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Then, all you need to do is send your electronic ad in .jpeg or .pdf file format, to the editor at editor@polygraph.org

Don't worry, short line items in the Buy and Sell and Upcoming Seminar sections are still free. We also publish (at no charge) in each Magazine a listing of upcoming polygraph training sessions for APA accredited schools.

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.

Please forward the certification directly to:

APA National Office  
P.O. Box 8037  
Chattanooga, TN 37414

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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An Examiner's Best Friend

52nd APA Annual Seminar Memoirs

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Submission of Articles

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Greetings from the Editor’s Desk: Supporting the Fight Against Corruption in Ukraine

By Mark Handler

Recently APA school director Fernanda Gadea, Axciton representative Oksana Stevenson and yours truly (APA editor Mark Handler) traveled to Kiev, Ukraine to conduct a three-day polygraph training for the newly formed Ukrainian Association of Polygraph Examiners for Law Enforcement. Approximately 110 examiners from across Ukraine met at the Interregional Academy of Personnel Management in Kiev, Ukraine where we discussed the APA meta-analytic review, PLC and DLC comparison question formulation, the theory of the polygraph, the Concealed Information Test, the DLST, the Utah Approach to the CQT, ESS, and the practical application of polygraph in a public safety screening setting.

The seminar was the brainchild of Oksana Stevenson whose credibility with the US State Department, the Ukrainian examiners, and the association made this possible. Oksana started planning the event a year ago and arranged for the facilities, identified the appropriate audience/attendees, and lined up the speakers. The event was graciously funded by the U.S. State Department, Bureau of International Narcotics and Law Enforcement office in Kiev. The INL program goals include:

- To bring Ukraine’s justice system into compliance with Council of Europe standards via new legislation.
- To reform Ukrainian law-enforcement bodies along Euro-
Some of the attendees posed on the steps leading to the beautiful auditorium on campus.

- To establish and strengthen anti-corruption institutions at national and agency levels.

The Interregional Academy of Personnel Management in Kiev, Ukraine where we held the training provided an exceptional venue. Many thanks to

Fernanda Gadea lecturing – she was a rock star!
Professor Sergei Lisenko the assistant director of the university. He ensured we had adequate seating, audio-visual support, and much more.

Professor Sergei, Maks and Mark heading to dinner.

The translator, Allan Levitov, was one of the best with whom I have worked.

Mark and Allan
While there we met with Regina Yaremchuk the president of the newly formed Ukrainian Association of Polygraph Examiners for Law Enforcement, who expressed an interest in becoming an APA Divisional Affiliate association. Regina had recently attended the APA seminar in Las Vegas and was very complimentary of the seminar content.
Regina had a great deal of logistic help from Maksim Klymenko and Taras Sokolovsky. Taras and Maks were the “guy-Fridays” providing everything from transportation to water, soda, pizza, Ukrainian McDonald’s and co-medical relief for the speakers. The seminar would not have been the same without these guys helping. Thank you Maks and Taras for many laughs and camaraderie.

Maks warming up the crowd for Mark

Taras and Mark
Regina toasts the success of the new association and the seminar and in gratitude to Oksana for making it happen.
Maks leads the traditional toast honoring women

Mark, Maks and Taras at dinner
Maks challenged Mark to a chili pepper eating contest

The Ukrainians’ are well-known for their incredible hospitality and kindness. We had many great meals and laughs, courtesy of them. They even took a group of us on a road trip to visit the Chernobyl Nuclear plant.

Eight of us “saddled-up” for the 200-km trip from Kiev to Chernobyl. Taras was our driver and is an incredible multi-tasker. He can text, take selfies, make calls, watch music videos, navigate, avoid oncoming traffic, and much more
On the left Fernanda and Mark at Chernobyl, on the right Oksana and Mark at Chernobyl.

The Ukrainians have a tradition to drink a glass of red wine while visiting Chernobyl.

Fernanda enjoying her glass of obligatory red wine as she enters Chernobyl.
We also visited the ghost town of Pripyat and had a personal tour of many of the famous parts of the town. We saw the old amusement park, the apartment complexes, the library, and much more. It was a haunting reminder of how things can go really wrong. We climbed to the rooftop of one of the many apartment complexes and had a glass of wine in honor of those who perished and those who lost so much.

Our gang, on the rooftop in Pripyat

Regina and Mark at Chernobyl. Note the damaged #4 reactor building may be seen behind us.
Oksana in an abandoned phone booth in Pripyat.

Oksana & Mark near the Chernobyl Nuclear Power Plant sarcophagus or Shelter Object - a massive steel and concrete structure covering the nuclear reactor No. 4 building.
Oksana, Fernanda and Mark at a lovely Georgian restaurant

Fernanda and Mark joined up with a traditional Ukrainian music group to sing.
Many of the attendees expressed a great gratitude to the APA Continuing Education Committee chair, Sabino Martinez, for reviewing and approving the seminar content for 24 hours of APA approved training. They expressed a great desire to learn and improve on their credibility assessment knowledge and were attentive throughout the 8-plus hour days, asking many excellent questions. Their appreciation humbled me, and reminded me of just how blessed and fortunate we are at home to have reasonable access to training. Most recognize they will likely never be able to attend an APA seminar due to the expense and logistics associated with doing so.

Several of the attendees posed for a group picture
As mentioned, none of this would have been possible without the hard work and dedication of Oksana Stevenson. Her love and respect for Ukraine and furthering professional knowledge was palpable. I watched her spend hours each day dealing with the logistics of a 100-plus person seminar and juggling the many responsibilities that come with managing such a training. She has boundless energy and commitment, and the Ukrainian Association of Polygraph Examiners for Law Enforcement benefited greatly from her work.

Oksana lecturing the crowd
1. Cleve Backster Award: Honoring an individual or group that advances the polygraph profession through tireless dedication to standardization of polygraph principles and practices. - 2017 Ana Von Schmeling.

2. William L. and Robbie S. Bennett Memorial Award: Honoring unrelenting efforts and display of ability in the interest of the American Polygraph Association - 2017 David Ehrmann.
3. David L. Motsinger Horizon Award: In recognition of a new shining star in the profession or association who early in their career demonstrates loyalty, professionalism and dedication to the polygraph profession (less than 10 years) - 2017 Katie Leggett (Pat O’Burke accepts on Katie’s behalf).

4. John E. Reid Award: For distinguished achievements in polygraph research, teaching or writing. - 2017 Benjamin Blalock (Jennifer Rider accepts on Ben’s behalf).
5. Leonarde Keeler Award: For long and distinguished service to the Polygraph Profession. - 2017 Craig Springer.

6. President’s Award - 2017 - Barry Cushman
American Polygraph Association Lyrics

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Newly-elected APA board member Erika Thiel with top left Rocky, bottom left Bonnie Blue and on the right with Brownie

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**Interview Objectives**

**Module One**
- Interview Foundation
- Personality Assessment
- How to Develop Rapport
- Why Narrative Style

**Module Two**
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- Which Cues are Diagnostic
- Why Cognitive Load
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September 4 - November 9, 2018

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December 4 - 8, 2017 (Lafayette, IN)
March 26 - 30, 2018 (Cape Coral, FL)
July 23 - 27, 2018 (Cape Coral, FL)

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

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

Philly March 12–16; October 1 - 5

Morgan Interview Theme Technique (MITT)
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
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CO-SPONSOR – VIRGINIA POLYGRAPH ASSOCIATION
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<td>8:00am – 5:00pm</td>
<td>Tactical Polygraph – Matt Mull and Billy McCloskey, Texas DPS</td>
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<td>Ethics, Pre-Employment, LEPET – Steve Duncan, APA President-Elect</td>
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CUTOFF DATE for hotel reservations is **10/2/17** Individual departure dates will be reconfirmed upon check-in. (5 DAY CANCELLATION notice required)

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CES-Virginia Beach, VA (Nov 2-3, 2017) 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.
## TOPICS

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<th>Donnie Dutton – APA Past President</th>
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## 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:

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President’s Message

Jamie McCloughan

As Vegas never sleeps, so too will the memories of the American Polygraph Associations 52nd Seminar in Las Vegas Nevada not fade. I would like to take this opportunity to share with you; a heartfelt shout out to those working through disaster, some of my thoughts of the seminar, and what the American Polygraph Association board will be doing for you in the future.

Firstly, and foremost, I would like to send out my support to those in Houston Texas and the surrounding region affected by hurricane Harvey. The entire American Polygraph Association, and my family’s, prayers go out to all of you. Anytime there is a critical situation, one of our brothers or sisters and their families are directly affected by it. If you need us to support you in any way, don’t hesitate to contact me,

Secondly, I was humbled by the opportunity to have my father, the most recent medal of honor winner, be the speaker for the opening ceremonies. According to a lot of the attendees I spoke with, his presence and interaction with them was the highlight of the seminar. On top of that, we had a record turnout of over 900 people from 37 different countries. The previous record was approximately 780. As always, Mike Gougler did an excellent job of lining up speakers in a fashion that suited all. I would be remiss if I didn’t recognize those who diligently worked hard behind the scenes. As always, Lisa Jacocks kept everything going. Anyone who knows, or has contact with Lisa, knows that their issue will be resolved. Sabino Martinez was a huge help at the seminar. He helped process incoming attendees and ensure those who were Spanish speaking were taken care of. Dan Violette was stellar at the mobile application table. He, without doubt, made sure that anyone who wanted to use the application had it up and running. Gordon Vaughn, as always, helped put out any fire that arose during the seminar; and did so in a way that most would not have recognized that one existed.
The biggest accomplishment of the seminar was that of finally passing, by unanimous vote, what had been the goal of the association since its inception; having a bachelor’s degree as a requirement for member status. As most of you know, we were the last forensic science to embrace this as a requirement for a profession.

Lastly, what is the board going to do for you? I have directed the board to accomplish several tasks over the year, with the contingency that incoming tasks may dictate further work of the board to be accomplished in our year together. Number one, we need to consolidate efforts amongst our organization and the American Association of Police Polygraphists. We can accomplish much more as a profession if we work together, so I instructed every committee chair to reach out to their counterpart of the AAPP to engage in a joint effort. Number two, I asked the board to look at what standing committees we currently have that could be consolidated into a more efficient committee, which was staffed by more than one board member and multiple committee participants. Number three, I asked Education Accreditation Committee and the board to look at a long-term goal of a true accreditation process that allowed future members of our association to receive college credits at some level. Number four, I asked the Education Accreditation Committee and the board to identify and approve a software program that better traced the accreditation process and streamlined reporting requirements of those we accredited. Number five, I asked the PCSOT committee and the board to find a way to allow PCSOT to be incorporated into the basic training and allow flexibility in continuing education requirements that commensurate with current membership requirements. Number six, I asked the PCSOT and the board to reach out to other organizations and entities working on PCSOT to ensure we are working to-
gether in the best interest of those volunteering to testing. Number seven, I asked the board to look at further ways that we can offer educational opportunities to our members. We have previously conducted webinars, but there are other forms of medium out there that can be currently used to give our members continuing education opportunities on those years they are unable to attend a seminar. Number eight, I asked the board and general counsel to design a conflict of interest form to be completed and signed by anyone conducting APA business, including the board. The last task of the board was to increase our social media output and keep our membership informed on all pertinent media avenues. Darryl Starks has done an awesome job of transforming how the APA communicates on social media over the last. I have asked Communications and Public Relations committee and the board to significantly increase how we keep our thumb on the pulse of what happens and try to reach out daily, by multiple social media platforms.

In closing, your board will be working hard for you over this next year and listening to your concerns and suggestions for additional projects. As always, thank you to those serving to protect us from threats, both foreign and domestic, and may you have Goodspeed in your return to your family and loved ones.
Hello, APA Members. It was great seeing so many of you at the annual seminar in Las Vegas this year. Thanks to the hard work of Mike Gougler (Seminar Chair), Lisa and Stephanie from the National Office, Gordon Vaughn (General Counsel), your Board, including the Ad hoc Members, and numerous volunteers the most attended ever seminar was a huge success. Thanks also to the speakers and Members who attended. The record setting attendance is proof that the Professionals of Polygraph are serious about staying on the cutting edge and maintaining their continuing education.

The Ethics and Grievance Committee is still hard at work. The majority of our complaints continue to be unfounded. 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. The Committee Policy is receiving the final touches and slated to go before the Board of Directors soon.

As President-elect 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 issues facing the organization.

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

Brian Morris
Director
asking you the members to share what it is that you want to see this committee focus its time and efforts on? Do you have areas that you would like to be studied that have not previously been addressed? Do you have a study that you would like to conduct that we can support? What are the things that are important to you and your work as a polygraph examiner that this committee can help you with?

Second, any committee needs the strength and support of willing members. During our annual seminar, the opportunity to volunteer to serve on a committee was provided. There are some strong members involved, but there is an absolute need for more participation. If you are willing to make yourself available and help in this important area of the APA, please reach out to me at your convenience so that we can move forward with those things that our membership needs and that our president tasks us with.

I look forward to working with and hearing from all of you soon!

Brian Morris
Director 7
(801) 864-4753
brianrmorris1929@hotmail.com

Raymond Nelson
Director

Greetings APA Polygraph Examiners,

The recent APA conference was a great success. Las Vegas is always a great destination for a conference – as if anyone needs an excuse to go to Las Vegas. Some conference participants were delayed or affected by the hurricane in Texas, and still others have been impacted by the hurricane in the Caribbean after the conference and the earthquakes in Mexico. All of our thoughts are with those who are affected. Hopefully the 2018 conference in Austin Texas will be free of dangerous weather events. One thing is certain: Austin is a fun city and a great city for a conference. So be sure to make your plans early. I hope every APA member can find a way to attend a conference there at some point.

It is a great honor to serve the APA, which I believe to be the greatest and most important association worldwide in the advancement of the polygraph test and polygraph profession. To me these two things are inseparable: the polygraph test and the polygraph profession. Without good professionals, the polygraph is simply a machine. Without trying to resort to mind-reading, I know what some may
be thinking at this point – why do I refer to the polygraph a “machine” when we are taught in polygraph school to call it an “instrument.” My reason: because it is a machine. Despite their power, machines do not actually think.

Machines have no intelligence of their own. Machines have no soul, no sentience or self-awareness. And of course, machines are not capable of human compassion (though in truth, some humans also lack regard for others). Machines cannot solve problems creatively the way humans can. Machines require instructions from humans. To me, this is as it should be. The alternative to we humans controlling the machines will be something like the opposite - a world in which decisions about humans would be made by machines. And so, the solution to human and machine interactions is not for people to avoid or neglect the machines, but to learn about them. Learn to make use of them. Learn to understand the available technology so that we can use it to achieve human goals and objectives.

Why does it matter if we call it a machine? Not so long ago, when the earth was younger and full of primordial ooze, closer to those days when Cleve Backster was busy making order out of chaos with his insistence on standard-ized practices and a careful review of all test questions during the pre-test I imagine that some humorous practitioners may have jokingly referred to the polygraph as a “machine” or worse, a “box” or even a “lie-box.”

I cannot know with certainty, but my best guess is that some smart person or persons in leadership noticed that referring to the polygraph as a “machine” or a “box” had the effect of trivializing our work and de-valuing the importance of the polygraph professional. Perhaps those same persons noticed, correctly, that we could help ourselves and help our profession by elevating our sense of professionalism – by not calling it a “machine” or “box” and disciplining ourselves to remind everyone that the polygraph is an “instrument” for which professional care and feeding (metaphorically speaking) would be required for it to be of any use to us. It is my view that, some time ago, referring to the polygraph as an “instrument” had the effect of emphasizing and elevating our professionalism and professional stature, and reminded us not to trivialize and instead to encourage elevate perceptions of polygraph professionals. As so the familiar game was born: for decades since, whenever polygraph students in accredited polygraph training programs call it a “machine” they
make a small donation to a special classroom fund that can later be used for fine coffee or some form of alcohol-based social lubricant.

So why does this matter today? Well, things are different today than they were 50 years ago. Today we have computers everywhere. (Today we have cameras everywhere.) Today we have the internet. Computers, cameras and the internet are machines; they have no intelligence of their own. Machines have made information on the polygraph available to anyone on earth. More importantly, the population today, and legislators today, have generally greater access to information about science and technology. In fact, it is basically impossible to read or watch the news without becoming somewhat aware of the importance of science, technology, computers, probability models, and of course big data. Data, analytics, and science are everywhere: business, finance, economics, health, education, entertainment, communication, forensics, politics, weather forecasting, and even transportation. “Machine-learning”, and the related term “artificial-intelligence” are becoming ubiquitous.

Machines can be either mechanical or electronic/digital. Every smart person today knows that computers and computer programs are really just robot-machines with no real intelligence of their own and still no real ability to think creatively, feel their own existence, care about others or ponder the meaning of life. Thinking creatively and becoming aware of our own existence – and our own limitations - are human activities. Machines, robots, and computers, still require instruction from humans. If we neglect to learn about and make use of, machines and technology, then we will eventually find ourselves in a situation where the machines understand humans better than humans understand the machines. (Robot-apocalypse anyone?)

Bottom line: the polygraph is a machine. Every technologically and scientifically minded person knows it. Every creative artistic and philosophically minded person knows it. For us, as polygraph professionals to continue the decades-old it’s-not-a-machine-it’s-an-instrument-game is not impressing anyone outside the polygraph training classroom. In fact, this game – fun though it is – may actually have the potential to negatively influence how others perceive the polygraph profession and polygraph professionals today. Why the need for a silly word game? What’s wrong with calling it what it is? Why not keep it...
real? What are we afraid of?

I am fortunate to have the opportunity to interact with many different types of people in many different locations: polygraph professionals, mental-health professionals, pharmaceutical and medical researchers, educators, data-scientists, statisticians, scientists of all types, engineers, artists, musicians, young persons, students, mature adults, legal professionals, and persons convicted or accused of serious crimes (often against other persons). It is my belief that everyone, everywhere, wants us, as polygraph examiners, to be scientific-minded professionals and they want the polygraph to be a scientific test.

The alternative to professionalism and science is... deep magic, or black magic. Mysticism. Given the choice between mystical polygraph and scientific polygraph I believe most rational and intelligent persons would choose science. Perhaps the only people who would choose mysticism over science are those who have constructed their economic and social livelihood on a composite foundation of science-phobia and covert insecurity about the reality of their work. Most likely they will never admit this, and will go to their grave touting their expertise as superior to everything else in existence.

No matter. The entire world, the public, scientists, business and economic leaders, academics, creatives, legislators, policy makers and managers of all types still want the polygraph to be a scientific test and they want polygraph examiners to develop themselves as highly competent professionals. They do not want polygraph magic or polygraph mysticism. Try to imagine the eventual public reaction or media reaction or legislative reaction if the APA were to take the position that the polygraph is not a scientific test that it is something else: either a mystical decision-making process (magic), or the polygraph is simply an interrogation prop or process.

In years past I had heard a number of polygraph examiners say this: “it’s a tool.” Well, tools are machines. So, what kind of tool is it? What is the purpose of this tool? Is it a tool to make an objective and replicable probabilistic quantification of deception or truth in the way that scientific tests are tools to quantify things that cannot be measured physically? Or, is its purpose limited to be used as an interrogation tool - we have to decide. And we have to be consistent about our decision and messaging. Whichever way we choose we will have to pursue the goal. My choice: polygraph is a scientific test. I would not want to stand
before the public, legislature or the courts and take the position that the polygraph is simply an interrogation tool. Polygraph is a scientific test. But the device, the apparatus, the sensors and the computer software are just a machine, with no soul, no self-awareness, and no intelligence of its own about how to use its own creativity to solve problems and pursue a goal. Machines require humans to provide all this.

And so, when I refer to the polygraph as a “machine” that’s just me, keeping it real. Then we can proceed to the detailed discussions about science and field practice – how can we advance the effectiveness and utilization of the polygraph test in the world today? Or, more practically, how can we advance the polygraph effectiveness and utilization in the world today in the context of new emerging scientific technologies for lie detection and credibility assessment testing? What can we do to help polygraph professionals and others to overcome the known limitations of the polygraph in the past and continue to make use of the best available technology today? These are the questions that absorb my attention each and every day - practically all day long. These are the questions that get operationalized in scientific research and projects intended to improve the effectiveness of polygraph professionals everywhere. In doing so, I harbor a sense of personal satisfaction that I am helping other humans.

Without doubt, underneath everything we do in the polygraph profession is a deep and unerring concern for people and for what is right. We value integrity, honesty, and truth. Trustworthiness. Dependability. Reliability. You know – all the boy-scout stuff. The existential stuff: what’s it all mean (i.e., what does it mean to be human.) It sounds silly and idealistic to write it and say it, but the fact is that I still believe that people have a choice in what they do, and that means that people can always find a way to do better. And so, I consider it my task to continue learning, and hopefully to help others along the way.

In a more practical vein, many PCSOT examiners are aware of the position statement published by ATSA (Association for the Treatment of Sex Abusers) regarding juveniles. Although no clear solution is immediate at this time, we will be attending the upcoming ATSA conference to discuss the situation in more detail. Our opportunity to engage this discussion is a very important and positive thing and we will keep others posted about how things progress in this area.
In other matters, the board is presently struggling to formulate an APA practice standard for how to make use of polygraph scoring algorithms. Our profession has progressed to a point where we can foresee eventual solutions to many of the problems that the public, legislators, media and scientific communities perceive surrounding the polygraph test. Those issues include discomfort, over-reliance on high-pressure psychological manipulation, vulnerability to manipulation and vulnerability to subjectivity in interpretation. Many of the solutions to these perceived problems involve making greater use of technology, automation and algorithms while continuing to capitalize on the subject matter expertise and the skill of the polygraph professional to engage each individual in the process of developing detailed interview information.

Today there is no profession that I am aware of that is continuing to attempt to analyze high-dimensional data through visual inspection methods that were the only available solution in the decades prior to the availability of powerful microcomputers. Even the forensic discipline of latent fingerprint analysis is moving towards the required use of computer algorithms to assist the analyst in making a statistical classification. I had the pleasure of meeting and interacting with the data-scientists who are working on those algorithms – when they introduced themselves to me after I had some questions during their presentation at the AAFS conference in New Orleans earlier this year.

One of our difficulties is that some polygraph examiners – and perhaps even some polygraph trainers - have steadfastly resisted learning about or using computer algorithms. The result is that the many examiners are presently unprepared to engage a rational discussion about how to proceed with the integration of algorithms into polygraph standards of practices. This is, from my perspective, a rather disappointing failure of leadership in this area – meaning that APA standards of practice presently offer no guidance on how examiners are to integrate the use of powerful computer algorithms into their work. The long-term result of continued negligence in this area will be that the polygraph may be increasingly perceived as antiquated and therefore scientifically – and economically – disadvantaged. This is especially true if we continue to observe the introduction of new scientific technologies into the lie detection marketplace.

From the Board
Why am I waxing so long and philosophical about all this? Well it seems important to me. Recently, there was some misguided suggestion (probably based in some secret fear of being replaced by a robot) that there may exist some secret plan or plot to replace the human polygraph professionals with algorithms/robots/machines. Well, it wasn’t said exactly like that, but that was the gist of the message. It became clear to me that many polygraph examiners – like the APA leadership – may also be presently under-prepared to know how to make the right use of the available technology today. The problem with this is three-fold: first, unless we learn to use the technology available today we will be increasingly at risk for accusations that polygraph testing is based on the best available technology during the mid-century pre-computer epoch; and second, we will be increasingly at risk for disruption and replacement by a new scientific technologies; and third, if us humans are not in control of the machines then the machines may eventually be in control of us! The solution is to learn to understand and make use of the machines and technologies available today – and that means computers and algorithms.

Finally, and meanwhile back in the boardroom, the BOD has now approved a model policy for domestic polygraphs. This is not to be confused with the previously adopted model policy for polygraph testing of domestic violence offenders. The Model Policy for Domestic Polygraphs is a nod to the fact that even though some examiners have expressed deep and abiding concern about the appropriateness of domestic fidelity polygraphs (and self-referred examinations of all types), it is not within the APA’s scope of authority to curtail this practice. Instead, it appears that the best approach to influencing a more stable and professionalized approach to field practices in this space is to actually apply our experience and leadership to the situation. The result is a reasonably good – though perhaps imperfect – set of field practice guidelines that essentially require polygraph examiners who do self-referred or domestic exams to adhere to normally established standards of practice. For myself, I notice that I am somewhat less concerned about the ethics and practices in this area having taken the time to think through and describe the various issues and how they might be stabilized through effective standards, that once again emphasize and elevate the stature of the polygraph professional as most important resource towards ensuring a compe-
tent, high-quality, evidence-based approach to the satisfaction of what are evidently important lie detection and credibility assessment needs.

In closing, I hope everyone can stay safe and comfortable with all of the significant weather and natural events that have occurred just before we begin to prepare for the transition to cooler autumn weather. Again, it is a great pleasure to serve the APA and the polygraph profession. As always, feel free to contact me by any means possible if there is anything I can do to help or support your important work.

Peace,
RN

Sabino Martinez
Director

It was a great pleasure to see each and every one of you at the seminar in Las Vegas, Nevada. I enjoyed speaking with those of you that I had not seen in years as well as those that I had not met before. I do not recall ever attending a seminar where over 900 attendees were gathered in one place, congrats go to Mike Gougler for his hard work. I would personally like to thank Lisa Jacocks our APA Office Manager and her Assistant Office Manager Stephanie Prairie for the tremendous job they accomplished behind the scenes and for a smooth registration.

In this new coming year, I would like to encourage all of you to look at you towards your coworkers to identify those who merit recognition for their contributions to the polygraph profession and send in an award nomination to Lisa for consideration in the annual awards. As we approach a new year and new election process I will ask for your vote so that I may continue serving you, the membership. Please keep all of those affected by the latest natural disasters in your prayers. I have also been asked to be on the forefront of our Latin American Conference and would appreciate any of you that would like to help and speak at the conference. I have asked the Latin American Membership to start giving their input on the training they would like to receive and we will be choosing speakers for that conference based on the requests. We are looking at having the conference during the month of March 2019. I will remind all members that when a seminar is approved it is approved for continuing education hours only. It is not the intention of APA to accredit, validate or agree with any continuing education material.

Saludos desde San Antonio, Texas a todo Latinoamérica y deseándoles lo
mejor. Primeramente, les mando saludos y abrazos a nuestros poligrafistas en México, esperando que todos se encuentren bien. Cuenten con nuestras oraciones, que dios los cuide y que siempre tengan el mejor ánimo de seguir adelante. Aprovecho para comentarles que, en marzo del 2019 se ha propuesto llevar a cabo un congreso de APA en la Ciudad de México, por lo que les pido por favor me hagan saber cuáles son los temas de más interés que les gustaría fueran abordados durante el seminario, lo cual nos permita contribuir adecuadamente con su proceso de actualización como poligrafistas. Así mismo les pido que si tienen la posibilidad de hacer llegar la información a todos aquellos poligrafistas que se encuentran a lo largo y ancho de América Latina y que por alguna razón no pueden o no han podido asistir a una conferencia de APA en EE. UU. que tomen la oportunidad de asistir a nuestro congreso en México. Muchísimas gracias y estaré al pendiente de sus correos.

Pamela Shaw
Director

Hello fellow APA members,

Since this is my first board report since returning to the APA Board of Directors, I would like to take a moment and thank everyone who participated in the election process, and those who supported my return to the board. I am eager to start serving the membership again and by appointment of our new President McCloughan, it looks like I will be able to start doing this best as Chair of the Membership Committee. I’m still forming some ideas about the projects I would like to undertake in this area to make our processes as smooth and as efficient as possible, but I would also love to hear your suggestions. After all, YOU are the membership. If you have suggestions or tips about how we can better recruit and/or welcome new members to our association, please send me an email or give me a phone call.

If you missed it, our recent annual seminar in Las Vegas was a hit! With nearly 850 in attendance, it was one of our most successful seminars yet. It was a great venue and the variety of seminar topics and lecturers was impressive. Kudos to Seminar Chair, Mike Gougler, for putting together a fantastic opportunity for our shared week of training! The whole seminar experience was well orchestrated under the caring and watchful eye of Lisa Jacocks. Thank you, Lisa, for all your hard work!

As I find myself back in the throes of board matters, it is again a healthy
dose of reality that our profession is always facing tough challenges; a good indicator that there are ever present opportunities for growth and learning. It is also a call out to all who love our field to be a leader and get involved in the areas where you know your strengths can be used. One of my hopes in the next couple years as an elected board member is to help bring up and foster new leaders in our association. If you’ve ever thought you might be interested, there’s no magic in the process to get involved; just a lot of heart, ethics, and sometimes patience in the process. If you want to get more involved, please contact our National Office, myself, or any of our board members. Now is the time when the new board will be appointing members to each of their committees to assist them carry out their missions in the year ahead.

Again, thank you for your support and if there’s anything I can do to better serve you and/or our community, just let me know.

All the best,
Pam Shaw

Darryl Starks
Director

Greetings my fellow APA members. It was an absolute pleasure seeing many of you at the 52nd annual seminar in Las Vegas, NV. The near-record attendance at this year’s seminar is proof of our continued dedication to professional excellence through education & training. A special note of thanks to our seminar chair, Mike Gougler and the APA National office staff, Lisa Jacocks and Stephanie Prairie for planning and executing a “flawless” Vegas seminar. The entire board works diligently to bring you the seminar. However, Mike, Lisa and Stephanie work tirelessly, year-round to give us an outstanding 6-day training seminar that just gets better and better. Well done!

As a profession, the APA is moving in the right direction. Your Board of Directors are all tasked with committee assignments and professional organization memberships with the sole purpose of improving the association and profession through research, education, established standards of practice, ethics, etc. To that extend, this year I have been tasked with co-chairing the Ethics and Grievance committee. I am honored to be entrusted with this critical task and I look forward to working with the current and new committee members who have in the past, done such outstanding work on behalf of the APA.

I want to challenge each of you to con-
Consider volunteering to serve on a committee this year. Committee involvement, is the backbone of the APA. From Ethics and Grievance to Professional Development, PCSOT, Communications and Public Relations to name a few, volunteers are needed across the board. Remember, you don’t have to be an elected board member to have a voice in shaping policy and the future direction of the APA. Please, get involved!

Finally, mother nature has reminded us all yet again, just how fragile life can be. So many of our members have been directly impacted by this year’s hurricanes as well as the earthquake near Mexico City. My thoughts and prayers go out to each of you who have been impacted by these recent events.

Erika Thiel
Director

My name is Erika Thiel and I would like to thank everyone who took the time to vote in the previous election. While I ran unopposed, I hope that each person who voted took the time to read my biography to understand more about me and my background. I feel I bring a unique set of skills to the APA board, working daily within a clinical PCSOT facility as a polygraph program supervisor. I interact often with members of ATSA and the Connecticut Association for the Treatment of Sexual Offenders (CATSO) and have an understanding of their use of, and concerns with, the polygraph in the PCSOT milieu. One of the things I hope to bring to the APA over the next two years is growth within our clinically-associated community.

I share the same passions as our current President Jamie McCloughan about developing a series of online training seminars to allow people to further their knowledge with polygraph testing from any part of the world. This is essential, for it is more important than ever for everyone to come together to learn from one another. Providing long-distance learning seems to be the way of the future in terms of professional education. About one in four of our members are not from the U.S and must incur a great expense and hardship to attend training here.

I also hope to help update the PCSOT model policy. Come early 2018, I will be a fully Licensed Professional Counselor and I have been fully immersed in working with Sex Offenders since 2012. I know the current model policy inside out and see the areas we can improve upon to ensure that all polygraph professionals are able to contin-
ue to run PCSOT tests in a manner that strengthens the information provided to therapists and supervising officers for better community safety. I feel my close relationship with the treatment community will allow me to make even better connections and facilitate better cooperation. Should you ever need any help from me please reach out to me via email at directorthiel@polygraph.org.

Thank you for trust you have placed in me.
“Price is what you pay. Value is what you get.”

- Warren Buffett
Excuses have a bad image. I remember that old cartoon strip “Peanuts” when Lucy blamed her missed fly balls on the “Sun, the moon, the wind, the stars” and even some kind of toxic substances in her baseball glove. We laugh at this light side of excuse-making, that kind of preserves the point of view that excuses basically are silly, even transparent and a weak ploy that people use. Although we sense that there is much more to excuses, we are kind of reluctant to see them in any serious, detailed way. However, just sitting back and observing over the years has convinced me that it is not only much more common than generally realized, but that it plays a central role in how we get along in life, both with ourselves, with others, and especially those we interview and test.

I’ve been interested by the dilemma, I guess we could call it human dilemma of accountability, or there are times I’ve called it fallibility. I’m sure its related to my years in criminal investigations and polygraph examinations which interact with human personalities. Let’s face it, we all make mistakes one kind or another (except for maybe Mike Gougler…. that’s a joke) and find ourselves in predicaments that we didn’t really need. Like something in which we did not perform well. Something should be done with these disappoint-
ing outcomes so they don’t restrict and intimidate us: That something often takes the form of, “The excuse.”

Excuse-making has a few basic components. First, most people want to maintain a positive image of themselves. While psychologists I’m sure would have much more psychological positions about this, than our other nicer more scientific motives underlying the way people behave, self-esteem is in my belief, the main driving force, probably in most of us.

Given this tendency, excuses are sparked by any situation that links a person to a bad performance, perhaps an action or an activity that does not meet either the individual’s or society’s standards. The more closely a person is linked to a bad performance, and the more negatively that performance is regarded, the greater the probability of excuse-making. People begin to explain or act in ways that lessen the negative implications or that bad performance in their own eyes, in the judgement of others, or both.

From my observations, excuse-making takes three general routes: First, “I didn’t do it.” Second, “It’s not really so bad.” And third, “Yes, but…” Since people seem to be linked to their poor performances by information (Which we know it as ‘Physical Evidence’), “I didn’t do it” excuses aim to sever the caused condition. We’ve experienced those we have interviewed over the years who frequently strike that unbelievable pose and respond with, “Who me?”

If he or she is not responsible of course, the obvious suggestion is someone else must be, and they feel it helps to give some clues as to who they want
to propose is the “Real culprit.” They even become helpful witnesses willing to “Testify” regarding the culpability of someone else—anyone else.

I live in Northern Indiana just about an hour’s drive from Chicago, and because of that many of our residents are Chicago sports fans, and it’s interesting how all our fans quickly shift from basking in reflected glory to then cutting off from reflected failure. When the Cubs, Bears, Bulls or Blackhawks win, you’ll hear statements like, “We won!” But the losses are reported as, “They lost.”

If excuse-makers cannot sever the ties to the bad performance, and if they must admit “I did it,” then they must somehow make it sound, “Not so bad.” So here we see a different maneuver, behavior aimed as softening, lightening and generally repackaging the bad act in a more positive light.

The simplest repackaging strategy that I’ve seen is to consciously or unconsciously hide from yourself the undesirable consequences of your actions. Over those years of talking to witnesses of violent crimes to obtain information, witnesses offered excuses rather than aid to assaults they witnessed. Most said things like, “I didn’t really know what happened,” while others said things like “It wasn’t serious” and others would give excuses like “Gosh, I didn’t hear a thing,” or “I didn’t know she needed help.” Many things obvious to others seem to “Escape the notice” of the excuse-makers. (I admit I’ve heard myself saying at home to Paula, “I didn’t know the garbage was ready to be taken out” well, I didn’t use that one all the time.)

If excuse-makers accept responsibility like “I did it” and concede further, like “Yeah, and it was bad…” they seem to need excuses of the “Yes, but…” variety. These are excuses to weaken the accountability link by introducing additional information that reduces the person’s sense of responsibility for the criminal performance. By playing on the familiar notion of extenuating circumstances. “Yes but…” excuses have hopes that tell the polygraph examiner that the excuse-maker shouldn’t be held totally accountable. In look-

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ing at all this, successful excuse-tellers sometimes blame their failure on “Bad luck, the difficulty of the task, divine intervention “Why is God doing this to me? That’s alternative facts; or, That’s just fake news.”

Another excuse concept is projection, the process by which a person can hang this failure and deficiencies on other people, as a way to explain failures. One of the present polygraph examinations programs I’m involved in is the testing of adolescents who have been convicted of some form of child molestation, and in addition to being on probation, are placed in Residential Treatment facilities and into treatment that includes polygraph examinations. I have heard excuses that take on the form of statements as “Everyone else was doing it; My victim asked me to do it; I just did what I saw on television, the computer or the internet.”

There is another tactic that I’m sure we all have witnessed is to claim no, or a lack of intent. “I didn’t mean to do it” implies that some unforeseen circumstances took control just this once. It’s like that legal plea of temporary insanity, but I think that’s a more complex form of this kind of excuse.

There’s another matter that I remember hearing about in a polygraph training session I attended about 20-years ago. What I remember was information that came from a study at a university which talked about excuses. In this study, after students were told they had failed a particular test, some research participants were hooked up to what they called “A device that monitored physiological reactions” and asked why they thought they had failed, and that these tests measured positive and negative feelings. For those participants who were told this device “Just merely measured physiological responses,” making excuses caused an expected decrease in negative feelings. The excuses apparently did their psychological work by protecting their egos. But for people who were told that the device was “A Polygraph, and a lie detector that measured their true feelings,” excuses increased their negative feelings. Some I remembered expressed their feelings of something like they were under scrutiny of the “All knowing machine.” The point I remembered from this study was that excuses may only serve to make us feel worse psychologically.

Although excuses sometimes backfire and excuse-making can become habitual and pathological, I believe they do serve a role for most people at a lot of times. It’s like it provides a way of handling some of life’s uncertainties. Normal excuses are often quite subtle and unrecognized even by the excuse-maker as well as their audience. Something like a degree of disability for example may nicely protect a person from a potential failure. In my youth, I still have many fond memo-
ries of those times I played in the Intra-City Baseball league, playing in the “Midget League” (Ages 12-13). My bandaged sprained wrist convinced me, and I suppose the crowd as well, that if I missed a ground ball hit to me, I wasn’t really a poor player, I was just “Temporarily hurt.” Thinking back about this however, I wonder now how long I wore that wrapping even after my wrist stopped hurting, just in case I missed another grounder. (By the way, I just turned 80 so my memory is not too good…..Well, OK yeah, that sounds like another excuse. Oh well.)

There is a position that many hold like, “Aren’t excuses always just lies?” In a way, I don’t think of them in that way. It’s true that by adopting an explanation that preserves positive self-images, I think that people are “Subjectively” biasing their interpretations of the world. But these biased interpretations are not always “Errors” or “Lies.” When there are no measuring devices, no yardsticks for measuring the “Truth” of different explanation of events, many explanations may fit the facts equally well. There often is not one black or white view of reality: some could be “Grey” interpretations.

The fact is regarding our work in polygraph testing and connected interviewing is that “Excuses work.” They serve to preserve a person’s self-image and also reduce the stress associated with failures. Excuses make it okay to disclose that negative activity, and whether or not this excuse actually provides some form of justification in the eyes of the subject, the important focus is that we have an admission to the act or event under investigation. My thought here is “Let the excuses come.” The important thing is that this person giving the excuse also acknowledges the validity of the matter they are admitting to, regardless of the excuse, and that’s the way I view it. Having said that, there will always be certain things for which individuals will be accountable. The inexcusable will and should remain inexcusable. But from the beginning of time we have pursued the personal and societal forgiveness that excuses bring. Adam blamed Eve and Eve blamed the snake, in a sense this biblical historic event, has in a sense, given birth to one of the frequently used justifications for some people, which is “The devil made me do it.” The point I’m making here is that let’s face it, “Excuses often lead to admissions, right?”
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Test data acquisition and recording occur after the completion of the pre-test interview phase of the polygraph test, following an explanation of the recording sensors, after a review of all test stimulus questions, and after attaching the sensor to the examinee. Prior to the presentation of the test stimulus questions, every polygraph recording begins with an announcement that the test is beginning. This is often referred to as the X announcement of test onset. This announcement is given every time the recording is started. Completion of recording is also announced, and this is commonly referred to as the XX announcement of completion. Skillful and thoughtful use of the X and XX announcements can improve the quality of the recorded data and may improve the effectiveness of the polygraph test for some examinees.

The X announcement of recording onset will provide both information and instruction to the examinee. All of the information and instructions are also provided during the pretest phase of the polygraph test, while explaining the instrumentation and testing procedures. That information will include an advisement of the importance of remaining seated and still during the testing process (i.e., the recording of responses to test stimuli), a reminder...
about the need to answer yes or no without other talking during the test, an instruction to look straight ahead and listen carefully to each test question and an advisement to avoid moving during the test.

It is important that this information is provided in a clear and professional manner that will convey both the importance of these instructions and the intent of the polygraph professional to assist the examinee to obtain test data of optimal quality for analysis and interpretation. For a variety of reasons, polygraph examinees may not fully appreciate the importance of the information and instruction, and some examinees may forget the instructions. For this reason, it is important for examiners to repeat the information and instructions at the onset of every recording. Following is a list of the recommended information and instructions for a complete X announcement.

- An advisement that the test is beginning.
- An instruction to sit still.
- An instruction to look straight ahead.
- An instruction to listen carefully to each question.
- An instruction to answer yes or no only.
- An instruction to refrain from other talking during the test.
- An instruction to refrain from moving during testing.

Some of these instructions may seem a bit redundant. For example, the instruction to sit still may seem to overlap with the instruction to look straight ahead or to refrain from moving. In this case the repetition and emphasis are intended, so as to emphasize and clarify the requirements for cooperation. Many polygraph examinees do not know how to sit still. Recall that for some children in school moving one’s head and move slightly while remaining seated may have been a perfectly acceptable. At the polygraph test, moving one’s head, hands or feet, even while remaining seated, will not be an effective form of sitting still. For this reason, it is important that examiners provide complete and adequate information about what is required for a successful test.

An examinee who understands and adheres to these instructions will more easily produce test data of satisfactory interpretable quality that is free of artifacts and with observable changes in physiology that are timely with the test stimuli. Examinees who do not understand or do not adhere to these instructions may be more likely to engage in movement, talking or other activity that result in data artifacts or changes in physiological activity that is not timely with the test stimuli. The following is an example of one way to conduct the X announcement and it is taken from an actual field examination involving a probable lie compari-
son (PLC) test format:

- **This test is about to begin. Please sit still, and look straight ahead. Listen carefully to each test question. Answer ‘yes’ or ‘no’ only. No other talking, and do not move during the test.**

A slight modification can be observed in the following X announcement taken from an example of an actual field examination involving a directed lie comparison (DLC) test format:

- **This test is about to begin. Please sit still, and look straight ahead. Listen carefully to each test question. Answer ‘yes’ or ‘no’ only, and remember the questions that I have instructed you to answer ‘no’. No other talking, and do not move during the test.**

In the X announcement for the DLC exam an addition statement is included to remind the examinee of the instruction to answer ‘no’ in response to the DLC questions. This additional instruction is not used for the X announcement for the PLC format. Although not strictly necessary, both of these X announcements include the use of the word ‘please’. Although some field practitioners maybe uncomfortable with an X announcement that may appear to take the form of pleading, or may convey that cooperation is somehow optional, use of the word ‘please’ in this context does little or nothing in reality to reduce the authority of the examiner in the testing context. Use of the word ‘please’ is merely a social convention intended to convey an attitude of dignity and respect, and acknowledge the reality that cooperation during test is ultimately the choice of the examinee. It is not recommended to use the word ‘please’ more than one time during the X announcement.

Following are the minimal recommended requirements for the XX announcement of the end of recording:

- An announcement that the test is complete.
- An instruction to remain still until the pressure is released from the cardio sensor.

Here is an example of an XX announcement from an actual field polygraph test.

- **This test is complete. Please sit still until I release the pressure in the cardio sensor.**

Again, use of the word ‘please’ is not necessary, but conveys an attitude of dignity and respect towards the examinee while acknowledging that cooperation during testing is ultimately a choice.

Some examiners may prefer to memorize the X and XX announcements. Others may prefer to write the com-
plete announcement into the list of test stimulus questions. An advantage of including the X and XX announcements in the question list is that the details of the X announcement will be permanently included in the test data.

It may be important at times to ascertain that the adequacy of the instructions and X announcement before a conclusion can be reached that an examinee’s observed failure to cooperate is indicative of malintention. In the event that movement, non-cooperation, or disruptive behavior is observed during the test it will be easier to determine if the examinee has received adequate and complete instruction about how to cooperate successfully during the test if the X and XX announcements are included in the question list. It will be more difficult to conclude malintent when the X announcement is incomplete or inadequate – even when adequate instruction and information was given during the pretest interview.

Provision of a complete and adequate X announcement of test onset will more easily support correct conclusions about the meaning of observed problem behavior during testing. Inclusion of a complete X and XX announcements in the question list can reduce the need for a reviewer, supervisor, or quality control professional to rely on the audio/video recording to determine the adequacy of the instructions when an examinee is observed to be confused or uncooperative.

Examiners who are prepared to deliver a clear and professional X and XX announcements are more likely to impress on the examinee the importance of these instructions and therefore more likely to achieve the cooperation of the examinee. Of course, some examinee’s are intent on not cooperating or appearing confused during the test, and it is possible that little can be done to rectify some situations. For those circumstances, the post-test and other investigative activities may be a more effective solution towards the resolution of the observed inconsistencies.
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How to Calculate the Expected Agreement and the Combined Accuracy of Two Test Results

Raymond Nelson¹, John Kircher² and Mark Handler³,⁴

Abstract

We describe how to obtain the combined accuracy of the results of two independent tests and the expected rate of concordance or agreement between them. For non-indepen-

dent tests – those in which the results of one test may have some shared source of variance with the other test – we show a table of results using the phi-correlation coefficient as the measure of correlation (dependence) between the tests. We manipulate

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³ Mark Handler is an experienced law enforcement polygraph examiner, the Editor in Chief for the American Polygraph Association, and works for Converus Inc. a company that develops and markets the EyeDetect ocular motor credibility assessment test.
⁴ There are no proprietary interests associated with the content of this publication.
the level of dependency between the tests (phi-coefficient) from 0 (independent) to 1 (perfectly correlated), and we manipulate the range of decision accuracy from .5 to 1 for both Test-1 and Test-2. We found that when the two tests agree on the outcome, decision accuracy increases to the extent that the two tests are independent (phi approaches 0). Decision accuracy for two tests can actually decrease under some circumstances, and this may be more likely when the phi correlation coefficient is high. Decision accuracy increases when the accuracy of individual tests increases and the outcomes for the two tests are less covariant.

**Introduction**

We describe how to obtain the combined accuracy of the results of two tests beginning with the expected rate of concordance or agreement between two tests for which the results are independent. For non-independent tests – those in which the results of one test may have some shared source of variance with the other test – we show a table of results using the phi-correlation coefficient for two dichotomous outcomes. The phi-correlation (or Mean Square Contingency) coefficient (Mangal, 2010; “phi-coefficient,” n.d.) is a measure of association between two binary variables (i.e. pass/fail, black/white, agree/disagree).

**Agreement between two independent test results**

The expected concordance rate for two tests is a function of the accuracy estimates for the two tests. The expected rate of agreement is the sum of the expected rate the two tests will be correct and agree, and the expected rate the two tests will be incorrect and agree. Step 1 shows the calculation of the rate that two independent tests will be correct and agree when both estimated to have an accuracy level of 80%. Step 2 shows the calculation of the expected rate that two independent tests with an estimated accuracy level of 80% will be incorrect and agree. Step 3 shows the sum of the expected agreement when the two tests are correct and incorrect.

**Step 1:** expected rate that two tests with accuracy = 80% will be correct and agree.

\[ .80 \times .80 = .64 \]

**Step 2:** expected rate that two tests with accuracy = 80% (20% incorrect) will be incorrect and agree.

\[ .20 \times .20 = .04 \]

**Step 3:** sum of expected agreement for correct and incorrect results.

\[ .64 + .04 = .68 \]
The combined rate of agreement for two independent tests for which the accuracy estimate of each is 80% will be 68%. Like all statistical calculations, this estimate is premised on certain assumptions. In this case, an important assumption is that the accuracy rate for each test can be characterized as a random variable. That is, that the results can take any of a range of values (from 0 to 1). Another important assumption is that the results from the two tests are independent of each other. Independence means that the two test results do not covary. For independent tests, whatever influences the outcome of one test will have no effect on the outcome of the other - independent outcomes have no source of shared variance.

**Estimated accuracy when two independent tests agree**

Combined test accuracy is different than test agreement or concordance. When results from two independent tests are in agreement the *aggregated accuracy* of the two results can be estimated as the ratio of expected agreement when correct to the total rate expected agreement when correct and incorrect. Example 1 shows the combined accuracy rate for two independent tests when the results are concordant using the values from Steps 1-3 above.

Example 1: aggregated accuracy rate for concordant test outcomes.

\[
.64 / .68 = .94
\]

The aggregated accuracy rate of two tests for which the estimated accuracy of each is 80% is 94%. Of course, if the tests agree on 68% of occasions, they will disagree on 32% of occasions. Disagreements might be considered indeterminate. Once again, a combined accuracy rate of 94% rests on some important assumptions – that testing errors are random events, and that the tests results are independent. Under ideal circumstances the two tests would be completely independent – with no shared source of variance other than the criterion of interest. In real-life circumstances, perfect independence is difficult to achieve, just as perfect covariance is not likely to occur. More commonly there is some degree of correlation or covariance between two tests intended to quantify the same phenomena.

When two test results are correlated – as can be expected when the tests use the same methodologies, or when the administration of one test is influenced by knowledge of the other test result – it is possible that whatever caused the occurrence of an error at the first test might also cause the occurrence of an error at the second test. For this reason, these formula in steps 1, 2 and 3 cannot be taken as an
expression of the expected accuracy when two tests results agree if the test are non-independent (or covariant).

**Combined accuracy of two non-independent (covariant) tests**

Combined accuracy of two test results that are non-independent will be influenced by the degree of covariance between the two tests. Correlation of two binary variables (i.e., correct or incorrect outcomes from two tests) is described using the phi-coefficient.

One method to calculate the phi statistic is to take the Pearson correlation coefficient for all binary results of the sample of cases for which each case was evaluated with both tests. This is convenient because commonly available spreadsheet applications today include a variety of functions to calculate such mathematical statistics. A second way to calculate the phi-coefficient is to use the following formula (Formula 1.).

Formula 1: calculation of phi from observed frequencies.

\[ \text{phi} = \frac{(A \times D - B \times C)}{\sqrt{(A + B) \times (C + D) \times (A + C) \times (B + D)}} \]

Values for A, B, C and D are taken from a 2x2 contingency table as shown in Table 1. Cell A is the proportion of cases where Test-1 and Test-2 are both correct. Cell B is the proportion of cases where Test-1 is correct and Test-2 is incorrect. Cell C is the proportion of cases where Test-1 is incorrect and Test-2 is correct. Cell D is the proportion of cases where both Test-1 and Test-2 are incorrect.

The marginal values A+B indicates the cases for which Test-1 was correct, while C+D indicates cases for which Test-1 was not correct. Similarly, the marginal values A+C indicates cases where Test2 was correct while B+D indicates cases for which Test-2 was incorrect. Values for A, B, C and D can be calculated from the three inputs: 1) A+B or the Test-1 cases that are correct, 2) A+C or the Test-2 cases that are correct, and 3) Cell A or the cases where both Test-1 and Test-2 are correct.
The increase in accuracy is the difference between the input value A+B (Test-1 accuracy) and the accuracy of the two test results when they agree. Formula 2 shows the increase in test accuracy for the two tests in Table 2, compared to the accuracy of just the first test (input A+B).

Values for cells B, C, and D can be obtained with subtraction. Thus, given the marginal proportions .8, .2, .8, and .2, B = (A+B) – A = .80 - .71 = .09, C = (A+C) - A = .80 - .71 = .09 and D = C+D – C = .20 - .09 = .11. The 2x2 contingency is shown in Table 2.

After A, B, C and D are obtained, the total agreement between the two tests will be equal to A+D. Accuracy when the two tests agree will be equal to the total A / (A+D). The phi correlation between the two tests can be calculated using the formula shown earlier. The increase in accuracy is the difference between the input value A+B (Test-1 accuracy) and the accuracy of the two test results when they agree. Formula 2 shows the increase in test accuracy for the two tests in Table 2, compared to the accuracy of just the first test (input A+B).
Formula 2: increase in accuracy for Test-1 and Test-2.

Increased accuracy = (A / (A + D)) – (A + B)

\[= (.71 / (.71 + .11)) - (.71 + .09)\]
\[= (.71 / .82) - (.80)\]
\[= .87 - .80\]
\[= .07\]

Results from formula 2 show a combined accuracy rate of .87 for the data for two tests shown in Table 2. This is an increase in accuracy of 7 percentage points compared to a single test with an accuracy rate of 80%. Formula 3 shows the calculation of the phi-coefficient for the data in Table 2.

Formula 3: calculation of phi for Table 2.

\[\phi = (.71 * .11 - .09 * .09) / \sqrt{(.71 + .09) * (.09 + .11) * (.71 + .09) * (.09 + .11)}\]
\[= .0781 - .0081) / \sqrt{.80 * .20 * .80 * .20}\]
\[= .07 / .16\]
\[= .44\]

The phi-coefficient for Table 2 is .44. Like the correlation coefficient, the phi statistic for 2x2 tables will give a signed decimal value between -1 and +1, with the value zero indicating no relationship or complete independence between the two test results, which can also be thought of as a random relationship. Perfect independence is not expected, but values closer to zero signify greater independence for the results of the two tests.

It is possible to calculate the test agreement and accuracy for a range of possible values for cells A, B, C and D. The results can be displayed in a table format with the calculations for phi, agreement, accuracy when the two test results agree, and the difference between the accuracy of two tests and one test (shown as Accuracy Increase). To do this it is necessary to calculate possible permutations of A, B, C and D for the range of input values for Test-1 accuracy (A+B), Test-2 accuracy (A+C) and the agreement between Test-1 and Test-2 (cell A). Appendix A shows an R function to accomplish the permutation and calculations of the Table values.

Table 3 shows the reduced output from the R function (R Core Team, 2016) in Appendix A while varying the results of Test-1 and Test-2 from .5 to .99 and also varying the proportion of agreement between Test-1 and Test-2 from .01 to .99. Results shown in Table 3 are sorted for the accuracy increase (Accy. Increase column) when Test-1 and Test-2 agree.
Table 3 shows the reduced output from the R function (R Core Team, 2016) in Appendix A while varying the results of Test-1 and Test-2 from .5 to .99 and also varying the proportion of agreement between Test-1 and Test-2 from .01 to .99. Results shown in Table 3 are sorted for the accuracy increase (Accy. Increase column) when Test-1 and Test-2 agree.

Table 3. Reduced output for agreement and accuracy for 2 tests for a range of phi correlation values.

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<th>Input A+C</th>
<th>Input A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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* Table 3 contained over 27,000 rows before reduction for this example.
Of great interest is the fact that under some circumstances accuracy when two tests agree is lower than accuracy for a single test. (An example of this is the first row where the accuracy of Test1 is 0.7 and the accuracy when the two tests agree is 0.66.) Inspection of the details of Table 3 suggests that lower combined test accuracy may be related to conditions where the phi-coefficient is high and the difference in accuracy for Test-1 and Test-2 (margins A+B and A+C) is greater. For example, in the first row, the chance performance of Test-2 reduces the accuracy that would have been achieved if only Test-1 had been administered.

Discussion

Under the ideal circumstance that two test results are independent -- they have no shared source of variance -- calculation of the expected rate of agreement between the two tests is simple and straightforward. Another reason this estimate is imperfect is that it regards test errors as if they are completely random events. In reality, testing errors may occur due to systematic causes. Systematic causes of error may be due to individual or group differences physiology, psychology, or level of development. They may also occur in the form of deliberate strategies intended to alter a test result. Systematic causes of error may be especially problematic when the two tests are not independent, such as when they use similar methodologies or when the tests are administered under non-blind conditions (wherein an evaluator knows the outcome of the other test).

Conclusion

The correlation between binary outcomes of two tests can be calculated using the phi-coefficient which can be interpreted in a manner similar to the Pearson correlation coefficient. Under circumstances where the phi-coefficient approaches the value 1 – where there is very high correlation between outcomes – there is no increase in accuracy when the two tests agree on the outcome as compared to the accuracy achieved by a single test.

Increases in accuracy when two test results agree, are associated with lower phi-coefficients (i.e., when there is greater independence between the two tests). When the two test results agree, decreases in test accuracy are associated with lower independence and greater covariance between the tests. A practical implication of this is that the strategic and effective use of multiple testing strategies will require some understanding of the concepts and principles of science, testing, statistical classification, and basic probability theory. Effective use of multiple testing strategies may also depend in part on the independence of the two tests.
References


Appendix A.

R Function to Permute the Table of 2x2 Matrices for Two Tests

permutePHI <- function(AB=seq(from=0, to=1, by=.01),
                         AC=seq(from=0, to=1, by=.01),
                         A=seq(from=0, to=1, by=.01),
                         rem.neg=FALSE ) {
    # R function to permute a 2x2 matrix, phi and accuracy
    # for the binary outcome of two tests
    # 9/18/2017 Raymond Nelson
    ###
    # input can be vectorized
    # input AB is the marginal sum of the criterion for cell A and cell B
    # input AC is the marginal sum of the criterion for cell A and cell C
    # input A is the proportion of the criterion agreement between test 1 and test 2
    # criterion is whatever condition satisfies cell A. For example: correct decisions
    # this may also work for other kinds of dichotomous outcome such as truth or deception
    # rem.neg will remove rows where phi is < 0
    # output is a data frame with cols for 2x2 cells and marginal values
    ###
    # permutation
    colAB <- rep(AB, each=(length(AC)*length(A))) # use "each" to repeat each item
    colAC <- rep(rep(AC, each=length(AB), times=length(A)))
    colA <- rep(A, times=(length(AB)*length(AC))) # use "times" to repeat the vector
    # construct a data frame from the permuted vectors
    DAT <- cbind.data.frame(AB=colAB, AC=colAC, A=colA)
    # remove permutations where A is greater than AB or AC
    removeRows <- which(DAT$A > DAT$AB | DAT$A > DAT$AC)
if(length(removeRows > 0)) {
    DAT <- DAT[-removeRows,]
}
# calculate the cells
# cellA is the proportion of criterion1 events where test1 and test2 agree
# cellB is the proportion of criterion1 events for test1 but not test2
# cellC is the proportion of criterion1 events for test2 but not test1
# cellD is the proportion test1 and test2 events that fail criterion1
    DAT$cellA <- DAT$A
    DAT$cellB <- ifelse(DAT$AB == 0, 0, signif(DAT$AB * (1 - DAT$A / DAT$AB),2))
    DAT$cellC <- ifelse(DAT$AC == 0, 0, signif(DAT$AC * (1 - DAT$A / DAT$AC),2))
    removeRows <- which((DAT$cellA + DAT$cellB + DAT$cellC) > 1)
    if(length(removeRows > 0)) {
        DAT <- DAT[-removeRows,]
    }
    DAT$cellD <- round(1 - (DAT$cellA + DAT$cellB + DAT$cellC),2)
# calculate the agreement between the two tests
    DAT$agreement <- DAT$cellA + DAT$cellD
# calculate the phi coefficient
    DAT$phi <- round(((DAT$cellA * DAT$cellD) - (DAT$cellB * DAT$cellC)) / 
                      sqrt((DAT$cellA + DAT$cellB) * 
                           (DAT$cellC + DAT$cellD) * 
                           (DAT$cellA + DAT$cellC) * 
                           (DAT$cellB + DAT$cellD) ),2)
# remove rows where phi is non numeric due to div/0
    if(length(which(is.na(DAT$phi)) > 0)) {
        DAT <- DAT[-which(is.na(DAT$phi)),]
    }
# calculate the accuracy when the two tests agree
DAT$accuracy <- signif(DAT$cellA / DAT$agreement, 2)
if(length(which(is.na(DAT$accuracy)) > 0)) {
    DAT <- DAT[-which(is.na(DAT$accuracy)),]
}
# determine the increase over the margin A+B
DAT$accyIncrease <- round(DAT$accuracy - DAT$AB, 2)
# remove rows where the phi coefficient is negative
if(isTRUE(rem.neg)) {
    if(length(which(DAT$phi < 0) > 0)) {
        DAT <- DAT[-which(DAT$phi < 0),]
    }
}
return(DAT)
} # end permutePHI()
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