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Event-related potentials reveal processing differences in honest vs. malingered memory performance

Hilarie P. Tardif*, Robert J. Barry, Stuart J. Johnstone

Brain & Behaviour Research Institute and Department of Psychology, University of Wollongong, Wollongong 2522, Australia

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Abstract

Twenty-two undergraduate students completed a recognition memory test while event-related potentials (ERPs) were recorded. During the testing phase, subjects distinguished old from new words in a forced-choice format. There were two counterbalanced within-subject conditions, one in which subjects performed to the best of their abilities, and another with instructions to feign memory impairment. Test scores and response latencies differed significantly between the two conditions. Analysis of PCA-defined epochs revealed that old words were more positive than new in the control condition, with this difference confined to frontal regions and interpreted as reflecting familiarity-based recognition judgements. In the malingering task, this old/new word difference emerged earlier and was broadly distributed across the scalp. A discriminant function analysis using reaction time and ERP measures resulted in 82% correct classification of honest and simulated performance, with 79% correct on cross-validation.

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1. Introduction

An increasing range of methods to detect feigned memory impairment has been investigated recently. The majority of these use scores on existing neuropsychological and specifically designed tests to screen for non-optimal performance. However, test scores have been shown to be highly sensitive to coaching strategies which provide participants with information on how to pres-

ent a believable deficit and thus avoid detection (Gunstad and Suhr, 2001; Lamb et al., 1994; Orr and Pitman, 1993; Rose et al., 1998; Suhr and Gunstad, 2000; Youngjohn et al., 1999). As a result, an increasing number of researchers are now investigating other, more covert, measures to distinguish honest from feigned performance. For example, Rose et al. (1998) found significant differences in overall response latency between malingering, control and head-injured groups, but not between coached and uncoached malingerers. Other studies have suggested the value of event-related potentials (ERPs) as a means of detecting feigned deficits. These studies have predominantly

*Corresponding author. Tel.: +61-2-4221-4511; fax: +61-2-4221-4163.

E-mail address: hilarie_tardif@psyc.uow.edu.au (H.P. Tardif).

focused on the P3 component of the ERP, and have demonstrated equivalent recognition of target stimuli in control and malingering subjects, despite reduced test performance in the malingerers suggestive of memory loss (Ellwanger et al., 1999; Rosenfeld et al., 1995, 1998).

A recent study by our group (Tardif et al., 2000) reported that another ERP measure, the old/new effect, may also be useful in the detection of those simulating memory deficits. The old/new effect refers to the more-positive waveform elicited in response to previously-encountered ('old') items relative to that associated with 'new' items. Studies have shown that this effect consists of a number of subcomponents reflecting functionally-distinct processes involved in the recognition of previously-studied items. For example, an old/new effect predominant over parietal scalp sites evident at approximately 500–800 ms following stimulus onset is thought to reflect conscious recollection of an item and the context in which it was seen (Curran, 1999, 2000; Wilding, 2000). Our recent study demonstrated that a similar effect did not differ in size or topography between subjects feigning a deficit or responding honestly, indicating actual recognition in the simulating subjects despite poor test performance. In addition, and unexpectedly, an early old/new effect confined to the waveforms of the simulators was also observed, evident in the 0–450 ms period following stimulus onset. This was interpreted as reflecting the more complex, or additional, processing required in the simulating task. To our knowledge, this early effect has not been previously reported in studies of feigned impairment. One of the major aims of the present study, therefore, was to replicate the results of our previous work and demonstrate the reliability of this early malingering effect.

The predominant focus of malingering research over the last decade has been on the use of Symptom Validity Tests (SVTs)—a range of tests which present stimuli in a forced-choice format (for a review, see Bianchini et al., 2001). Consistent with this line of research, our previous study presented words in pairs, with subjects discriminating previously-studied words from distracter items. In contrast, ERP studies of recognition memory typically require that subjects make rec-

ognition judgements for each word presented in the test phase, in either a 'yes–no' (e.g. Rugg et al., 1998; Wilding, 2000) or 'continuous' (e.g. Berman et al., 1991; Dietrich et al., 2001) format. Despite the widespread use of forced-choice tests in behavioural studies of recognition memory (e.g. Aggleton and Shaw, 1996; Keane et al., 2000) and simulated impairment, to our knowledge there have been no studies examining the electrophysiological correlates of recognition memory in this paradigm, and how these may differ from those typically reported in the yes–no and continuous formats. For example, an anonymous reviewer of our previous study speculated that the forced-choice format might permit differential processing of each word in the pair—presentation of the first word may be sufficient to make an old/new judgement, thus reducing the need to attend to the second word. Furthermore, attention to, or analysis of, the second word might differ between the control and malingering groups. A further aim of the present study, therefore, was to address these issues with a more-detailed analysis of the electrophysiological response than was used in our previous study. This involved using a principal component analysis (PCA) to define the components underlying the ERP waveform, and separating ERPs to words not only as a function of their old/new status, but also according to whether they were presented as the first or second word in the pair. This allowed investigation of differential processing of the stimuli as a function of presentation order and to compare this in honestly-responding and simulated-impairment conditions.

The present study also utilised a within-subject design in order to provide confirmatory evidence that any differences between the control and malingering conditions were task- rather than subject-related.

2. Materials and methods

2.1. Subjects

Twenty-two undergraduate students from the University of Wollongong participated in the study as one means of satisfying a course requirement. Three subjects were discarded from the final anal-

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