Using Reaction Time to Measure "Guilty Knowledge"

Travis L. Seymour, Andrea Mosmann, and Colleen M. Seifert
Department of Psychology
University of Michigan
Ann Arbor, MI 48109-1109
{nogard,mosmann,seifert}@umich.edu

Despite numerous studies casting doubt on its effectiveness, the polygraph is admissible as evidence in many courts across the United States. It uses physiological indicators, such as galvanic skin response, of the activation of crime-related information when suspects are presented with cues pertaining to a crime. Because these indicators are indirect measures of knowledge activation, they are subject to influences other than the presence of guilty knowledge as well as covert attempts to manipulate them.

For years, cognitive psychologists have used more direct indicators of knowledge activation, such as reaction time (RT) and evoked related potential (ERP) to detect online activation of knowledge. Farwell & Donchin (1991) first used an ERP paradigm to detect Guilty Knowledge. They had participants learn information relevant to a mock crime, including location, name of contact (a confederate) and instruction for committing the "crime". After physically carrying out their 'mission,' in a subsequent session, these same participants were given an ostensibly new task of learning a word list similar to the previous session. After learning this Target list, participants made "old" or "new" judgments for items presented serially on a CRT. In addition to blocks of Target ("old") and Irrelevant ("new") items, there was a secret third category of items. These Probe items ("new") were either from the "crime" the participant committed previously ("guilty") or from a "crime" the participant had not committed ("innocent"). EEG data were collected during these blocks with the expectation that similar P300 ERPs would occur to the recognition of Target items and Guilty-Probe items, but for Irrelevant and Innocent-Probe phrases no ERP would be observed. Because this expected pattern was found, it was possible to determine whether a block contained Guilty or Innocent Probe items by comparing the correlation between ERPs for Target and Probe trials with the correlation between ERPs for Irrelevant and Probe trials. This method allowed for 100% correct classification of Innocent Blocks and 90% correct classification of Guilty Blocks.

Though RTs were collected, Farwell and Donchin do not analyze this data, arguing that RTs are not suitable for detection of Guilty Knowledge because they are easily manipulated. Our analysis of their RT data shows that response to Probe items is reliably slower and less accurate than response to Irrelevant items, while during Innocent blocks, RT and accuracy to Probe and Irrelevant items were identical.

In Experiment 1 of the current study, we investigated the viability of a Guilty Knowledge test based solely on RT. Our first experiment replicates Farwell & Donchin. We used their stimuli in a single-session version of their paradigm. Also, to eliminate the need for a confederate, we used a simulated electronic-mail based "crime." We found that RT was significantly slower and accuracy significantly poorer for Probe items compared to Irrelevant items during Guilty blocks, and no such difference between RT or accuracy for Innocent blocks.

Experiment 2 was identical to Experiment 1 except that participants were given general knowledge about the test. Participants were also motivated to appear "innocent" during Guilty blocks. If RT is easily manipulated, we expected the Guilty Knowledge Effect to be attenuated by an intent to deceive the test combined with general knowledge about it. The data show the same Guilty Knowledge Effect as Experiment 1, unaffected by general knowledge of the test. To further test Farwell & Donchin's claim, we conducted an additional experiment. Experiment 3 was identical to Experiment 2, except that participants were given more detailed knowledge about the task, including the RT pattern associated with the Guilty Knowledge Effect and strategic suggestions. Data from this experiment were identical those of Experiment 2. As long as participants follow instructions (i.e. accurately indicate "old" for Target items and "New" for Irrelevant items, and respond to all stimuli within 1000ms) there was a significant Guilty Knowledge Effect.

In all 3 experiments, comparing the difference between RT for Target and Probe items with the difference between RT for Irrelevant and Probe items allows correct classification for 100% of Innocent Blocks and 90% of Guilty Blocks. Because RT is less expensive, easier to collect and produces more easily analyzed data, we argue that a RT based alternative to the polygraph may be more economical than its ERP based counterpart. Also, because we demonstrate that manipulating the pattern of responses in this paradigm is far from easy, we believe this method is a viable measure of Guilty Knowledge.

References

Farwell, L. A., & Donchin, E., (1991). The truth will out: Interrogative Polygraphy ("Lie Detection") with event-related brain potentials. *Psychophysiology*, 28(5), 531--547.