

# The Effects of Sweep Numbers Per Average and Protocol Type on the Accuracy of the P300-Based Concealed Information Test

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**Abstract** In the first of two experiments, we compared the accuracy of the P300 concealed information test protocol as a function of numbers of trials experienced by subjects and ERP averages analyzed by investigators. Contrary to Farwell et al. (*Cogn Neurodyn* 6(2):115–154, 2012), we found no evidence that 100 trial based averages are more accurate than 66 or 33 trial based averages (all numbers led to accuracies of 84–94 %). There was actually a trend favoring the lowest trial numbers. The second study compared numbers of irrelevant stimuli recalled and recognized in the 3-stimulus protocol versus the complex trial protocol (Rosenfeld in *Memory detection: theory and application of the concealed information test*, Cambridge University Press, New York, pp 63–89, 2011). Again, in contrast to expectations from Farwell et al. (*Cogn Neurodyn* 6(2):115–154, 2012), there were no differences between protocols, although there were more irrelevant stimuli recognized than recalled, and irrelevant 4-digit number group stimuli were neither recalled nor recognized as well as irrelevant city name stimuli. We therefore conclude that stimulus processing in the P300-based complex trial protocol—with no more than 33 sweep averages—is adequate to allow accurate detection of concealed information.

**Keywords** Concealed information test · P300 · Event-related potential · Deception

## Introduction

One of the more recently investigated techniques for the detection of deception and concealed information involves the use of EEG and its event-related potential (ERP) derivatives. The ERP wave peak which we specifically focus on here is the P300, a positive peak occurring 300–800 ms after the presentation of a *recognized* rare and meaningful stimulus (Donchin and Coles 1988; Cohen and Polich 1997).

Though many P300-based Concealed Information Tests (CITs; see Rosenfeld 2011 for review), have been published, the earliest of these protocols (circa 1987–2007) were determined to be susceptible to countermeasures (CMs; Rosenfeld et al. 2004; Mertens and Allen 2008). These traditional three-stimulus protocols (3SPs) originally used in P300-based detection of concealed information involve the presentation of three types of stimuli (1) probes, crime-relevant items such as a murder weapon, (2) irrelevant, other weapons but not used in the crime, and (3) targets, irrelevant items requiring unique responses. The 3SPs require “yes” responses to the target stimuli and “no” to all other (Probe and Irrelevant) stimuli. The meaningful and relatively rare probe and target stimuli will evoke P300s in people who recognize probes (such as guilty people). Rosenfeld et al. (2004) found that this type of protocol was vulnerable to CMs, with successful detection rates of 82 % in the simply guilty group but only 18 % in the guilty group employing CMs. A newer protocol, the complex trial protocol (CTP), has been found to be resistant to CMs, and associated with higher accuracy rates (>90 %) in all subjects, even those employing CM strategies (Rosenfeld et al. 2008). The probe-irrelevant P300 differences were also found to be significant in all knowledgeable subjects in the new CTP, each with averages based on 33 probe and 33 irrelevant stimuli

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