Electrophysiological and behavioural indices of simulated recognition memory impairment

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ELECTROPHYSIOLOGICAL AND BEHAVIOURAL INDICES OF SIMULATED RECOGNITION MEMORY IMPAIRMENT

A thesis submitted in fulfilment of the requirements for the award of the degree

DOCTOR OF PHILOSOPHY

from

UNIVERSITY OF WOLLONGONG

by

HILARIE P. TARDIF, B.Sc.(Hons.)

DEPARTMENT OF PSYCHOLOGY
2003
DECLARATION

I, Hilarie P. Tardif, declare that this thesis, submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Department of Psychology, University of Wollongong, is wholly my own work unless otherwise referenced or acknowledged. The document has not been submitted for qualifications at any other academic institution.

Hilarie P. Tardif
March 2003
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I would like to dedicate this thesis to my parents, John and Patricia Tardif. Together you created an environment which valued and nurtured effort and achievement, but at the same time promised unconditional love and support, regardless of how successful I was. Thank you!
ABSTRACT

This thesis examined the use of event-related potentials as a means of detecting feigned recognition memory impairment. In seven studies, undergraduate students were instructed either to complete a recognition memory test to the best of their abilities, or to simulate accident-related memory loss. These studies extended previous research by investigating electrophysiological differences between the control and malingering tasks (1) for stimuli which differed in linguistic frequency, (2) in tests which varied the format of word presentation, (3) during the initial encoding of the stimuli, and (4) using ERP components not previously considered in studies investigating the detection of malingering. The main results were that simulating individuals appear to use more active or additional cognitive processing during task performance compared to those who respond honestly, with this enhanced effort reflected in an ERP effect indexing earlier recognition of previously-studied words. This earlier recognition, considered to be the result of more elaborative or efficient encoding of the stimuli, was most evident in the easier forms of the recognition test and in malingers who presented a more believable profile of impairment. The malingers also demonstrated different electrophysiological responses to items that were incorrectly classified, and a pattern of response latency suggesting that they concealed recognition of previously-studied items. Overall, the results indicate that the simulation of amnesia on a recognition memory task involves qualitatively different processing of the word stimuli, which may be detected in the waveforms and more covert patterns of behaviour of these individuals.
OVERVIEW

This thesis aimed to extend knowledge regarding the use of ERPs to detect feigned memory impairment. This was achieved through examination of the effect of malingering task instructions on components and ERP effects other than the P3, which has been the focus of most previous studies investigating ERPs and malingering. Studies 1 to 5 examined the behavioural and electrophysiological responses of control and simulating malingering participants on recognition memory tests that varied the linguistic frequency of the stimuli, and the format in which the words were presented during the retrieval phase. Studies 4 and 5 also included a comparison of ERP outcomes of processes occurring in the two groups during initial encoding of the stimuli. Study 6 delayed assignment of participants to the malingering and control groups until after the encoding phase to further explore the relationship between encoding and retrieval ERPs. A final study compared the behavioural and electrophysiological data of malingerers who presented a believable deficit with those whose performance appeared to be less plausible. Discriminant function analyses were used throughout to assess the reliability of ERP and behavioural effects in predicting group membership at the individual level.

The first three chapters of this thesis provide comprehensive literature reviews on malingering (Chapter 1), the more traditional approaches to its detection (Chapter 2), and the use of ERPs for detecting simulated impairment (Chapter 3).

Study 1 (Chapter 4) investigated the performance of a group of 24 participants on a computerised version of the Words subtest of the Warrington Recognition Memory test. Twelve subjects were instructed to feign an accident-related recognition memory deficit,
while the remainder served as controls. In this and all following studies, EEG data from nine scalp sites were analysed. The malingerers performed poorly on the test compared to the control group. However, the “old-new effect”, an ERP measure thought to reflect recognition memory processes, did not differ in size or topography between the two groups. In addition, a second, earlier-emerging difference between old and new words was evident, confined to the waveforms of the malingerer participants. These results suggest firstly, that the malingerers did recognise the previously-studied words despite poor test performance, and secondly, that the task of malingerer involves differential or additional processing of the stimuli.

Study 2 (Chapter 5) aimed to replicate and extend the findings of the first study, using a statistically more powerful within-subject design, a principal components analysis of the data to define the underlying components of the waveform, and an analysis of response latency data. The data from 19 participants completing the task in both a control and malingerer condition were analysed. Behaviourally, individuals performed poorly on the recognition task when simulating impairment. They also demonstrated equivalent reaction times regardless of the accuracy of their response, whereas correct responses were made more rapidly in the control task. The control task waveforms were characterised by old/new word differences associated with a frontally-distributed N400 component, and a later right frontal old/new effect, consistent with shallower processing and less confident recognition of the words. In contrast, old/new differences were broadly distributed across the scalp and emerged earlier in the malingerer task. These results replicated the main findings of the first study, suggesting that recognition occurred earlier in those simulating
impaired. In addition, the qualitatively different ERPs were consistent with additional or enhanced cognitive processing of the stimuli in the malingering task.

The recognition tests used in these first two studies presented words with a high linguistic frequency in a forced-choice format, whereby the participant decides which one of a pair of words was shown in the study phase. Numerous studies have demonstrated that cognitive processing differs according to word frequency, and the format in which the words are presented. The following three studies therefore aimed to assess the reliability of the findings of Studies 1 and 2 through the systematic manipulation of test format and word frequency.

Responses to words with a low frequency of occurrence presented in a forced-choice test of recognition memory were investigated in Study 3 (Chapter 6). Ten controls and nine simulating malingerers completed the task. ERP effects indicating earlier recognition of studied items in those simulating impairment were again observed. In addition, the response latency effect observed in the previous study was again evident in the malingering participants. These results demonstrate the reliability of those reported in Studies 1 and 2, using low-frequency word stimuli.

These results were also replicated in Study 4 (Chapter 7), which assessed the responses of 17 control and 23 simulators to high-frequency words, presented in a yes-no test format. In addition, qualitative differences in the ERPs recorded during both the study and test phases suggested that encoding strategy influenced processes occurring during retrieval, and that these processes differed in the two groups. Furthermore, the ERPs of the malingering group were consistent with more elaborative and efficient encoding of the stimuli. An analysis of the ERPs associated with incorrect responses revealed that these
elicited an increased negativity at about 600 ms in the control group only. This was interpreted as reflecting the purposeful provision of incorrect responses in individuals simulating impairment.

Study 5 (Chapter 8) completed the series of studies manipulating word frequency and test format, assessing recognition memory in 20 controls and 22 simulating malingerers on a test using low-frequency words in a yes-no format. Group differences in the time taken to classify correct and incorrect responses were again evident in this study. However, the ERP effects identified previously and taken to reflect additional or enhanced cognitive processing in the malingering group were not observed. These results suggest that the additional processing or effort hypothesised in the malingerers in the previous studies might be a function of the combined effect of word frequency and test format.

The findings of Studies 2 to 5 were integrated and discussed in Chapter 9. While the behavioural group differences in test scores and in response latency as a function of accuracy were evident in all studies, ERP effects signaling additional effort were most evident in the easier forms of the recognition task – those involving highly familiar words and/or a forced-choice format. These results suggest that easier tasks may enable additional processing or planning in malingering participants and may therefore be preferable in ERP studies aiming to distinguish feigned from honest performance.

Study 6 (Chapter 10) further investigated the relationship between encoding and retrieval phase ERPs. Twenty participants completed a recognition memory task that presented low-frequency words in a forced-choice format, and were assigned to either the control or simulating group after the initial presentation and encoding of the words. The study phase ERPs of the two groups did not differ, and the early malingering recognition
effect was absent. These results indicate that the early recognition of the words in those simulating impairment, identified in previous studies in this thesis, may be the result of differential processing during the initial encoding of the stimuli.

Study 7 (Chapter 11) identified malingerers from the previous studies in this thesis who responded at chance levels, and compared them to malingerers who presented a more believable deficit. ERP effects interpreted previously as reflecting more effort in the processing of the stimuli, in particular, the early malingering recognition effect, were larger in the simulators who were more able to feign a believable impairment. The results of this study therefore suggest that ERPs may play an important role in the detection of these typically difficult-to-identify individuals.

An overall summary of the main results obtained in this thesis, and suggestions for future research, are provided in Chapter 12.
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