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PARKINSON'S DISEASE:
MEMORY DEFICITS

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Abstract

Parkinson's disease (PD) has long been thought of as a debilitating motor disease: only relatively recently has research focused on cognitive functioning. It is now widely accepted that memory processes are among the primary cognitive functions to deteriorate in PD. However, less is known about the role that task variables (e.g., difficulty) and participant characteristics (e.g., gender, disease progression) play in this relationship. In addition, few studies in the PD literature have looked at the important issues of statistical power and the magnitude of memory deficits. The present investigation addressed some of these concerns. The first stage involved conducting a power analysis, based on 48 studies, followed by a meta-analysis. The meta-analysis included 32 effect sizes from studies assessing recognition memory in PD. This analysis paved the way for a large-scale study examining recognition memory in 41 nondemented PD participants compared to 41 age- and education-matched healthy controls. Both verbal and nonverbal recognition tasks were specifically designed for this purpose, the latter employing two levels of difficulty. In addition, prospective memory (remembering to remember) was examined with two event-based tasks because no study to date has looked at this issue in PD. The results of the power analysis indicated that past research has typically had insufficient statistical power to detect all but the largest memory deficits. Integrating the data from many studies, the meta-analysis suggested that nondemented, medicated PD participants may suffer from small recognition deficits. Support was provided by the subsequent primary study. In addition, it was found that the progression of memory impairment operates in parallel with the progression of motor symptoms. Moreover, task demands interacted with disease stage, such that nonverbal recognition deficits were only seen in early-stage PD participants when the task was made more difficult. Conversely, advanced-stage participants produced deficits irrespective of the level of difficulty. With respect to prospective memory, only the advanced-stage participants showed clear evidence of memory impairment. The main outcome of this research is that recognition memory impairment does occur in PD. However, low levels of statistical power in previous

research and moderating factors such as symptom severity and task difficulty have likely obscured true deficits.

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Preface

The work presented here evolved from a review of the literature on cognitive deficits in Parkinson's disease (PD) focusing on memory deficits. The review indicated that it is widely recognised that people with PD often suffer from cognitive dysfunction including memory deficits. However, the exact nature of these deficits is still under debate. It also became clear that there are considerable inconsistencies in the research findings coupled with little consideration for issues of statistical power, effect size (ES), and cumulative research synthesis. In the PD literature, it is often reported that recall memory is impaired, whereas recognition memory is relatively intact. However, these reports are often based on studies with inadequate statistical power.

Statistical power is important because studies with low statistical power will have little chance of detecting true deficits (effects) when using conventional statistical significance testing (Cohen, 1988). Moreover, statistical significance provides little information about the magnitude of any deficit. To interpret an individual study's results, an alternative to statistical significance testing is the use of point estimates of ES and confidence intervals (Schmidt, 1992, 1996), the approach adopted in this thesis.

To interpret the results of multiple studies, an alternative to the traditional narrative review is the meta-analysis. Meta-analysis is a perspective that uses objective techniques for research synthesis. It is generally used to produce a quantitative summary of a set of studies based on ES rather than significance tests (Bangert-Drowns, 1986; Cooper & Hedges, 1994). In situations where a field of research contains many inconsistent results, as judged by significance tests, meta-analysis is potentially most effective. In these circumstances, the statistical techniques developed by Hunter and Schmidt (1990) allow a meta-analyst to decide whether the variance in the results is due to sampling error or possible moderating factors. Without quantification of the results, it is difficult, if not impossible in most situations, for a narrative review to achieve this. Above all, meta-analysis maintains all of the qualities of the traditional literary format, but also provides a process for judging whether a set of studies produced consistent results.

The main purpose of the present research, then, was to examine memory deficits, more specifically recognition memory deficits, in PD. A meta-analytical review and a power analysis paved the way for a large-scale experimental investigation of recognition memory impairment in PD. In addition, the study was designed to look at prospective memory, a topic that has not been examined in people with PD. This investigation also assessed a range of possible moderating factors that might interact with the disease process itself to bring about any observed memory deficits.

It should be noted that the meta-analytical data reported here are only a subset of what were originally collected. The complete data set includes ESs calculated from over 100 studies that used recall and/or recognition memory tasks. However, to limit the focus of the present investigation, only the recognition memory data were analysed and reported here.

This dissertation is unconventional in the sense that statistical power and ES are used extensively in the interpretation of both past and present research findings, rather than statistical significance. Further justification for this approach is given both in chapter 2 and in chapter 4. In my opinion, because the present work (like most current psychological research) is exploratory, nothing is lost by taking this approach. In fact, as demonstrated in chapter 4, interesting effects would have been discarded had this approach not been taken.

Finally, a planned comparison approach with simple effects tests was used to examine the influence of potential moderating variables at two different experimental sessions. In retrospect, a multivariate approach, such as multiple regression, could have been taken instead. However, as discussed in chapter 4, the composition of the sample varied as a function of time. Therefore, a multivariate analysis would have been complicated by differences between sessions.

Organisation of this Dissertation

This dissertation consists of four chapters. Chapter 1 includes six major sections that provide a general overview of PD and the known cognitive deficits, recognition memory, prospective memory, memory systems, and concludes with a summary and rationale for conducting a power analysis and a meta-analysis on the PD literature.

Chapter 2 contains the statistical power analysis and the meta-analysis. It has four major sections detailing the issues and rationale, the methods used, the results, and a discussion. (Note that substantive parts of the method, results, and discussion have been accepted for publication. A copy of the article (in press) is provided in Appendix U.)

Chapter 3 has four major sections detailing the experimental rationale, the methods used, the results, and a discussion of the results.

Finally, chapter 4 provides a general discussion of the present research, including its limitations and future directions, and a general conclusion.

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