists should conduct their examinations blind, without the benefit of outside contextual information. If those forensic examinations work as a science, then Kassin et al. (2013) are making a valid point. Why do forensic examinations require outside information? I would ask you to think of how contrary and contradictory that is to polygraph expectations and polygraph training. We want all the information about why we should test a suspect. Cleve Backster even created a scale to evaluate "case information adequacy" as a prediction of accuracy.

Question - should we in polygraph rethink our training and protocols? Should polygraph examiners be blind to other forensic testing, confessions, or eye witness testimony? The answer would appear to be "yes". We should be blind to these things.

The problems humans face with cognitive bias applies to us as people, not just polygraph examiners. We need to be smart and think about this. Kukucka, Kassin & Zapf (2017) continued to examine the problems and understanding of bias within forensic sciences. Out of 400 respondents in various forensic disciplines, 71% of forensic scientists responded that bias was a significant problem in "other" forensic disciplines. However, only 51% reported it was a specific problem within their own discipline. Further, only 25% reported that bias was a problem with their own judgement. Amazingly, 37% of the respondents reported that they considered themselves 100% accurate in their own judgements! I have heard that there are polygraph examiners who have testified to the 100% accuracy figure as well. How would you evaluate this statement of 100% accuracy for any forensic science?

As a profession, it is time for us to look at scoring algorithms and embrace their use as something we do for every examination. Do some scoring algorithms have issues that concern us? The answer is "yes", but until we embrace the idea that bias operates below our level of consciousness, we are fooling ourselves. Our profession can request, and even demand, that science provide better algorithms and that we should be requiring examiners to use them.

If DNA and fingerprints can have prob-

lems in analysis, where do you think polygraph will fit in this discussion for the future? Hochschild (2008) reported that 2000 years ago Julius Caesar said that "men freely believe that which they desire". I really think it is time to consider that there are better and more objective tools for measuring physiological responses on a polygraph. The reasons why we refuse to believe this are numerous. The cost for refusing to believe may be too costly.

I encourage you call the manufacturer of your polygraph instrument and ask why we do not have a better scoring algorithm, one that every examiner will feel comfortable using with every test. I have already.

J. Patrick OBurke, Wishing you a Merry Christmas.

References

Kassin, Saul M.; Dror, Itiel E.; & Kukucka. Jeff. (2013). The Forensic Confirmation Bias: Problems, Perspectives, and Proposed Solutions. Journal of Applied Research in Memory and Cognition. 2 (2013) pp 42-52.

Kukucka, Jeff; Kassin, Saul M.; Zapf, Patricia A. (2017). Cognitive Bias and Blindness: A Global Survey of Forensic Science Examiners. Journal of Applied Research in Memory and Cognition. In press 2017.

Mike Gougler
Seminar Chair

APA 2018 Seminar Dates & Updates

Fellow Professionals,

Plans are underway for the 53rd Annual APA Seminar to be held August 26 thru August 31, 2018 in Austin, Texas. The conference will be held at the beautiful Austin Hilton Hotel.

We are anticipating a large turnout based on the quality training classes being offered, coupled with a very favorable room rate. Please make your reservations early, as we expect to sell out our allotment of rooms.

We are currently organizing a Tuesday night event to be held in the downtown Austin area. Periodically check back to the website for updates.

A schedule of classes will be posted after the first of the year. Please remember to nominate deserving individuals for the various APA awards.

Interpretation services will again be offered in Classroom A on Monday

through Friday for all classes. For those wanting to take advantage of these services, the cost will be $100 per person if you pay at the door. Those paying in advance before arriving at the seminar will be charged $50. Please take advantage of the discount by paying early so we can better project the number of headsets required. (No headset will be issued without payment.)

I would again like to thank all of our sponsors for their support.

See you in Austin.

George Baranowski
Director

George Baranowski

1885 Police Rules Change a Bit

I wanted to share something with all my fellow law enforcement kin, whether it be local city police officers, county police, state police and any and all others.

For all those police officers either still on the job or retired who think they have it rough now or in the past when they were on the force, may get some consolation from these ancient departmental bulletins from their ancient archives that my friend on the Indianapolis Police Department sent me years ago, back when I carried a gun and a badge.

This March 5, 1885 bulletin, which leads one to believe that the good old days weren't really all that good, listed the following instructions.

Each officer will bring a bucket of water and a scuttle of coal for each shift.

Make your pens carefully. You may whittle nibs to your individual taste.

Officers will be given an evening off each month for courting purposes upon written request.

If an officer can show proof he attends church regularly, he will be given an extra evening off each month.

Each officer should lay aside from each pay a goodly sum so that he will not become a burden to society in his declining years.

Any officer who smokes Spanish cigars, uses liquor to excess or frequents pool and dance halls will give good reason to suspect his integrity and honesty.

Any officer who performs his duties faithfully without fault for five years

will be given an increase of 5 cents per day, city funds permitting.

In another document, arrest statistics from 1885 show that the same old crimes were being committed then and about as often as they are probably even now. Remember the population then was only about 105,000.

The records for that year show 400 arrests for prostitution, 188 for gambling, six for murder, 128 for assault, 20 for robbery and 1,980 for drunkenness.

A further look at the arrest figures indicate that the Indianapolis Police had a few problems not faced by today's force.

That year, for example, there were four arrests for playing hand organs in the street; 27 for letting livestock run at large, 16 for feeding a horse on an improved street and 13 for leaving a horse unhitched. I think the most fascinating however, were the two arrests for "committing a nuisance in a tunnel" (whatever that was). There was also one arrest for "Keeping an opium joint."

Hey, what do you think our jobs, our lives or the world, will be like 130 years from now? Wow.

Sabino Martinez
Director

Hopping everyone in the USA had a great Thanksgiving and that each and every one of you enjoyed the company of loved ones and great food. Unfortunately here in Texas we lost a DPS Trooper and Thanksgiving will never be the same for that family. I ask that all of you take the time to appreciate the good things in life especially those who risk their own lives to keep us safe. I wish all of you a festive holiday season and a Happy New Years.

As we start a new year I would like to remind all of you that we need award nominations for the annual banquet. As chair of the awards committee I encourage all of you to look around. We all know that one person that excels or performs beyond the call of their everyday duties, please nominate that person so that they can be recognized.

I continue to remind all of those asking for approval of hours for continued education that APA only approve the hours for members to receive credit for the presented material and does not condone or agree with the material presented at any seminars.

Saludos a todo América Latina aquí presente deseándoles a todos ust-

edes una feliz navidad y un próspero año nuevo. Les comento que estamos aceptando candidatos para los reconocimientos que se presentaran en nuestra próxima reunión anual. Les pido a cada uno de ustedes que vean a su alrededor y nos ayuden a reconocer a todos esos compañeros suyos que son miembros de APA, los cuales han sobresalido como proligrafistas o que apoyan nuestro trabajo y profesionalismo. Cabe señalar que no todos los reconocimientos son para miembros y les pido que me manden un correo electrónico para tenerlos en consideración. Por otra parte, como director encargado de aceptar horas de educación continua se les recuerda a todos que APA no avala el material, seminarios o congresos ni está de acuerdo con el material que se presenta, ya que solo se aceptan las horas para los miembros de APA con fin de que ellos reciban educación continua. Les recuerdo que como miembros se requiere atender y registrar horas de educación continua ya sea en los congresos de APA, o en cualquier otro seminario o congreso en el cual las horas son aceptadas con el mismo fin.

También les aviso que el congreso para América Latina se llevara a cabo en el mes de marzo 2019 en la Cuidad de México y que los planes siguen adelante. Les pido que hagan sugerencias de material o ponentes al congreso lo más pronto posible. Les mando un fuerte abrazo a todos y todas.

Gracias por su atencion.

Brian Morris
Director

The Research and Development Committee is pleased to have added Michael O. Mitchell to its committee. He brings over 20 years of polygraph experience from the law enforcement arena and is currently the Maryland Polygraph Association President. He will be a tremendous asset to the committee.

Currently, there are not any research projects that are ongoing that the committee is aware of. If you, our members, are aware of any research projects we would appreciate being able to hear about those projects and being able to help in those endeavors. Thank you for the opportunity to help our profession continue to stay on the leading edge of the industry and to help each of you be the best examiners in the world.

Raymond Nelson
Director

Greetings APA Members. I hope everyone is ready to have a very Merry Christmas and Happy New Year (or Happy Holidays in general if you prefer a more neutral perspective on the December festivities). Regardless, I'm sure that we'll all be checking our naughty lists and nice lists (twice) and forwarding the information to the relevant authorities. In the meantime, work continues. President McCloughan and all members of the Board of Directors, including myself, are diligently thinking ahead about the future of the polygraph profession. The APA is continuing to move forward with ASPA membership (to increase the value and strength of our school accreditation program) and there is ongoing discussion about the role of polygraph in broader area of forensic science. We are already talking about ways to increase awareness and visibility of scientific advancements in polygraph at AAFS, potentially including the Forensic Science conference. In the past few months, I've had several opportunities to present and discuss the science and decision theoretics of polygraph with a couple of difference small-group conferences of statisticians, data-scientists, and neuroscience researchers, and I anticipate a couple more such events in early 2018.

I recently attended the ATSA conference, along with other Board Members Erika Thiel and Pat O'Burke, along with Don Grubin. As many polygraph examiners are aware, ATSA has recently published a position opposed to polygraph testing with juveniles – premised on their concerns about the lack of available normative data for juveniles, absence of published outcome studies showing the effect or contribution of polygraph outcomes to treatment and supervision with juveniles, and the ever-present ethical concern about the potential for harm that might result when using treatment and supervision tools that have not been adequately studies or not adequately understood by all involved professionals. To be clear, the concerns expressed by ATSA are understandable and appropriate concerns, for which we have to accept the challenge of developing an evidence-based (not anecdotal or opinion oriented) response. It was a welcome opportunity to meet people and engage some thoughtful, if not high level, discussion about how and with which youthful offenders we may want to continue discussion about the use and value of polygraph testing with consideration for their level of development and level

of risk. There is still a lot to do in this area. Treatment professionals have not stopped learning, developing and improving their approach to the problem of sexual offending. Treatment and supervision methods today, for adults and juveniles, are quite different than they were 10 and 20 years ago. In contrast, some of the activities and discussion among polygraph examiners engaged PCSOT have continued to rely on innovations from in the 1990s and even the early 2000s. So this is definitely an area of needed ongoing discussion, and definitely an area where we want to be positioned to be responsive (not reactive) to the concerns of other professionals.

In other areas, it is never too soon to be thinking ahead about the annual conference. Seminar Chair Mike Gougler along with President McCloughan and others are planning another terrific event, and I hope to see you there. As always, do not hesitate to contact me directly or through the APA office if there is anything I can do to be of assistance to anyone.

Merry Christmas and Happy Holidays.

Erika Thiel
Director

The Association for the Treatment of Sexual Abusers (ATSA) held its annual conference this year in Kansas City, Missouri. The American Polygraph Association was delighted that we were invited to hold a short session on administering polygraph examinations with juveniles; as this is a much debated topic. I am proud to say that I was able to be one of these presenters.

ATSA took an overall opinion about testing juveniles in their 2017 practice guidelines. The overall opinion by the board of ATSA is that polygraphs should not be administered on juvenile testing and that if a program choses to do juvenile testing, then they should proceed with caution. Practice guidelines, policies and procedures of any association should always be looked upon as guidelines and not draconian law. Unfortunately, there are many states that see these guidelines as a definitive source and the use of polygraphs to test juveniles has been deemed unlawful and has been taken away in its entirety.

Many states are on the fence - unsure of what to do and are likely waiting for a larger court case to make the overall decision. If this were the case, history would show that polygraph would likely not win this battle and we could lose what many have considered benefits of testing juveniles.

With this information in mind, we want to be thoughtful about testing juveniles. In doing so, we have a better chance of standing up alongside of clinicians and therapists who are in favor of juvenile polygraph testing instead of being viewed as a direct oppositional force that "does harm," "harasses," or "goes against the therapeutic values."

Being a mindful examiner in the juvenile testing milieu may require fine-tuning some skills that have been practiced by polygraph examiners for many years, as well as taking new continuing education trainings focused on the differences between juvenile and adult testing. In the meantime, here is information that should be known:

Juvenile's minds and emotionality are not yet fully developed. This means that juveniles may not fully understand concepts you are presenting to them and are more likely to both overagree and falsely make confessions due to a lack of understanding, or the exact opposite. This means when you have relevant questions on these topics, your results may not be as valid as you think for there will be an increased rate of false negatives and/or false positives. Ensuring a juvenile can define a question in their own words that accurately depicts what you are asking is essential. If they are only reciting your definition without them being able to elaborate, proceed with caution.

Post-test interviewing can be done by a therapist. Now before you grab your pitchfork and torch and start protesting, I am not saying that a post-test interview cannot be done by the polygraph examiner. I am simply stating that if you are the polygraph examiner who is doing juvenile testing, and the program wants to be more a part of the post-test interview, then that is okay. In fact, it can be a welcomed opportunity for the polygraph examiners and the clinicians to learn more about the theories of practice that is happening which means more utility of the polygraph exam for the clinician and stronger interviewing skills of juveniles for the examiner (that may just carry over into other types of polygraph exams).

Be extremely picky about your relevant questions, especially when doing a "full sexual history." There is a much larger debate to be had about the concept of a full sexual history, and is not the intended point of this board report. So to keep this concept short, stay away from questions such as "did you lie about anything in your full sex-

ual history packet?" and focus more on direct, observable behaviors such as "did you have sexual contact with more than one person below the age of 12?" If you are ever unsure of how to word PCSOT questions for adults or juveniles, please reach out to me directly or the PCSOT Committee and we will be happy to help.

It is no big secret that it is time that we start advancing ourselves forward when it comes to PCSOT testing. This is something I am very adamant about and will be creating additional trainings for people to attend. In the meantime, I encourage everyone in the PCSOT field to read what is being published by ATSA. It is important for everyone to be aware of what is being said and to form their own thoughts and opinions on the matter so that we can come together and expand our utility in the field.

Pre-Test Examination Interviews: The Importance of Listening

By George Baranowski

Yeah, I know, the first thought that comes into your mind when you hear this is saying something like, *"Yes, I know that."* Do you really? And do you always follow that philosophy? See that's the important part here.

One can obtain good information and more accurate and complete information in such interviews through **simply listening**. A personal incident comes to my mind every time I talk about pre-test interviews and this takes me back to when Post Conviction Sex Offender Testing (PCSOT) came into polygraph's focus, some 30 years ago. In this procedure, convicted sex offenders, placed on probation or parole, and also directed into treatment, usually in a weekly group program with a Treatment Provider, and also directed into a variety of specialized polygraph tests. In any case, when this program came into practice in my area, the first time I conducted a Sexual History test upon a subject, conducting a pre-test interview, conducted the polygraph test and presented the report to the probation officer and the subject's therapist, the subject's treatment provider went into an unexpected tirade. The therapist complained, *"I've had this guy in*

treatment with me for 2-years, and he's in there with this polygraph examiner for a couple of hours, has a polygraph test and comes out with pages and pages of admissions, other victims, and other violations. This isn't right." The thinking expressed by the treatment provider was that it was *"The fear of that Lie Detector Machine that caused all these admissions."* She had no thought that establishing a reasonable relationship and listening to this subject during our interview, produced this information.

In any case, it took a little time to build a relationship not only with this therapist but all the others in her counseling group, and to also promote the concept that we're all part of a team in this process and not adversaries. That she was not going to lose her job, as what she later told me. There were probably other states and other locations throughout the country who might have experienced this same kind of situation. In any case, that's the past.

But the point I'm presenting here has to do with the attitude that assists at developing a degree of rapport that works positively, rather than negatively, one that produces necessary information.

My background history is in law enforcement and the training I received back then was more or less what was seen in movies as well as television showing heavy duty interrogation activities. The theories presented then were more often designed to put the subject toward defense, to only get the admission, and to interrupt frequently. Even though there are interviewers who even today still seem to hold on to that attitude, there has been research that such communication or attitude design actually makes people more defensive. The person being interviewed senses things like control or superiority that would obviously produce defensive attitudes. Such commands as *"Get to the point", "Give me the bottom line"* are forms of impatience that can eliminate much of the detail from any interview. The *"Bottom line"* has no relevance without sustaining explanation.

Having said that, I have to say that there is in each of us, a terrible temptation to offer advice and criticism. This distorts or even blocks the information we are getting from the person we're interviewing. The point is, one can obtain more accurate and complete information in interviews through, ***"Simply listening."*** Allow the person to tell the full story, or all the information as that person sees it. How well the interviewer listens initially is crucial to the interview. The best practice is that only after the full description has been told in narrative form,

without interruption, should specific questions then be asked. And these questions should be based on missing elements of the narrative. A practice of these type of listening skills should improve interviews. One should listen actively rather than passively. Good listening is hard work.

Also, people speak at a speed that's slower than compared to what the brain can handle, and because of that, a poor listener's thoughts drift away into daydreams or outside thoughts during this almost "spare time," and might miss a point that should have been clarified. In other words, while a listener is wondering whether he locked the front door of his house when he left this morning or brought his I-Phone with him to work today or left it at home, the person he is interviewing may say something important – and guess what, that thought connection is lost. This important phrase may be spoken only once by the person being interviewed while the listener's thoughts have drifted away. This phrase he gave up may have contained an important item or important evidence, or maybe even an important admission, but it might have gone undetected because the interviewer was daydreaming.

Watching the clock can also be a distraction to good listening habits. Adjust your schedule. Make sure you have time to conduct this interview, that there's nothing time pressing.

There's another related issue to good listening skills which takes on the role of nonverbal behavior. Words only

convey a part of any message. I'm not completely sure of the percentage figure involved in this but its' probably more than 60-percent of a message is nonverbal.

To listen well, the interviewer needs to expand beyond mere words, gathering meaning from tone of the voice, eye contact, facial expression, hand gestures, body language, clothing and maybe even environment. When I think about individuals in our profession, and particularly members of the American Polygraph Association that projects these traits or abilities as almost a second nature to their personality, the person who automatically comes to mind is our editor, Mark Handler. I've had the pleasure of knowing Mark for a number of years now and experienced this developed gift first hand, without analyzing or realizing why this personality is so effective. He is a great example. There are of course other examiners or instructors who I feel also display these assets, such as Ben Blalock, Barry Cushman, Don Krapohl, John Schwartz, and Pam Shaw, to name a few. Also, there are some very excellent instructors who give programs on these issues throughout the country that are exceptional.

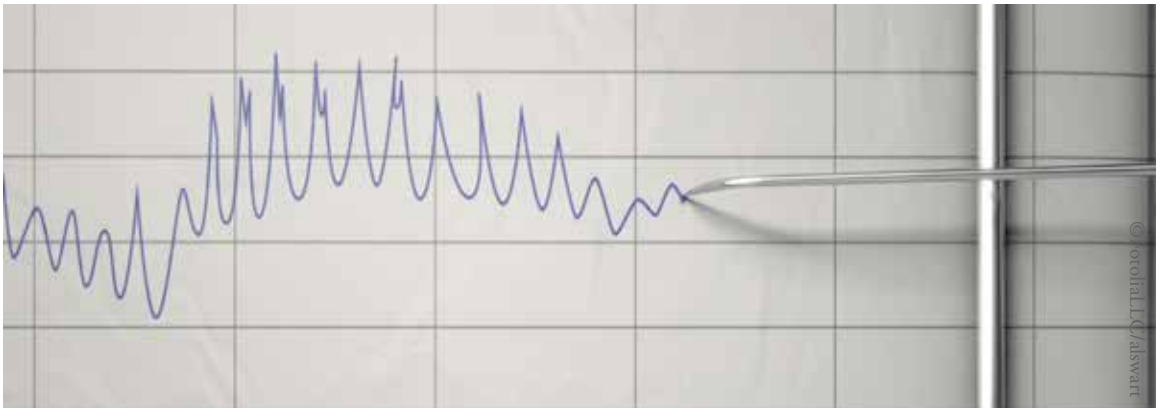
Emotion and attitude in particular, are often exhibited through nonverbal means and are often difficult to ex-

press through words alone. For example, if the interviewer may say, *"I'm very interested in what you are saying"* but unless these words carry with them the listener's intensity in gesture, tone of voice, eye contact and maybe even body movement, the total statement conveys very little interest or enthusiasm. Think about professional poker players for example, they develop a degree of competency in detecting deception and possess what we might call psychological skills that clearly separate them from amateurs.

In summary, listening has become an important part of interviewing. Experience has shown that the best listeners are also the best interviewers. Poor listeners interrupt; concentrate on questions instead of answers; they fail to ask follow-up questions to clarify what was said, they are impatient, over-eager, or over-relaxed; have little eye contact; and have bad listening habits.

An interviewer may not be satisfied that he or she had obtained enough information or that it has been received accurately. By adhering to a few simple, practical interviewing rules, especially good listening skills, will find themselves understanding others better, and may also earn an unexpected dividend – understanding themselves better.

Practical Polygraph: A Recommendation for Combining the Upper and Lower Respiration Data for a Single Respiration Score



by Raymond Nelson and Donald Krapohl

Polygraph testing instruments make use of multiple physiological signals including the cardio and electrodermal activity, respiration activity, physical activity, and vasomotor activity (American Polygraph Association; APA, 2016). Polygraph test data analysis involves the assignment of numerical scores to the data for each of the recording sensors and each iteration of the relevant target stimuli. Manual scoring protocols, based on visual inspection and analysis of the recorded data and some automated statistical scoring methods, have relied on nonparametric integer scores using a Likert-type coding system (Likert, 1932), referred to by polygraph field practitioners as seven-position scores, three-position scores and Empirical Scoring System (ESS) scores. An important aspect of numerical and statistical scoring of polygraphic data is that the respiration sensor consists of

1 A transducer is a device to convert energy from one form to another. The respiration transducers transform respiration activity into changes into a time series signal that can be digitized and analyzed numerically.

two transducers[1] and associated recording channels, for the thoracic and abdominal areas, that are evaluated together. In practical terms this means a single respiration score is derived from the two respiration transducers.

A number of publications have described the rubrics and protocols for manual analysis of polygraph data (Bell, Raskin, Honts & Kircher, 1999; Department of Defense, 2006a, 2006b; Dutton, 2000; Krapohl, 2002; Krapohl & McManus, 1999; Handler & Nelson, 2008; Krapohl & Shaw, 2015; Nelson et al., 2011; Raskin, Honts & Kircher, 2014, Weaver, 1980). Krapohl and Russell (2014) described the procedure for dealing with differences in upper and lower pneumograph scores. The present paper expands upon the Krapohl and Russell (2014) description, providing a rationale and procedure for handling scores when a relevant question can be scored against either of two comparison questions, along with a score sheet template that can more easily accommodate the scores arising from this procedure.

Numerical Scoresheet Arrays

A two-dimensional score sheet array can be arranged for each iteration of the sequence of test questions, such that each relevant question is entered as a case row with different sensor scores entered as columnar values (test question x sensor). Table 1 shows an example. Each iteration or repetition of the sequence of test questions is traditionally referred to as a chart, referring to the erstwhile practice of recording polygraph sensor data as a series of tracings or plots onto a time-series paper scroll. Table 2 shows that the cells of the score-sheet array can be rearranged so that the sensor scores are oriented as case rows with the series of relevant questions presented as columnar values (sensor x test question).

Table 1. Score sheet array for a single chart – questions as case rows.

	Respiration	Electrodermal	Cardio	Vasomotor
R1	0	2	0	0
R2	0	0	1	1
R3	-1	2	1	0
R4	0	-2	1	1

Table 2. Score sheet array for a single chart – sensors as case rows.				
	R1	R2	R3	R4
Respiration	0	0	-1	0
Electrodermal	2	0	2	-1
Cardio	0	1	1	1
Vasomotor	0	1	0	1

Table 3 shows a score sheet for three completed repetitions of a question sequence that includes four relevant questions. Taken together the dataset of scores for all iterations or repetitions (charts) of the question sequence are mathematically a three-dimensional array (questions x sensors x repetitions). However, manual scoring protocols have traditionally relied on the simple addition of positive and negative scores for the sensor array, and for this reason it is more convenient for scorers to represent the three-dimensional score-sheet in two dimensions (chart/test question x sensor) as seen in Table 3.

Table 3. Score sheet array for a single chart – sensors as case rows.				
Chart 1	R1	R2	R3	R4
Respiration	0	0	-1	0
Electrodermal	2	0	2	-2
Cardio	0	1	1	1
Vasomotor	0	1	0	1
Chart 2				
Respiration	0	0	-1	0
Electrodermal	2	2	2	2
Cardio	1	1	1	-1
Vasomotor	0	0	0	1
Chart 3				
Respiration	0	1	0	-1
Electrodermal	2	0	0	0
Cardio	0	0	0	1
Vasomotor	0	1	0	1
Chart 4				
Respiration				
Electrodermal				
Cardio				
Vasomotor				
Chart 5				
Respiration				
Electrodermal				
Cardio				
Vasomotor				
Subtotals	7	7	4	3
Grand total	21			

When the three-dimensional score-sheet array is rearranged in two-dimensions, the columns can be easily summed to derive the relevant question subtotals[2]. Question subtotals can then be summed to achieve a grand total score. Neither subtotals for individual charts nor the subtotals for individual sensors are used in any standardized way when manually scoring polygraph data. In the score-sheet arrays shown in Tables 1, 2 and 3 it can be seen that each of the physiological sensors receives a single numerical score. For the Electrodermal, Cardio and Vasomotor sensors it is a simple matter to derive a single numerical score for each sensor for iteration of each relevant question. A single numerical score is also assigned to the respiration sensor, even though the respiration sensor consists of two transducers.

Some field polygraph examiners may use a variation of the score-sheet array that includes separate data-entry cells for the scores of the thoracic and abdominal sensors. A potential problem arises because the column sums will include two respiration scores for each presentation of each relevant question instead of one. The potential problem is that respiration data can become overweighted or overemphasized, relative to the other sensor scores, in ways that are not accounted for in published normative data or polygraph validity studies. Fortunately, this is easily remedied by combining the thoracic and abdominal transducer scores into a single score for the respiration sensor, and by including only the respiration sensor score in the relevant question subtotals. As can be seen in Table 4, it can be helpful to include in the score sheet some additional data-entry cells for the combined respiration sensor score. In this way only the combined respiration sensor score is included when summing the relevant question subtotal scores.

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2 This has at times been referred to as "vertical scoring" but the use of the term vertical is equivocal in this context because it refers not to the actual data or recorded physiology but to the organization of the score-sheet array. A score-sheet organized differently, as occurs in some agencies, would give the same mathematical result by summing the scores horizontally. For this reason the term question subtotal is preferred.

Table 4. Score sheet array for a single chart – sensors as case rows, including thoracic and abdominal scores								
Chart 1	R1		R2		R3		R4	
Thoracic resp.	0	0	1	0	-1	-1	0	0
Abdominal resp.	0		-1		-1		0	
Electrodermal	2		0		2		-2	
Cardio	0		1		1		1	
Vasomotor	0		1		0		1	
Chart 2								
Thoracic resp.	0	0	1	0	-1	-1	0	0
Abdominal resp.	0		-1		0		0	
Electrodermal	2		2		2		2	
Cardio	1		1		1		-1	
Vasomotor	0		0		0		1	
Chart 3								
Thoracic resp.	-1	0	1	1	0	0	-1	-1
Abdominal resp.	1		1		0		-1	
Electrodermal	2		0		0		0	
Cardio	0		0		0		1	
Vasomotor	0		1		0		1	
Chart 4								
Thoracic resp.								
Abdominal resp.								
Electrodermal								
Cardio								
Vasomotor								
Chart 5								
Thoracic resp.								
Abdominal resp.								
Electrodermal								
Cardio								
Vasomotor								
Subtotals	7		7		4		3	
Grand total	21							

How to select the comparison question for each relevant question

Before the thoracic and abdominal transducer scores can be combined, and before the sensor scores can be summed to obtain the subtotal and grand total scores, it is first necessary to obtain the numerical scores. This must be done using the correct procedure for the selection of relevant and comparison question pairs. Selection of which comparison question to use for evaluation with each relevant question is determined by the polygraph test format (i.e., the design of the sequence and content of test questions) and the intended method for test data analysis. In other words, different test formats and different analysis protocols can sometimes employ different ideas for the selection of which comparison question will be assessed against each relevant question.

Polygraph field practitioners and polygraph trainees have traditionally memorized the various rules for selecting relevant and comparison question pairs for analysis. However, Nelson (2017) described a set of heuristic principles that can be used for manual or automated selection of question pairs for the complete variety of polygraph test formats. To simplify this matter, the selection of which comparison question to evaluate with each relevant question will rely on one of two basic approaches: 1) select the comparison question immediately preceding the relevant question, or 2) choose from the nearest two comparison questions preceding and subsequent to the relevant questions and select the comparison question with the greater phasic response.

Some polygraph formats are structured such that the selection of relevant and comparison question pairing is unambiguous, usually relying on the first of these two basic approaches, with the relevant question normally paired and evaluated with the preceding comparison question. Other test formats make use of the second method, and require the examiner to choose from the comparison questions that precede and follow the relevant question.

As a matter of convention, when choosing between two comparison questions, responses at the relevant question are evaluated against those at the comparison question that produced the greater change in physiological activity. Tables 3 and 4 are virtually identical except that Table 4 has a cell for the combined pneumo score. The important procedural difference is that thoracic and abdominal scores are combined *prior* to entering the data onto the score sheet when using

Table 3, and are combined *after* entering the transducer scores onto the score sheet when using Table 4.

Herein exists a potential area of inconsistency; if, for example, a program or field practitioner were to require that responses to relevant questions, for thoracic and abdominal transducers, be evaluated with the same comparison question. In practice this would require that field examiners evaluate each response to each relevant question to both comparison questions for each respiration transducer and then combine the transducer scores for both comparison questions before selecting the comparison question and score that will be entered onto the score sheet. In addition to increasing the potential for undocumented analytic activity, this could result in a reduction of numerical scores that contribute to truth-telling because it would prevent the field practitioner from selecting the transducer score from the comparison question that produced the greater change in physiological activity. This would be an unfortunate form of bias to impose, and for this reason common practice among polygraph field practitioners and polygraph programs has been to obtain the numerical scores for each recording transducer by selecting the comparison question that produced the greater change in physiological activity – even if this means that the thoracic and abdominal transducer scores are obtained via different comparison questions.

Done correctly, when using a polygraph test format for when responses to relevant stimuli questions are evaluated with two comparison questions, scores that contribute to conclusions of truth-telling can occur if either of two comparison questions produce a greater change in physiology than the relevant stimuli questions. At the same time, scores that contribute to conclusions of deception will occur only if the response to the relevant question produces a greater change in physiological activity than both comparison stimuli.

How to combine the thoracic and abdominal respiration scores

Although summing the thoracic and abdominal respiration score is incorrect, aggregation of the numerical values for two transducer scores into a single value is actually a simple and straightforward matter using the sign values of the numerical scores. Sign values are + if the number is greater than 0 and – if less than zero. The numerical value of zero is neither + nor – and can be thought of as signless or unsigned (sometimes referred to as 0 signed). A simple rubric can be

applied to seven-position, three-position and ESS scores.

1. If the sign values of the thoracic and abdominal sensors are opposite (+ and –) then the combined score is 0.
2. If the sign values are not opposite (including, + +, + 0, – –, or – 0) then the combined score is taken from the transducer score with the greater absolute value[3]. In other words, we use the score that is further from zero.

This simple rubric can be applied similarly to seven-position scores, three-position scores and ESS scores. Table 5 provides a number of examples using seven-position scores. Table 6 provides examples with three-position scores that can also be thought of as ESS scores.

Table 5. Examples (Ex) with seven-position scores.

	Ex 1	Ex 2	Ex 3	Ex 4	Ex 5	Ex 6	Ex 7	Ex 8	Ex 9
TR	1	-2	-1	2	1	2	-2	1	2
AR	-1	2	2	2	0	1	-2	-2	0
Score	0	0	0	2	1	2	-2	0	2

Table 6. Examples (Ex) with three-position scores (also ESS scores).

	Ex 1	Ex 2	Ex 3	Ex 4	Ex 5	Ex 6	Ex 7	Ex 8	Ex 9
TR	-1	0	1	0	1	1	-1	0	-1
AR	0	-1	-1	1	0	1	-1	0	1
Score	-1	-1	0	1	1	1	-1	0	0

3 An *absolute value* in mathematics is any positive or negative value taken as a positive value (i.e., without the sign). Absolute values are expressed mathematically by bracketing a number between vertical lines. So |-4| and |4| both represent the absolute value 4.

Summary

Scoring the respiration sensor is a process in which each presentation of each relevant question is assigned a single numerical score as a function of the evaluation of thoracic and abdominal respiration transducers. This process includes three important steps: 1) feature extraction – or identification of changes in physiological activity that are correlated with deception and truth-telling in the comparison question testing context, 2) selection of the comparison and relevant question pair and the assignment of a numerical score for each respiration transducer, and 3) reduction of the thoracic and abdominal transducer scores to a single respiration sensor score.

Scoring of polygraphic respiration data is potentially more ambiguous than scoring other sensors because the nature of respiration activity as more easily influenced by a combination of voluntary and involuntary activity. Scoring of polygraphic respiration data is also more ambiguous than scoring other sensor data because the respiration sensor consists of two transducers – one for the thoracic area and another for the abdominal area. Some variations of the score-sheet array include cells for both respiration and abdominal transducers; other score sheet arrangements may capture information only for the combined respiration sensor. There is no inherent basis to suggest that one score sheet is more correct or than another, though there are some advantages in terms of the reproducibility and accountability of the analysis when capturing more information.

As the polygraph profession moves towards increasingly structured and reproducible analytic models it may become increasingly important or useful to continue to increase the degree of standardization among polygraph programs and polygraph field practitioners. It is hoped that documentation of the procedures for combining the respiration transducer scores into a single respiration score will help serve the future needs of the polygraph and the needs of the agencies and communities served by the polygraph profession.

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Polygraph Instrument or Polygraph Machine

by Joel Reicherter
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This article is in response to Director Raymond Nelson's article published in the Sept/Oct APA Magazine. I commend Ray's scholarly and dedicated contributions to the APA and the polygraph profession before expressing my opinion of his article. But arguments on the ongoing debate in our profession about the application of the descriptive term "instrument" versus "machine" can reflect an important expression of terminology to the larger scientific community.

As Ray mentioned the expression "instrument" is widely used in polygraph schools. In my teaching of neurophysiology at NCCA from January 1997 through January 2007, I often made specific reference to the recordings obtained during a polygraph examination were done by an "instrument" and not a "machine".

The background of the application of those descriptive terms can have some multiplicity of usage. Let's start with some variable definitions of the

word: “instrument,” not applicable to the polygraph profession.

- Musical Instruments
- Legal Instruments: documents of many different types
- Specialized hand-held Instruments used by surgeons or dentists
- Specialized tool Instruments specific to a variety of professions
- In the medical community, many technical “instruments" provide physiological patient data to the physician for analytical assessment and diagnosis - the EKG or EEG recordings would be good examples.

Now for the application of the term “machine”. Machines are devices designed to perform “work”. Work may be a difficult word to define in a simple sentence because of its many varied applications, particularly in our complex culture and technical advances in recent times. However, a simple and basic understanding of work may be of help to understand the application of the term “machine”.

Perhaps the simplest form of work can be described as moving an object through a distance by a force, typically measured as foot-pounds. Typically, a machine will perform that task by converting energy into the force. For example, converting electricity into a snow blower “machine” which will compress air into a force to move the snow. How about a motorized lawn cutting machine that will convert gasoline into high speed rotating blades to cut the grass? A bull dozer converts gasoline into soil movement.

These examples, and many others, dramatize that some form of work requires that energy be converted from one form to another to accomplish the task. Machines make that energy conversion. In the medical community, the device that helps to pump blood and assists in the physical breathing activity of a patient is commonly referred to as the “heart lung machine” because it does “work”. In contrast, the EKG provides technical data to the medical decision maker, and therefore referred to as an “instrument”. Now that I have provided a brief and somewhat simple description of “instrument vs machine”, I ask the following question: “Is the polygraph device an instrument or a machine?”

The neurophysiological recordings of electrodermal activity, ventilation

dynamics and cardiovascular activities obtained during a polygraph examination are the outcome of the brain's management of these visceral systems. In that regard, the polygraph recordings parallel the EKG and other physiological recordings obtained for medical evaluation of the subject (patient). Like the medical doctor who must evaluate the "instrumental" recorded data, the polygraph examiner must have the knowledge to follow the proper examination protocols and the neurophysiological (PDD) skills to evaluate the polygraph recording outcome.

If we can agree on the definition that a machine does work like an automobile's engine converts the energy provided by gasoline into a moving force or the snow blower converts electricity into high pressure air to move snow, then what would be the work effort of the polygraph device?

In my opinion, the algorithms developed by polygraph researchers to assess the neurophysiological recordings obtained in the polygraph format setting must be evaluated by the examiner for decision making. As in all science, particularly medical science, data collected from physiological activity leads the healthcare evaluator to assess the recorded outcome.

Keep in mind that all scientific tests are subject to an error rate. To declare a test to be "scientific" does not mean free of error but rather the testing format followed accepted testing protocols by that discipline. The most significant protocol in science is to compare a "variable" to a "control". An "inconclusive" outcome is a buffer against an unacceptable error rate.

In conclusion, an "instrument" must record the polygraph subject's neurophysiological assessment of the question presentations. Based on the scientific polygraph question format designs available, pretest examination interviewing skills and post-examination recording test data analysis methods, the Polygraph Examiner is the "Decision Maker" of the instrumental recordings obtained in the polygraph setting.

If historical definition of terminology is still a problem for polygraph personnel, perhaps we can adopt the term "Polygraph Device".

The Influence of Three Biological Rhythms on the Psychophysiological Reactions of a Person

by Lysenko, Serhiy Oleksiyovych[1]

Modern polygraph in Ukraine has an increasing interest in the study of the factors that control the psychophysiological reactions of the organism. It has long been known that psychophysiological reactions are related to a person's emotions. It is the emotions about the stimuli that are often most important to the person at a certain moment and in a certain place, [3]. I propose to consider some factors that have an undoubted influence on the everyday functions of the human body. These factors are often deprived of the attention of polygraph examiners in the study of psychophysiological reactions and the laws of their origin and development.

You all have probably had days when everything was falling from your hands, you fell into different overwhelming situations, you were unnecessarily conflicted or it was difficult to concentrate on any issue. Often you can blame this on the changing biological rhythms of your body.

Biological rhythms are fluctuations in the functional parameters of the human body relative to the conditioned

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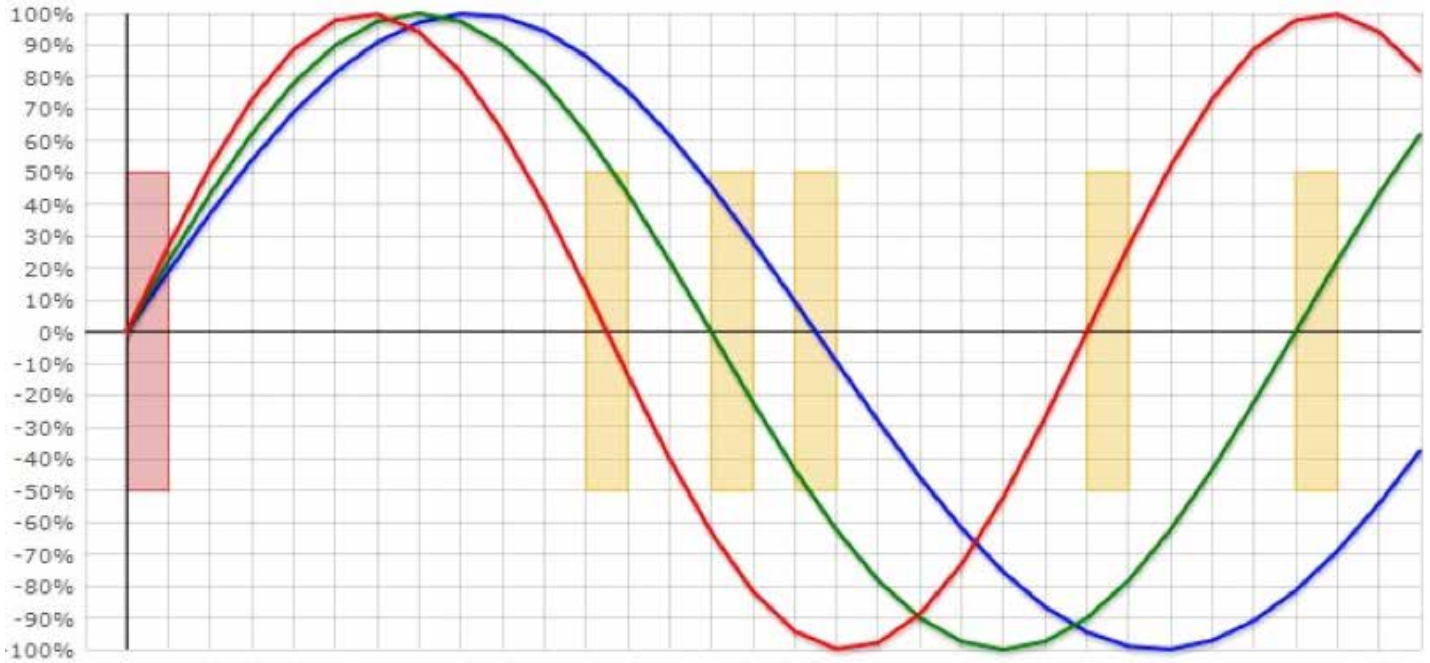
zero level, deployed in time. All biological rhythms originate from the date of birth of a person, they come out of this date, which is a common zero point for them. The most important rhythms are three multi-day biological rhythms - physical, emotional and intellectual, which have the most powerful influence on the state of the organism [1].

In humans, the physical state (the physical biological rhythm) changes with a period of 23 days, more precisely 23.688437 days. The emotional biological rhythm changes with a period of 28 days, more precisely 28.426125 days. Intellectual abilities of a person, together with an intellectual biological rhythm, change with a period of 33 days, more precisely 33.163812 days. Half of the period is a positive value for the human body, during which the activity of the corresponding functions rises, and the second half is negative when there is a decrease in their activity [4].



The graphs of biorhythms have the form of a sinusoid, ranging from a maximum +100% activity level to a minimum -100% level, around the axis, reflecting the course of time measured in days. Zero zones are noted when the sinusoid crosses the axis and passes from the positive to the negative, and vice versa. In these places, the organism experiences a risk zone for those functions, because at these points, the functions, by their qualities, almost come to naught. Also, a special threat to humans can arise if all three basic biological rhythms of a person are in the negative zone, when all functions are reduced and weaken each other [4].

The first time I heard about the biological rhythms of a man was from a scientific adviser, Doctor of Psychology, Professor V. Klimenko. He described how, as a psychologist for the Soviet national chess team, he served the world champion Anatoly Karpov. It was then, according to him, the study of the basic biological rhythms of man was actively conducted. Professor Klimenko said there were even detective stories around the most successful dates for the three main biological rhythms of Karpov. Their team was trying to fix the date of the match, so they tried to set the date on these most successful dates for their athlete and on the most unfortunate dates for his opponent. And the opposing team, on the contrary, knowing and studying the same questions, tried to counter these intentions and tried to win for themselves their most favorable days, and the unsuccessful days for the Soviet chess player. Professor Klimenko suggested that his calculations and conclusions, sometimes altered the fate of Soviet sport of chess [1].

Since then, I began to study the features of the influence of the three main biological rhythms on the psychophysiological reactions of man, in the context of polygraph. As a trained polygraph examiner, I sought to determine what, if any, influence these had on polygraph testing.

The physical biological rhythm is responsible for the physical condition of a person, his or her state of endurance, muscular and, most importantly, cardiac strength and endurance - the ability to withstand stress. During the positive period, the physical tone of the body rises, and during the negative period, it decreases.

Zero is a zone of high risk. In the zero zone, there are possible attacks of weakness and exacerbation of heart diseases, and an increased pain threshold for sensations. Psychophysiological reactions of a person become dulled, which is expressed in sluggish breathing. At the zero mark of the physical biological rhythm, as shown by laboratory tests, a person can have weakened sensitivity to reactions on the cardio channel. They sometimes

acquire a chaotic form of heart failure, which reduces the information cardio channel [5].

With a weak cardiovascular activity, at zero mark of the physical biological rhythm, disturbances occur in the flow-isolation, respectively, the blood pressure channel which can then become less informative. In the event that it is not possible to postpone the polygraph for a day, it is recommended that more attention be given to stimulating the interviewee on a test topic. A thorough pre-test conversation is recommended, which could help activate memory, stimulating the release of additional adrenaline into the blood [2].

The emotional biological rhythm "guides" all five senses and is responsible for the body's ability to create and experience emotions. During a positive period of emotional biological rhythm, a person is able to create works of art, feel loved by others, and is often accompanied by a higher level of sensitivity. In the negative zone of this biological rhythm, people often experience a crisis of creativity and sensitivity, and they may be depressed. In zero, the most dangerous zones there is an increased tendency to be conflicted and experience excessive anxiety and irritability [1].

The psychophysiological reactions in such a state can be reflected in the form of a false positive result or a strong irritation in the testing procedure. There may be irritability and conflict in the discussion of the comparison and testing topics. In the zero indicator of emotional biological rhythm, a person's emotions can acquire an illogical, violent or decadent nature. In laboratory conditions, it has been established that polygraph channels may have an exaggerated response to relevant, neutral and comparison stimuli. The analysis of such tests can cause difficulty and can lead to an uncertain result. The examiner, in such cases, is recommended to carefully prepare for testing. If you get an undefined result, it is recommended to move the test to another day [6].

The intellectual biological rhythm determines the state of the person's mental activity, his or her ability to memorize various information, to study sciences, to learn, and to draw the conclusions. Accordingly, in the positive part of this biological rhythm such abilities are increased, and in the negative part they are lowered. In zero zones of intellectual biological rhythm, effective mental activity can become paralyzed [1]. In the zero mark, it is difficult for the person interviewed to concentrate on the topic of verification, it is difficult to recall and update the situation in your mind.

In this case, it is necessary to devote more time to pre-test conversation and allocate more time to discuss details of the situation from the mem-

ory of a person. Particular difficulty can arise during testing by the search technique, where the whole emphasis is on remembering a person with respect to true private traits. In case of receiving undefined test results, I recommend moving the test to another day and repeating it in a different state of the person.

It should be noted that for each person, the level of influence of biological rhythms is very individualized, depending on what kind of lifestyle people lead. If a person engages in physical labor, constantly experiences physical exertion or trains his or her body, then the influence of the negative period of the physical biological rhythm will be less noticeable. Creative people, and people of art, regularly train their emotional abilities and they are able to better control their mood. Therefore, it is believed that the physical and emotional state of the body can be trained and then the effect of biorhythms will not be felt so strongly [7].

Only the intellectual level of a person is not subject to training, he or she is, or is not, intellectually motivated. The general level of a human education is constant and will fluctuate depending on the fluctuations of the intellectual biological rhythm of that person. Therefore, it is necessary to conduct a pre-test conversation more attentively, to study the ways of life of a person in order to take into account the degree of possible influence of biological rhythms on him or her.

The study of the state of the biological rhythms of the organism of the respondents, before testing, can be helpful for a more thorough picture of their internal state. This study will help in planning further conversation and establishing contact [8].

As an aid to the work of a polygraph examiner in calculating the levels of three biological rhythms, I want to recommend mobile applications that do the calculations for you. This feature allows you to quickly determine the level of biological rhythms of the right person by the date of his birth and use it in his work. There are mobile apps commercially available to help assess these rhythms.

It should be noted that the problems associated with the influence of the three main biological rhythms on a person's psychophysiological reactions requires further study. Our laboratory and field experiments will attempt to test these new hypotheses. I hope for further cooperation in this direction with the APA for the development of science and technology for polygraph testing.

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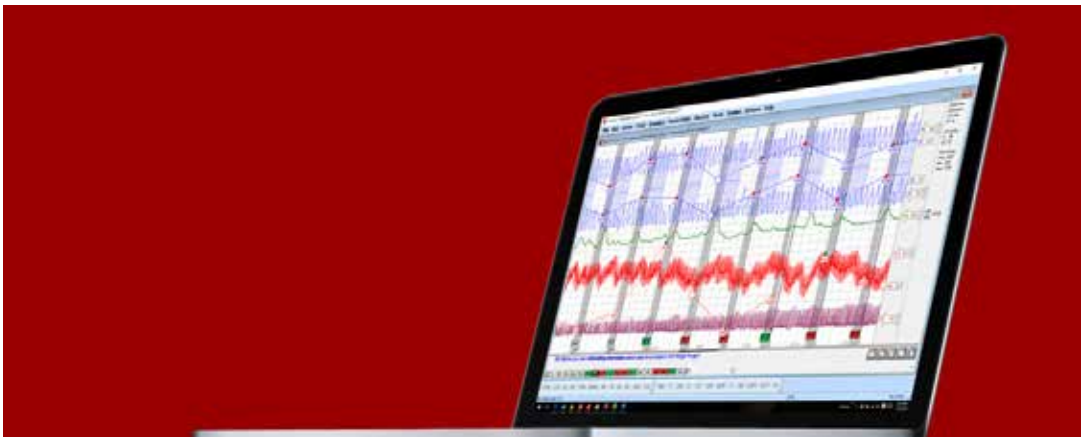
The Practice of Conducting Forensic Psychophysiological Examinations with the Use of Polygraph in Ukraine



by Usikov IP[1]

This paper will describe the Ukrainian practice of forensic examinations using polygraph examinations for the period 2007-2017 conducted by the Ukrainian Bureau of Psychophysiological Research and Safety. We list the categories of criminal cases on which the polygraph examinations were appointed and conducted, the categories of officials who appointed these examinations, the total number of examinations conducted and describe the procedural decisions at different stages of the pre-trial and judicial investigation. Finally, we discuss the forensic and procedural requirements for the formulation of an expert opinion.

Introduction of modern scientific knowledge, scientific developments and technical knowledge in law enforcement activity, provides an opportunity to address the key tasks of criminal justice. The aim of which is to establish objective information in a criminal investigation. These aims have attracted the attention of forensic scientists. The introduction of the new Criminal Procedural Code of Ukraine radically changed the domestic criminal justice system, and created

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new guidelines for further reform of the legal system. In particular, was the reform of the structure of law enforcement agencies and the prosecutors, the purpose of which was to ensure effective protection of constitutional rights and freedoms for us of our citizens.

The new Criminal Procedure Code of Ukraine, has changed the approach to the use of special knowledge of authorized persons who investigate criminal offenses and provide them with sources of evidence. This, provides broader possibilities for applying the Institute of Forensic Expertise.

Since the 1st of November 2010, the profession "expert polygraph examiner" has been officially included in the National Classifier of Occupations of Ukraine (code 2144.2), which is a state recognition of this profession in Ukraine.

To date, in Ukraine, the number of polygraph examiners, constantly in professional activity, is about 300 specialists, monthly up to 3 thousand tests are conducted.

Of the specified number of polygraph examiners, only about 10 specialists are taken to conduct forensic examinations with the use of a polygraph.

We have analyzed the Ukrainian practice of applying polygraph at the pre-trial and judicial investigation for the last 10 years (2007-2017). The collected information confidently shows the significantly increased interest of all procedural categories of participants in forensic investigation productions to this type of expert research using a polygraph.

To date, we can confidently talk about the existence of at least 10 years of statistics of judicial decisions from courts of various instances, including appeal courts, with consideration of the use of polygraph examinations.

The following information came from the official Internet resource of the Ministry of Justice of Ukraine - the Single State Register of Judicial Decisions (http://www.reyestr.court.gov.ua/), for the period from 2005 to May 2017. In court documents found in the Register, in different variants there are 211 mentions with the wording "psychophysiological or psychological examination with the use of a polygraph". (registration № resolution in the Register: 51918739, 64034113, 53087565, 31422491, 61662487, 62702947, 64586660, 51670223, 46402520, 51918740, 53341793, 47733675, 59696216, 66387624, 65246972, 61212439, 46127381, 55166217, 51817700, 58695211, 28731363,

43373462, 59243159, 52324616, 64705249, **52098328, 65214286, 42181396, 53139780, 61363936, 52167228, 55329751, 55348497, 53341793, 59696216, 55591923, 61662487, 59323284, 64513418, 47095268, 42181372, 49394616, 55268937, 49395170, 55139779, 52712620, 64825647, 63866532, 63936530,** 53044392, 64082949, 44564797, 45621598, 45621612, 65368042, 66281038, 57853258, 46402520, 58448941, 57741973, 57483211, 51460370, 48229022, 43373462, 54921469, 65933594, 55979851, 55591769, 52094779, 64477518, 53570730, 54247135, 44528645, 56151125, 46750008, 28516163, 41613731, 57502555, 58275248, 57413394, 44365919, 35541365, 39808994, 41739169, 59129440, 48422946, 32850600, 59802800, 56322165, 53673527, 27275950, 57586152, 6378406, 42957873, 46647457, 64989453, 9400244, 59511758, 43401977, 57413247, 34599284, 59345903, 9531920, 2320953, 42272381, 22390773, 35306744, 58719608, 1094779, 8100829, 55485223, 66655674, 27623466, 53132068, 10682076, 53885781, 49460620, 10990938, 44988490, 58902286, 32703632, 3909595, 62395649, 41742836, 24704154, 37219574, 59118401, 43144486, 31369803, 32878716, 7545977, 58604619, 57413587, 56340204, 59721326, 12503683, 92321, 54913124, 27595308, 64270837, 36864697, 54150180, 28622902, 63375091, 39659069, 36646877, 40620162, 61839454, 23975190, 56876996, 59248624, 61297360, 58113386, 59768493, 57184522, 2416101, 59768513, 58719652, 46292596, 32237353, 36826691, 31515987, 24568714, 41551355, 12691124, 58359044, 25217722, 58282068, 42048160, 66547834, 39808547, 56901468, 31507889, 20834222, 20853474, 125381, 50718465, 42634844, 66192826, 51785000, 42897584, 65459135, 56560130, 56759082, 42099755, 3629237, 39106724, 28493889, 58936336, 19437972, 41927514, 46586948, 32332625, 26235479, 22073060.)

Mention about the polygraph, in most cases, contained mainly in consideration by courts solicitors about setting of the indicated examinations, and part deals with sentences, where this examination is taken into account as one of proofs.

The analysis of information from the Register, which is freely available to the Ukrainian Internet portal, showed the following statistics
(as of May 29, 2017):

Business cases - 2

Administrative cases - 15
Civil cases - 18
Criminal cases – 176

2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
1	2	1	4	1	7	9	17	21	28	39	62	19

The statistics presented gives only a general understanding of the availability of the dynamics of the polygraph as an expert method in the judicial and investigative practice of Ukraine.

The increase of polygraph use becomes apparent in forensic investigation practice since 2012. It was this year in Ukraine that a new criminal procedural code began to operate, the provisions of which have come close to the European practice of legal proceedings.

On 27.07.2015, the Ministry of Justice of Ukraine amended the "Instruction on the appointment and conduct of forensic examinations and expert studies" (approved on 08.01.1998 No. 53/5 (as amended by Order No. 1950/5 of the Ministry of Justice of Ukraine of 26.12.2012, Registered with the Ministry of Justice of Ukraine on January 2, 2013 under No. 1/22533.), as well as in the "Scientific and methodological recommendations on the preparation and appointment of forensic examinations and expert studies".

In Section VI, paragraph 6.8 of the said Instruction, had put additions about the possibility of carrying out expert studies using a special technical means - a computer polygraph. Starting in 2015, the Kiev Scientific Research Institute of Forensic Expertise, for the first time at the state level, began to conduct forensic psychological examinations with the use of a polygraph by several experts- psychologists having special training that allows conducting studies using a polygraph.

The demand for courts and investigative bodies in this type of expert research has increased quite rapidly, over the period 2015-2017, only the specified state expert institution con-

ducted up to 70 expert examinations and expert studies using polygraph. During the period from 2009 to May 2017, experts of the Ukrainian bureau conducted 87 expert examinations with the use of a polygraph.

Categories of the accepted court and judicial decisions taking into account the conclusions of examination with the use of polygraph
(The practice of the Ukrainian bureau PFDB for 2007-2017).

Indictments (court) 11 (13%)
Exculpatory decisions (Court, prosecutor's office) 3 (3%)
Refusal to prosecute during pre-trial investigation 65 (75%)
Considered 8 (9%)

The categories of criminal proceedings for which psychophysiological examinations were conducted using a polygraph (The practice of the Ukrainian bureau PFB 2007-2017).

Murders (including custom) 32
Official crimes (including those with confirmed ОСГОПГ??) 12
Theft, looting 9
Severe bodily harm, incl. Accident 8
Rape 4
Hooliganism, arson 4
Drug Sales 4
Pedophilia 3
Bringing to suicide 2
Abduction of a person (including staging) 2
Raiding 1
Civil and Administrative cases

The examinations were requested as follows:

Appointed by investigators 54

Appointed by the prosecutor's office 8

Appointed by the court 13

Appointed by lawyers 12

Of the total volume of examinations conducted in the Ukrainian Bureau with the use of a polygraph, approximately 30% of the total number of examinations passed before consideration by the courts. Thus, on the example of the expert practice of the Ukrainian Bureau of Psychophysiological Research and Security, hidden (latent) statistics on the use of polygraph in criminal proceedings, with the adoption of procedural decisions at the pre-trial investigation stage is 70%. The brought numbers are very approximate, because lately greater part of examinations was appointed and conducted exactly already in courts.

Legislation of Ukraine provides for the possibility of conducting forensic examinations by persons who are not judicial experts. First of all, this is determined by Part 4, Article 7 of the Law of Ukraine "On Forensic Examination". Thus, even though in the register of forensic experts of the Ministry of Justice of Ukraine, there are no forensic experts with the qualifications of an expert polygraph examiner, an investigator, a prosecutor, a lawyer or a court can attract specialists and appoint them as experts to conduct one specific examination.

In addition to the Law "On Forensic Expertise", the legal provisions of the Law "On the Bar" are used, as well as a number of articles of the Code of Criminal Procedure. Any expert study is a scientific hypothesis. In our deep conviction, the conclusions of expert polygraph examiners can only be considered. In all cases, they should be considered in conjunction with other proofs and materials of criminal proceedings. This particularly applies to situations where available proofs of guilt or innocence of a particular person is not enough and it is difficult to take a procedural decision.

Our practice shows that, as a rule, a polygraph is used in court proceedings with insufficient evidence base to obtain additional objective information about the actions or awareness of the suspect, accused, victim or witness about what happened.

The production of psycho-physiological examination using a polygraph is carried out only by those questions that are connected with the clarification of any actions in the past. Each question submitted to the study should help to make the correct legal assessment of the action in the event of a crime. The competent formulation of the conclusions made by the expert polygraph examiner with observance of all the necessary procedural and forensic requirements allows one to consider, evaluate and recognize the results of his work as one of the proofs. Ultimately, this makes it possible not only to build up investigative and judicial versions with greater confidence, but also to take decisions in the case together with other collected evidence.

The value of a psychophysiological study using a polygraph is determined not only by the ability of the polygraph examiner to properly conduct testing, but also by his ability to correctly articulate and formalize the results of his work, which is especially important when it comes to investigative and judicial situations. For court, an important requirement in assessing the expert's conclusion as evidence,

along with its admissibility, relevance and reliability, is accessibility for perception, scientific support and credibility of the conclusions in it.

The need for coverage of the principles related to the use of polygraph is essential for society, since the lack of theoretical knowledge in this issue, awareness of the technology of instrumental psychophysiological research causes an ambiguous interpretation of the results of such studies, in particular in criminal proceedings. The modern state of use of the results of expert conclusions of psychophysiological examinations carried out with the use of polygraph shows that the indictments and judicial decisions are no more than 15% of the total number of forensic examinations performed in open criminal proceedings. The other almost 85% - are examinations in respect of citizens and psychophysiological examinations carried out on them using a polygraph for criminal proceedings, in which procedural decisions were taken to deny or suspend the criminal prosecution or acquittal of a person. That is, a psychophysiological examination using a polygraph in the overwhelming majority of cases turned out to be more necessary and useful precisely to confirm the person's innocence in the commission of a criminal offense. For this reason, the presumption of innocence is always the first principle of the methodical approach when preparing and conducting instrumental diagnostics of the verbal information.


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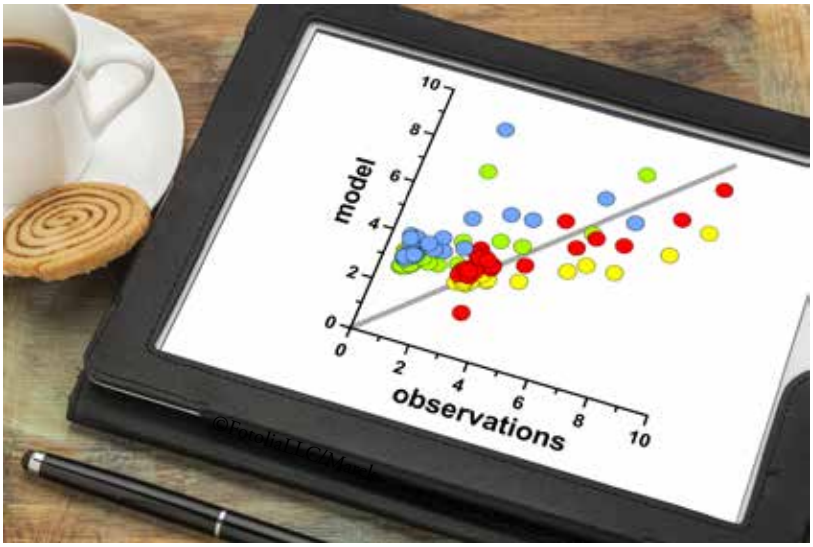
Five Minute Science Lesson: Correlation and Covariance (What is it, and How to Roll-your-own)



by Raymond Nelson

Science is all about trying to understand the universe and reality. What is it? How does it works? What is it made of? How big is it? What is going to happen? It's a big universe and so we do not try to understand everything at once. Instead we take things one little piece at a time. If our knowledge about some small aspect of the universe and reality is correct then we can expect our knowledge to fit together nicely with other pieces of knowledge of other pieces of the universe. Understanding the universe, or anything in it, requires that we organize our knowledge such that our conclusions can be re-analyzed and reproduced at a latter time without having to start at the beginning and learn everything anew. In this way others might begin to develop additional knowledge about other aspects of the universe and reality.

Understanding the universe, or anything in it, requires that we not only systematically differentiate one thing from another but that we also attempt to learn about the relationships between things. Relationships between physical things, much like relationships between people, are abstract and amorphous things that cannot themselves be subject to physical measurement. And yet amorphous

things exist; they are describable and real. Relationships between things can be experienced, observed and even quantified. And so, a goal of science is to understand, describe and quantify things in the real universe and the relationship between those things.

Covariance refers to similarities in the changes in something and something else. The notion of covariance implies that the phenomena under observation are changing and not static. Covariance means that as one thing changes the other thing tends to change in a similar way. Covariance in statistics refers to a unitized description of how much the two things change together.

In general usage *correlation* is a word that describes a mutual relationship or connection between two things. In scientific and statistical usage, correlation also refers to the statistical strength of the relationship. The difference between relationship and correlation is that a relationship is an abstraction that can be observed, experienced or described qualitatively, whereas a correlation implies that we have attempted to quantify a relationship between two things. Correlation implies that the relationship between two things is imperfect. A perfect correlation between any two things would be easy to understand because every aspect of one thing would be mirrored in the other. A perfect correlation would signify redundancy, wherein understand one thing to any degree of satisfaction will provide equivalent knowledge and information about the other. Perfection, however, is rare. Most things, including most relationships and most correlations between things are imperfect. Imperfect relationships and imperfect correlations take more effort to understand and quantify.

To our good fortune, others before us have devoted considerable energy and effort to define the concepts and procedures necessary to begin to describe and quantify the correlation between observable phenomena in the form of a *correlation coefficient* (Katz, 2006; Pearson, 1895), also known as the *Pearson correlation*. The Following is a description of the intuition and procedures for the calculation of a Pearson Correlation coefficient that is often designed with the letter *r*.

Intuition: how to think about correlation

Intuition refers to our ability to think about and understand the concept. The intuition for a correlation coefficient is this: a perfect correlation is signified by the value 1.0, whereas no correlation is signified by the value 0 (similar to 0%). These are similar to the values 100% and 0%, though it would

be incorrect to discuss or describe correlation coefficients as percentages. No correlation (no relationship) can also be thought of as a completely random relationship in which any change on one thing can be accompanied by absolutely any of all possible changes in the other thing. Also, correlations can be either positive or negative (inverse correlation). Inverse or negative correlation means that a change in a particular direction for one thing is generally accompanied by a change in the opposite direction for the other thing. A correlation coefficient is therefore a number on a continuum from -1. 0 to +1.0 (See Figure 1).

Figure 1. Correlation coefficient
-1.0 ---------- 0 ---------- +1.0

How to roll-your-own correlation coefficient

Calculation of a correlation coefficient requires that we first quantify the observed phenomena. And so we begin with any set of data. For this example we will calculate the correlation between two fictitious sets of data, A and B. Calculation of a correlation coefficient requires that the two group have an equal number of items and assumes that the data are normally distributed.

Data A is the set of number 1, 2, 3, 4 and 5. Data B is the set of numbers 6, 7 8, 12, and 10. Notice that there is some describable, though imperfect, relationship between these two sets of numbers. Data A is a simple sequence of five numbers beginning at one and for which each item increases by one. Data B appear to be a similar sequence beginning at six and for which the first three items increase by one while the fourth item is out of sequence before the last item is the expected value 10.

Data A
1
2
3
4
5

Data B
6
7
8
12
10

Step 1: calculate the mean of each data group.

This is done easily by summing the items for each group and then diving those sums by the number (n) of each group.

Mean A = 3
Mean B = 8.6

Step 2: calculate the standard deviation of each data group.

Virtually every computer today can run software such as Excell (proprietary) or LibreOffice (free/open source) that an easily calculate standard deviations using included functions. Or you can roll-your-own standard deviations using the procedures described by Nelson (2017; *Five Minute Science Lesson: An Algorithm to "Roll-Your-Own" Standard Deviations)*. for a description of how to roll-your-own standard deviation.

Standard Deviation A = 1.581
Standard Deviation B = 2.408

Step 3: calculate the deviation for each value and the corresponding group mean

Deviation refers to the difference between each item and the mean. The mathematical deviations give us information about how the data vary around the group means.

Group A Deviations
1 – 3 = -2
2 – 3 = -1
3 – 3 = 0
4 – 3 = 1
5 – 3 = 2

Groups B Deviations
6 – 8.6 = -2.6
7 – 8.6 = -1.6
8 – 8.6 = -0.6
12 – 8.6 = 3.4
10 – 8.6 = 1.4

Step 4: Calculate the products of the paired deviations for the two groups

Multiply each pair of deviations for the two groups. Multiplying the paired deviations gives us a way to quantify the deviation of the two groups.

-2 * -2.6 = 5.2
-1 * -1.6 = 1.6
0 * -0.6 = 0
1 * 3.4 = 3.4
2 * 1.4 = 2.8

Step 5: Sum the products of the deviations

Summing the products will give total amount of deviation around the two group means.

5.2 + 1.6 + 0 + 3.4 + 2.8 = 13

Step 6: Divide the summed product of paired deviations (the result from step 5) by N-1

N is the number of pairs. We divide by N-1 because we cannot observe the entire population and are limited to calculation with a sample. When we have access to all population data we can divide by N.

13 / (5 – 1) =
13 / 4 = 3.25

Step 7: Divide the result from step 6 by the product of the standard deviations for the 2 groups

The product of the standard deviations is obtained by multiplying the results from step 2.

3.25 / (1.581 * 2.408) =
3.25 / 3.807 = .854

Result is the correlation coefficient

r = .854

In this example fictitious data there is an obvious correlation between the changes in the items in the two groups. As the items in Group A increase we can generally, though not always, expect to observe the items in Group B to increase.

Covariance coefficient (what is?)

Covariance is related to correlation. The covariance coefficient is the un-normalized measurement of joint variability between two groups of data. The normalized measure is the correlation coefficient. In the example above we normalize the result in Step 7 by dividing the result of Step 6 by the product of the standard deviations for the two groups. In other words we see the covariance coefficient at Step 6. The covariance coefficient tells us essentially the same conceptual information as the correlation coefficient but does so using units of measure that are the same unit of measure in which the data are expressed (whereas the correlation is constrained or normalized to the range -1.0 to +1.0).

Interpreting a correlation coefficient

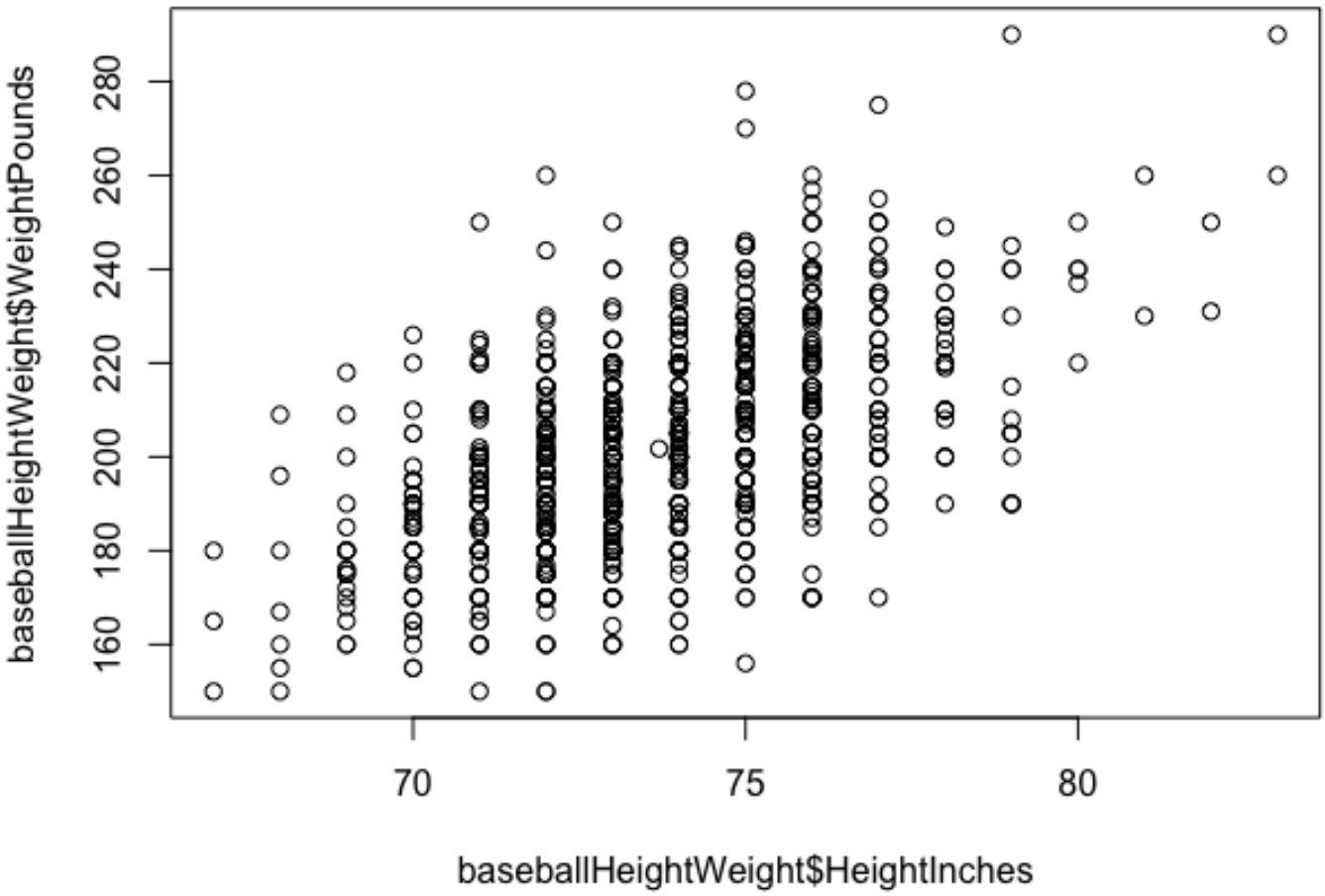
Statistical correlations are often interpreted described qualitatively using words such as *very weak*, *weak, moderate, strong,* or *very strong.* A desire for concrete interpretation guidelines has prompted some to suggest numerical thresholds for different qualitative adjectives, though these are increasingly viewed as arbitrary, unwise and problematic because they distract from an adequately nuanced understanding

of the information. To simplify our understanding and interpretation of meaning of a correlation statistic it is generally sufficient to remember that correlation coefficients close to 1.0 are approaching a linear or perfect relationship. Similarly, a relationship that approaches the value -1.0 is approaching linearity or perfection though as one thing changes the other will be observed to change in the opposite direction. Values close to 0 signify no relationship – also thought of as a random relationship. It is also helpful to develop our understanding and intuition for correlation coefficients by thinking about examples.

An example using height and weight with major league baseball players

A sample of baseball statistics can be obtained from (http://wiki.stat.ucla.edu/socr/). Intuitively we understand that there is a coherent relationship between player height and weight. Players who are taller will tend to weigh more than those who are less tall. Using a sample of N=1035 players we know that their heights rage from 67 inches to 83 inches and their weights range from 150 to 290 pounds. We can calculate the correlation between height and weight as r = .542. This is generally regarded as a moderate to strong correlation. We know that height and weight are determined largely by genetics, though nutrition and lifestyle (and growth hormones) may also play a role. We will forgo the details of the calculations and encourage readers to obtain the data and work it out for themselves. Figure 2 shows the scatterplot of players' height and weight. The correlation between player height can be observed in the apparent linearity of the data points; as player height increases player weight also generally increases.

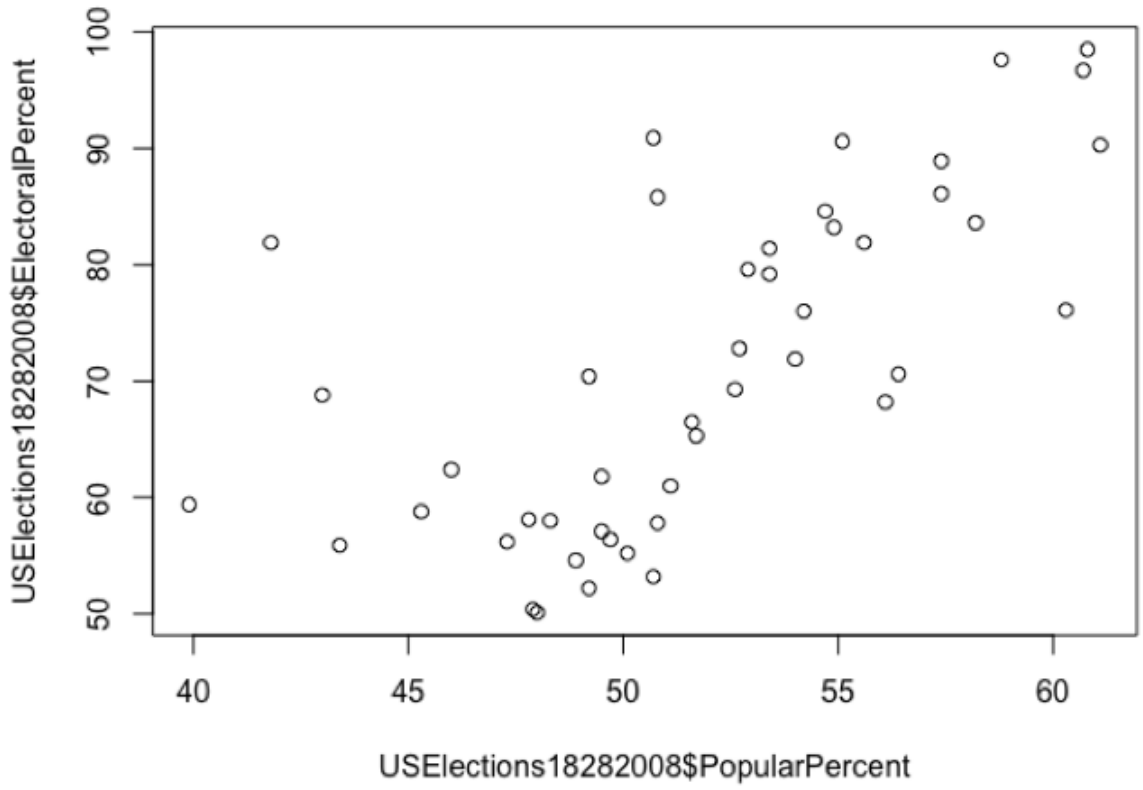
Figure 2. Scatterplot of height and weight for N=1035 major league baseball players.



Correlation of popular vote and electoral college votes for US elections from 1826 to 2008

The population of elected U.S. Presidents from 1826 to 2008 can also be obtained from (http://wiki.stat.ucla.edu/socr/). Calculation of the relationship between popular votes totals and electoral college totals revealed a correlation coefficient of r = .681. This relationship is approaching what is generally regarded as a strong though imperfect relationship. Again, readers are encouraged to obtain the data and practice the calculation of the correlation coefficient. Figure 3 shows the scatterplot of popular vote percentages and electoral college percentages, with some obvious linearity despite the presence of some noisy data points.

Figure 3. Scatterplot of popular and electoral vote percentages for US Presidents 1828 to 2008.



Caution

Correlation is not itself an effect size

The correlation coefficient does not tell us the size of the effect in terms of a linear proportion or rate of agreement between two things. For that we will need to calculate the *coefficient of determination* which is simply r^2 (r-squared). The coefficient of determination tells us how much of a change in each can be attributed to a change in the other thing.

Correlation is not causation

Correlation is not causation is a phrase that might easily be repeated as a mantra. It is easily overlooked despite its importance. Simply identifying a relationship, and even the direction of the association, between two phenomena does not automatically tell us about the underlying causal relationship. In a now infamous and entertaining example, Messerli (2012) published a study in the New England Journal of Medicine showing a strong correlation ($r = .791$) between chocolate con-

sumption per capita and the number of Nobel laureates per 10 million persons in 23 countries. A causal inference from the reported data indicated that an increase of 0.4kg of chocolate per capita per year would increase the number of Nobel prizes by one. The humor and entertainment value of that publication was as useful as the point: correlation is not causation. Conclusions about causation require controlled studies. In the case of the chocolate/Nobel study it is likely that some intervening variables such as per capita income, time and resources for sustained study activity, and education in general may play some more plausible causal role.

Why bother to learn these calculations

Once upon a time computers were not widely available as they are today. In that epoch it was necessary for both scientists and field practitioners – anyone who wished to claim expertise or achieve any productivity – to learn to execute mathematical and statistical calculations using only pencils and paper (and perhaps a slide-rule). Today computers are everywhere are calculations are rarely completed without the use of a computer. Why then should scientists and field practitioners today have to be exposed to any suggestion that they learn to calculate statistics such as the correlation coefficient?

My answer: there is no expectation that scientists or field practitioners will ever again manually calculate any statistics in field practice. However, those who take the time to familiarize themselves with basic statisticians and basic calculations, and those who take the time to work through a few simple examples, will possess much stronger intuition and much greater expert understanding of the meaning of probabilistic results. And many, if not most, professional and scientific conclusions are, in reality, probabilistic conclusions – including when those conclusions are reduced or simplified to categorical conclusions.

Professionals who do not take the time to develop their knowledge and intuition about science and basic statistics will present a limited and flawed form of expertise at best, and will be less able to help other professionals and members of the public or information media to correctly understand their work and their conclusions. Moreover, there is a risk that pseudo-expertise will be accompanied by an obvious undertone of insecurity and phobic avoidance of concepts having to do with science, statistics or probabilities. In the absence of real expertise there is the very real danger that the void will

be filled with pretense and over-statement around the strength of one's conclusion, and this can lead only to professional embarrassment when faced with the need for real discussion with other educated professionals. Moreover, in an age where artificial-intelligence can begin to invite us to more completely outsource a wider variety of skills and judgments that formerly required trained and experienced human expertise, there is potentially grave risk in neglecting to develop mathematical, statistical and analytic skills and intuition because this would require that we complete surrender our expertise to robots and machines. Said differently, if human professionals want to continue to enjoy the role of expert then it is our responsibility to develop our expertise and competence. Professionals who take the time to develop their intuition for science and skills for statistics, as the mathematical language of science, are likely enjoy and important advantages in marketplaces that are expected to enjoy an increasing range options to replace non-expert practitioners with autonomous systems while continuing to require the involvement of human experts.

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Predictions of Polygraph Results vs Field Examinations

Robert Peters[1]

In 2000, the U.S. Congress requested and funded an assessment by the National Academy of Sciences (NAS) of the validity of polygraph testing for personnel screening. Congress acted in response to a proposal for expanded use of polygraph counterintelligence screening exams for Department of Energy personnel. In 2003 the NAS published The Polygraph and Lie Detection, which sets forth the findings of the NAS Committee to Review the Scientific Evidence on the Polygraph. In all likelihood, the Committee's review is the most comprehensive assessment of polygraph research to date. Contained in the report is a sophisticated and comprehensive discussion of polygraph accuracy, how to measure it, and its impact on test results.

The NAS Committee concluded that it is inappropriate for the federal government to use polygraph testing as a personnel security screening method because polygraph is not sufficiently accurate. Given the thoroughness of the NAS assessment, the finding should be disturbing to all members

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of the polygraph community. Despite its opposition to the use of polygraph testing for personnel security screening, the NAS Committee concluded that polygraph testing does provide accuracy significantly above chance in identifying truth and deception. The committee devoted considerable time to the discussion of base rates of deception and the impact of base rates on test results. The occurrence of serious counterintelligence offensives by personnel with United States Top Secret security clearance is low. That is because personnel with high level security clearance are screened by a variety of collateral tools such as background investigations, record reviews, and personal interviews. In addition most of those personnel work in an environment governed by restrictive security procedures.

Behaviors addressed by counterintelligence polygraph testing, such as involvement in terrorism, secret relations with foreign intelligence/security services, and compromise of classified information simply do not occur often. As a result of this low base rate of deception, the NAS Committee concluded that the overwhelming incidents of polygraph error would be false-positives (truthful individuals judged deceptive). The NAS Committee presented various predictive scenarios to demonstrate the impact of low deception base rate on test results. One example indicated that about 100 false-positive test results were likely to occur for every single true-positive.

Given the professional qualifications of the NAS Committee and the detailed nature of the analysis, the conclusions are troubling and demand serious consideration. The author's personal experiences in 40+ years of administering polygraph examinations in the field do not seem to coincide with the prediction of the NAS Committee. The author participated in numerous situations in which polygraph testing was administered to groups in which the base rate of deception was very low. Yet, the test results do not seem to come close to matching the forecast of the NAS Committee. Test results in numerous field examinations generated few false-positive results. False-negatives are often more difficult to identify. However, the author's field experience does not provide evidence of significant false-negative results. The author's accounts of field examinations are anecdotal. Data from these field exams was not collected or analyzed by research professionals. Nonetheless, it appears that there is an extraordinary difference between the predictions of the NAS Committee regarding the influence of base rates on polygraph results and author's experience in field polygraph testing. Fol-

lowing are descriptions of polygraph testing in several field investigations with low base rates of deception:

Case #1: In a country where many of financial transactions are executed in cash, daily commerce requires large amounts of available currency. The primary function of one business is collecting, transporting, processing, and redistributing large amounts of currency. Within a period of several months, that company experienced several mysterious disappearances of cash, in amounts ranging from $40,000 to $80,000. The majority of cash processing is performed by employees represented by an assertive labor union. The union members were less than completely cooperative with the investigation of the cash losses. Some management personnel also had access to the cash that disappeared. Because of their access, the management personnel had to be included in the pool of suspects. The executive responsible for all cash processing operations concluded that morale and trust among the management personnel suffered as a result of the unresolved cash disappearances. The executive decided that if all management personnel, beginning with himself and the director of operations, submitted to polygraph testing morale and trust amongst management personnel would improve. Based on his investigation of the cash losses, the executive believed that the losses were the actions of union members and that no management personnel were involved in the apparent thefts. He believed that the results of the polygraph exams of all managers would be truthful. He envisioned that the shared ordeal of submitting to the polygraph testing would enhance morale and trust amongst the managers who shared the experience. When presenting the factual background information in preparation for polygraph testing, it was made clear that the expected base rate of deception among the 28 management personnel was zero. Polygraph testing resulted in 27 non-deceptive conclusions and one deceptive test. After the testing was concluded the individual with deceptive polygraph results acknowledged that he had stolen $80,000 and provided details to corroborate his admission. Several losses were never resolved. It is possible that false-negative results occurred. No evidence was developed to even suggest that any test result was a false-negative. The majority of suspects were union members who declined to cooperate with the investigation.

Case #2: A corporation that manufactured industrial grinding and polishing equipment experienced several instances of sabotage. The sabotaged

equipment resulted in significant damage to a customer's property and endangered the lives of personnel present when the polishing and grinding equipment was being used. An investigation established that the sabotage took place during a specific phase of the manufacturing process and most likely performed by an individual acting alone. Investigators decided to initiate polygraph testing for personnel present during the manufacturing process. The base rate of deception in group to undergo polygraph testing was low. The base rate might very well be zero as two employees, including a primary suspect, had resigned by the time polygraph testing commenced. All 23 individuals that underwent polygraph testing were deemed truthful in denying any involvement in the sabotage of the polishing/grinding equipment. The prime suspect, who resigned, denied committing the sabotage but declined to cooperate with the various requests of law enforcement investigators including submission to polygraph testing. As all test results were negative, there could not be a false-positive. No further sabotage occurred following the polygraph testing.

Case #3: Several transportation companies experienced repeated losses due to refunds issued for fraudulent travel documents. The transportation companies focused their suspicions on the facility that printed the travel documents. The transportation companies suggested that an employee in the printing facility produced duplicate documents and provided the duplicates to criminals that arranged the fraudulent redemptions. The printing company's audit of the facility's operations failed to identify security shortcomings. In order to assure their clients as to the integrity of the printing process, the production company decided to administer polygraph exams to all employees of the printing facility. In preparation for the exams, a corporate executive informed the polygraph examiners that due to the production controls and the audit he believed none of the employees were involved in the printing of fraudulent travel documents. Therefore, the anticipated base rate of deception in the population to be tested was zero. But even if there was compromise of the printing process it was probably confined to one or two individuals on a specific work shift. Testing of the 63 employees resulted in 62 non-deceptive results and one deceptive result. During post-test discussion, the individual with a deceptive test acknowledged that he had stolen travel documents printed in the plant. He claimed that he only used the stolen documents for personal travel. Investigation confirmed that the deceptive

individual regularly traveled using the transport mode for which he admitted stealing documents. No evidence was developed to indicate he had obtained cash refunds for travel documents or provided travel documents to others.

Case #4: A money center bank discovered the disappearance of $50,000 from the currency processing unit. The currency processing unit was located three levels below street level in the bank's central facility. Access to the processing unit was by a stairway or an elevator. A security officer monitored all personnel entering and exiting the facility. Employees were required to leave all coats, briefcases, purses and similar extraneous items in personal lockers before entering the area in which the actual currency processing was performed. The bank's operations manager reported that the $50,000 shortage was identified by an audit at the end of a work shift. Polygraph examiners were informed that the only explanation for the disappearance of $50,000 was that large denomination currency had been secreted out of the processing area. The operations manager insisted that at least one, possibly two, of the unit's workers were lying when they denied involvement in the mysterious disappearance. All 18 members of the processing unit, including two security officers, submitted to polygraph testing regarding the missing $50,000. The polygraph exams concluded that all 18 suspects were truthful in denying involvement in the disappearance of the $50,000. When presented with the polygraph results, the operations manager insisted there was an error in the polygraph testing. He provided additional circumstantial evidence pointing to one individual. He insisted that the suspect be tested again. The suspected employee was angry when informed further testing was requested, as he had been previously informed that his test result was non-deceptive. A different examiner administered the second exam. The result of the second polygraph test was truthful, just as that of the first session. During a final review of the test results, the operations manager acknowledged that he had fabricated the circumstantial information he presented regarding the twice tested individual. The manager explained he simply did not trust the twice tested employee and wanted to be certain that the polygraph examiners were thorough in their testing of that individual. Slightly more than a month later, the bank received notice from the Federal Reserve that a bundle of currency received from the currency processing unit at the time of the shortage contained $50,000 more than reported on the delivery document. Therefore, the Federal Reserve

credited the money center bank's account with an additional $50,000. All 18 exams (19 if the twice tested individual's exams are counted) are confirmed true-negatives.

Case #5: A U.S. Senator proposed legislation that would impact the members of a particular profession. The executives of an organization representing many members of that profession developed a confidential lobbying strategy to defeat the proposed legislation. The strategy was set forth in a restricted internal memorandum. Not long after distribution of the restricted memorandum, the Senator called a press conference to reveal that he obtained a copy of the confidential memorandum. The executives of the professional organization commissioned an investigation to determine how the senator came into possession of confidential internal memorandum. The investigation found that 33 members of the organization's staff had access to the completed memo. Some of the individuals were administrative personnel and the rest were management or professional staff. Polygraph testing was administered to the 33 individuals who had access to the memorandum. Polygraph testing concluded that one member of the administrative staff was deceptive in denying providing the confidential memorandum to the senator. The remaining subjects were deemed to be truthful. Subsequent investigation established that the individual deemed deceptive had previously been a member the senator's staff and maintained contact with former associates from the senator's staff.

Case #6: After attending the first two class periods of the day, a teenage male student at a large suburban high school disappeared. There was a significant snow fall the night of the young man's disappearance. Ten days later, after the snow melted, the young man's body was found in a park about five miles from the high school. Death was caused by blows to the head. The young man had been sexually assaulted. Initial investigation focused on a man with a criminal background who was working on a construction project at the school the day of the student's disappearance. Polygraph testing of that individual generated a non-deceptive result. Ten additional suspects underwent polygraph testing. The test results were non-deceptive in all ten exams. Two years later an anonymous tip notified investigators that an individual with a history of deviant sexual conduct, including conviction for assault of a young male, was present in the school the day of the student's disappearance. Investigation established that a list of adult males present at the high school the

day of the crime mistakenly failed to include the new suspect. Investigators now focused their attention on the unlisted man. They developed significant circumstantial evidence of guilt. Polygraph testing of that individual produced a deceptive result. The individual continued to deny his guilt. He was not prosecuted due to errors in processing physical evidence.

Case #7: A Rolex wrist watch was discovered missing from the evidence room of the police department in an affluent suburb of a major city. An initial investigation failed to resolve the disappearance of the watch, but established that several additional valuable items were missing from the evidence room. The chief of police directed that all personnel with access to the evidence room would submit to polygraph testing. A separate law enforcement agency was commissioned to administer polygraph exams regarding the missing Rolex watch. The police chief insisted that he would be the first person to undergo polygraph testing. In all 14 personnel submitted to polygraph testing. All were deemed truthful in denying involvement in the disappearance of the Rolex watch. One individual failed to appear for scheduled examinations on several occasions. During a subsequent interview with investigators, that individual acknowledged stealing the Rolex watch and the other missing property.

Case #8: Some international activity of a large organization was disrupted following the publication of newspaper articles disclosing that several foreign governments were assisting the organization's activities. Analysis of the news stories established that protected information available to a limited number of organization personnel was contained in the news articles. An internal investigation determined that there were 73 individuals who had access to that protected information. Each of those individuals denied providing information to the journalist. The chief executive of the organization directed that those 73 individuals, beginning with himself, would submit to polygraph testing as to whether they provided the protected information to the journalist who authored the articles. It was possible that none of those 73 individuals provided the information directly to that journalist. So the base rate of deception was possibly zero. Polygraph testing deemed three individuals to be deceptive. In a subsequent interview one of those individuals acknowledged providing the protected information directly to the journalist. A second individual with a deceptive test result acknowledged a number of face to face meetings with the journalist but denied providing any protected information

to the reporter. The third person with a deceptive result denied contact of any type with the reporter.

Case #9: An audit of production at a large food manufacturing plant identified a significant shortfall of finished product compared to the raw material delivered to the facility. The shortfall of final product was so great that auditors concluded fraud might exist in the documentation of materials delivered to the facility or shipped out of the plant. Both raw material and final product were moved in and out of the facility by truck and railroad tankers. Both delivery and outbound shipments occurred 24 hours per day. Shipments in and out of the facility were recorded by contract security staff. In an effort to satisfy concerns of the manufacturer's management, the security service agreed to have all members of the security staff undergo polygraph tested regarding false documentation of shipments in or out of the plant. Fourteen members of the security staff submitted to polygraph testing. All those exams resulted in findings of no-deception. More than a year later, further investigation established that the shortfall of final product was the result of shortcomings in the manufacturing process. The plant general manager and several executives were found to have been at fault.

Case #10: The primary business of a small engineering firm consisted of designing, installing, and maintaining assembly line equipment for beverage companies. The primary customers of the firm were soft drink bottlers and breweries. The design and installation of bottling equipment was not very profitable. However, the maintenance service generated excellent profits. Because the equipment was designed by the specialty engineering firm, equipment specifications were proprietary information. Therefore no other company was able to provide replacement parts which are a standard aspect of the maintenance service. About two years after installing new equipment at a brewery, the brewery terminated all maintenance service. An investigation revealed that the maintenance service was being provided by a company operated by a former employee of the specialty engineering firm. It was obvious that the maintenance company operated by the former employee had obtained the technical specifications for the breweries bottling equipment. The former employee now operating a competitor maintenance service had left the engineer firm prior to completion of the brewery equipment design and installation. Therefore it appeared the proprietary technical information came from someone inside the engineering firm. After conduct-

ing interviews the firm's legal counsel asked those with access to the technical specifications to submit to polygraph testing. Seventeen individuals underwent polygraph testing. Sixteen of the examinees were deemed truthful. One individual was deemed deceptive. When interviewed regarding his deceptive test results, that individual stated that he had lied when he denied having any contact with the former employee running the competitor maintenance company. He admitted to several meetings with the former employee, but insisted these were social events. The subject with deceptive test results continued to deny providing proprietary technical specifications to the former employee. That individual declined to cooperate further with the investigation and resigned from the engineering firm.

The cases cited addressed the polygraph examinations of 295 individuals in subject populations where the base rate of deception was low. In some individual cases that base rate was zero. Polygraph testing deemed 2.7% (eight) of the 295 examinees to be deceptive. Four of those eight deceptive results were confirmed as true-positive results. If all four unconfirmed deceptive tests are assumed to be inaccurate the false positive- rate would be 1.4%. Circumstantial evidence related to three of the unconfirmed deceptive examinations supports the deceptive test results. There was no evidence to support the deceptive test results for one exam. Therefore, available (not conclusive) evidence indicates that 0.35% of the exam results were false-positives.

One federal agency informed the NAS Committee that the number of deceptive test results produced by its polygraph examination process was much less than the projections of the Committee. The Committee concluded that then there must be a significant number of false-negative test results generated by that agency's testing process. The Committee assumed that the examination decision point had been moved to avoid false-positive tests, thus increasing the occurrence of false-negatives. Since the majority of test results cited in the cases above were truthful findings there exists a greater chance of false-negative errors in those exam results. The examinations described in anecdotal accounts above generated negative (truthful) findings for 97.3% (287) of the individuals tested. Of those truthful findings 41.7% are confirm true-negative results. It is certainly possible, some might argue probable, that false-negative tests are present among the remaining non-deceptive test results. It appears unlikely that there are a sig-

nificant number of false-negative findings among the truthful results. Collateral investigations did not develop information to indicate that any of the truthful findings were false-negatives. The contrary is actually the case. All the evidence developed by collateral investigations, while not conclusive, supports the truthful test results.

All the exams described in these anecdotal accounts are specific issues tests administered with probable-lie comparison question procedures. Some of the exam technique probably did not correspond to the American Polygraph Association's standards of validated techniques. A number of examinees required more than one exam session to obtain a conclusive test result. The narratives are anecdotal. The material presented does not approach the rigors of scientific data analysis. Nonetheless, these polygraph test results for the cited cases with low deception base rate are drastically different from the projections of the NAS Committee. One cannot help but ponder as to the reason for the divergence between scientific projection and the results of the field examinations cited. Laboratory research provided the majority data utilized by the Committee. Laboratory data may not capture the full dynamics of field examinations. So projections based on that data are not likely to be as precise as some might believe. The Committee did speculate that in administering exams field examiners may take actions to accommodate such issues as the base rate of deception. What those actions might be is unclear. The Committee recommended that, despite the difficulty involved, some future research efforts should address the analysis of field examinations. The membership of the NAS Committee did not include any polygraph examiners. The Committee's analysis probably would have benefited from the presence of one or two examiners with experience in a variety of field environments and some understanding of research as part of its membership.

During the past 60 years, the utilization of polygraph testing significantly expanded in a variety of forensic applications, despite the skepticism of the scientific community. It appears that satisfaction of the consumers of polygraph testing service often overcame doubts raised by scientific assessments. It would be beneficial for both field examiners and the research community to develop a closer more collaborative relationship.

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Personal Response to Joel Reicherter: Polygraph Instrument or Polygraph Machine

by Raymond Nelson

My main purpose in responding to Prof. Reicherter is convey my sense of appreciation and gratitude for taking the time to pen such a thoughtful and articulated response to my board report in the previous edition of this magazine. In that report I waxed philosophically about the tradition of referring to the polygraph device as an instrument and not a machine, and whether this continues to serve the advancement of the profession. Prof. Reicherter's response is demonstration that there is ongoing value in choosing our words and terminology wisely and greater value in taking the time to ponder the meaning of those words beyond the few syllables and seconds it takes to utter them. Though I admit my point in raising this discussion was to provoke some increased awareness around this point, I in no way wish to provoke controversy or friction in response to Prof. Reicherter's article.

In reading the response article in this publication I can find little or nothing to argue and little or nothing to hold as issue of difference or contention around this matter. Instead I feel compelled to state that I believe Prof Reicherter's response article provides important value in anchoring our rationale for our chosen terminology. There is, in my view, no great need for a change in terminology or even for an official terminology on this. What is needed, as Prof. Reicherter points out, is conscious awareness of the ethics of professional decision-making, where-

in the human professional, not the instrument or machine, should be ultimately responsible for decisions that may affect the future well-being or rights and liberties of another. This, as Prof. Reicherter also points out, is not to suggest that human experts should be expected to be infallible – only that they should be expected to make use of good scientific technologies and methodologies available and that they should be prepared to assure others that a test result, and corresponding precision and error estimates, are premised on scientific knowledge and not on mere experteeism.

I feel confident suggesting that Prof. Reicherter and I are in alignment on most if not all issues of any real substance concerning the polygraph technology. I am also confident that we share interest in advancing perception among the public and other scientific thinkers concerning the stature of polygraph examiners and the polygraph profession. Most importantly, I believe the Prof. Reicherter's taking the time to clearly articulate the rationale behind the tradition does exactly that – it advances our professionalism by helping us to think and understand more clearly. On a personal level, I am gratified that someone of Prof. Reicherter's stature would take the time to read something I had written, much less take the time to craft a written counterpoint. In the end, the exact words we use are sometimes much less important than the substantive knowledge, skill, and experience that each individual brings to work each day.

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