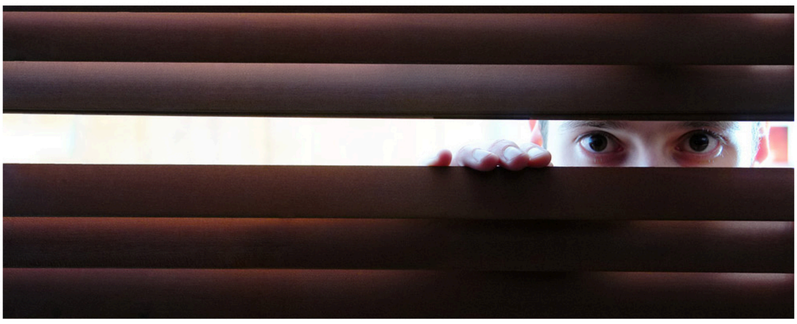

YOUR LYING EYES

December 11, 2017

By Jana Cunningham, communications specialist, University Marketing & Communications

When John Kircher, professor of educational psychology, arrived at the U as a graduate student in 1977, he wasn't interested in studying lie detector technology, but after a sequence of events early in his career, he has become a leading expert in the detection of deception. Kircher served as a consultant to the U.S. Department of Defense, U.S. Secret Service, U.S. Department of Homeland Security, National Science Foundation, National Research Council, Royal Canadian Mounted Police and numerous state and local police departments.

Kircher's research led him to create groundbreaking technology that uses eye tracking behavior to detect lies. It's faster, less invasive and cheaper than a polygraph and since it's automated, it's unbiased and fair. He's commercialized the technology through Converus, a company that has provided the test to businesses and government organizations in North, Central and South America.

Below, Kircher describes his journey to creating the eye tracker, its uses and the future of the technology.

HOW DID YOU BECOME INTERESTED IN RESEARCHING POLYGRAPH TECHNOLOGY?

I had never been interested in lie detection or polygraph techniques. I arrived on the U campus in 1977 as grad student in psychology to work with David Raskin, who was a professor in psychology and well-known psychophysiologist. I was interested generally in the field of psychophysiology, but Raskin had developed an interest in the polygraph just prior to my arrival. Initially, he conducted research to show that the polygraph is ineffective, but he found that it worked, and as a consequence, developed a research program to study it. By the time I arrived, all he wanted to do was conduct research on the polygraph. He didn't know exactly what to do with me, so he put me in a room with a microcomputer and asked me to program it to measure psychophysiological reactions to polygraph test questions. I spent my first couple of years in grad school teaching myself how to program a computer. I ended up creating algorithms for extracting diagnostic information from polygraph recordings and combining them in a statistically optimal way to decide if the examinee was truthful or deceptive on the test. David and I introduced the first computer-assisted polygraph system in 1986 – which was used by the U.S. Secret Service – and the first fully automated polygraph system in 1991. The Computerized Polygraph System (CPS) is still used worldwide today.

WHAT LED YOU TO CREATE AN EYE TRACKER TO DETECT LIES?

In 2004, my colleague, Doug Hacker, an educational psychologist, and I were on a road trip to climb Mt. Rainier. We had a 14-hour drive and got to talking about using an eye tracker to detect deception. Doug and I came up with the idea to develop a reading test for deception that relies on an eye tracker to record eye movements and changes in pupil size while people read and answer test questions. When we returned from Rainier, we called a meeting with our grad students and colleagues Anne Cook and Dan Woltz. The U's vice president for research gave us the funding to conduct a study using an eye tracker that Anne already had in her lab, which she used to study the psychology of reading. I spent a year or two developing computer programs to control her eye tracker and process the data. I used many of the algorithms I had developed to extract diagnostic features from polygraph signals to measure changes in pupil size, and Anne taught us how to analyze reading patterns using gaze position. We also used the computer to record response time, error rates and eye blink rates. I figured we might not be able to detect deception with an eye tracker (I gave it one chance in five of working), but if nothing else, the software would facilitate Anne and Doug's research on reading and writing.

HOW DOES THE TRACKER WORK?

We have test subjects put their chin in a chin rest to maintain a constant distance between the eyes and the tracker. We use the X, Y coordinates to identify eye fixations on the test questions we present and use them to study reading patterns (number of fixations, fixation duration, saccade distance, re-reading, etc.). We use the pupil signals to look for changes in pupil dilation associated with different types of test questions. Some questions we know are answered truthfully. Other questions we don't know if the person is being truthful. We compare the person's reactions (fixations, pupil, response time, response errors and blink rates) to the two types of questions. If there is a reliable difference between reactions to the two types of questions, we'd conclude that the person was deceptive. If there is little or no difference between reactions to the two types of questions, we'd conclude that the person was truthful.

WHAT ARE THE BENEFITS TO USING THE EYE TRACKER OVER A POLYGRAPH?

The Ocular-motor Deception Test (ODT) is faster than the polygraph (30-40 minutes rather than two to four hours). Because it is completely automated, its ability to distinguish between truthful and deceptive people doesn't depend on the qualifications and skills of a polygraph examiner. It is unbiased and fair – its decision is not affected by a person's race, gender, ethnicity or age, whereas a polygraph examiner can be influenced by those factors. With the ODT, the examinee receives all of the instructions from a computer and then simply answers a series of true/false statements. The examinee is not placed in an adversarial and usually aversive social competition with a polygraph examiner – they just complete a questionnaire on the computer.

IS THIS TECHNOLOGY MEANT TO REPLACE THE POLYGRAPH OR COMPLEMENT IT?

The ODT is meant to complement the polygraph. They have different advantages (for say, employment screening and criminal investigation) and the outcomes of the two types of tests are probably largely independent of each other. In other words, they provide different sources of information about a person's deceptive status. If two tests are independent, then the joint probability that they will both will make incorrect decisions is low. Let's say both tests are 80 percent accurate. Each has a 20 percent chance of calling a truthful person deceptive. According to the multiplication rule for independent events, if you run both tests (ODT and polygraph), the probability that a truthful person will fail both tests is .20 X .20 = .04, or only 4 percent. So, two moderately effective technologies can yield high accuracy when used in combination.

HOW HAS THE EYE TRACKER TECHNOLOGY EVOLVED OVER THE YEARS?

The eye trackers have improved greatly in accuracy and robustness. When we started our research program in 2004, we'd have to drop 20-30 percent of our subjects because we couldn't track their eyes, and when we could track their eyes, the tracker would drop lots of samples. These days, it is very rare that we can't track a person's eyes.

In 2004, a moderately priced tracker cost between $30,000 and $40,000. Now you can get a much better tracker on Amazon for under $200 (although the company will charge much more if you want a license to gain access to the raw data it produces).

Over the years, we've identified new diagnostic aspects of the signals that we get from the tracker. We've conducted research to determine if the ODT works as well in the field with actual job applicants as it does in our lab experiments on campus (it actually works a little better in the field). We found that it works as well in Spanish in Mexico as it does in English in the States. We've explored effects of age, sex and motivation to pass the test, the sequencing of different type of test questions, syntactic complexity and generalizability to a mid-Eastern language and culture.

WHAT TYPES OF ORGANIZATIONS USE THIS EYE TRACKER TECHNOLOGY?

In the U.S. there is a law that prohibits use of lie detection technology to screen applicants or employees, although the federal, state and local law enforcement agencies are exempt. So, in the U.S., some police departments are using the ODT. In Mexico, Central America and South America, government agencies and businesses are using the ODT to screen job applicants and in some cases to investigate theft. More information is located on the Converus website.

WHAT'S NEXT FOR THIS TECHNOLOGY?

We are trying to expand the number of relevant issues we cover in a single test. Currently, we ask about two topics, but we think we can expand the test to cover four topics without adding time it takes to complete the test. We also are developing an audio-based test for people with poor reading skills, which is common in many parts of the world. Our current technology does not work well if the examinee can't read well. The difficulties they experience reading overshadow effects of deception on ocular-motor measures.