

Review of Doctoral Dissertation by Michał Wereszczyński,

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Review by Emeritus Professor Peter Rendell

(1) PhD Thesis Overview

The thesis involves two innovative and complementary studies that have resulted in two articles, one published and another article that has been accepted for publication- both in the journal *Scientific Reports*. This is a very high quality and high impact international journal. The studies examine two very important and novel aspects of the emerging Spontaneous Retrieval Deficit hypothesis. The main objective was to test the SRD hypothesis in groups with elevated risk of developing AD. This is the prediction that in these groups, reduced spontaneous retrieval could be an early indicator of potential cognitive decline given that AD is associated with reduced spontaneous retrieval

This overall objective was soundly addressed in the first study by investigating 27 amnesic Mild Cognitive Decline (aMCI group) which is a group that is known to have an increased risk of developing AD. They were compared with a group of 27 healthy controls. The first study tests a key and previously untested prediction that is central to the SRD theory - that groups with risk of developing AD will demonstrate reduced mind wandering. The study involved two comprehensive sessions of individual testing. A previous test of mind wandering was modified and piloted to develop the very substantial Man Made/Natural Task used in this thesis. There were two versions with highly meaningful stimuli and unmeaningful stimuli. This innovative test of spontaneous retrieval along with comprehensive neuropsychology testing generated a rich set of data that was well analysed. The main findings were very substantial and were fairly much as predicted. The aMCI group were shown to experience less mind wandering – fewer spontaneous task-unrelated thoughts. The abstract concluded that spontaneous retrieval deficits represents very promising early markers of cognitive impairment. This measured conclusion was appropriate but possibly underplays what I think is an important and timely study that successfully confirmed a central prediction of SRD.

The second study tests appears at first to be not so central to SRD and possibly quirky. However, on closer consideration it is a really innovative and creative study that turned out to be ground breaking. The study investigated, for the first time, spontaneous retrieval with a group of people with high number of periodontal disease symptoms. This is a group of people with a higher risk of developing AD. The participants were sixty independent living older adults free of dementia. Substantial individual testing was conducted. Periodontal health was precisely and thoroughly tested with both subjective measures and objective measures conducted

by a qualified dentist. A comprehensive and very appropriate battery of neuropsychological tests were conducted. Following on from the first study mind wandering was cleverly and thoroughly assessed. The findings provided very exciting support of the SRD and were basically as boldly predicted that both subjective and objective symptoms of periodontal health were associated with less-mind wandering.

Both studies make important theoretical and applied contributions. They address and progress the general theories and knowledge related to SRD and AD. The substantial applied contributions in the first study include confirming predictions of SRD that have significance for clinical practice. In particular the studies show deficits in spontaneous retrieval are very promising early markers of Alzheimer's disease. The second study presented ground breaking and exciting evidence on dental health contributing to AD.

(2) Theoretical knowledge of the candidate

I assess that the dissertation demonstrates the candidate has very strong general theoretical knowledge for doctoral degree in psychology.

The two papers have a very strong focus on examining very important theoretical questions, both with well-designed experimental studies. The review of the literature in each paper and the design of the studies show a strong understanding of the broader theories in neuropsychology and the specific theories on AD and mind-wandering. Firstly, this core focus of the thesis on theories provided opportunity to demonstrate very clearly the impressive theoretical knowledge. Secondly, the way all the relevant theories are articulated so well in each section of the thesis: the introduction, the overview of the research program and the two papers. These sections in combination present an insightful overview of the relevant literature that is both very current but also shows understanding of the how these fields have developed. The theoretical context of the large body of research on AD and in contrast the emerging literature on SRD was really well covered in the thesis introduction and in the introductions of the outcome papers. In particular, the insightful outlining of the counter-intuitive nature of SRD and how this is possibly why clinicians have focussed on strategic encoding and retrieval when considering AD. The thesis introduction presented a very clear outline of the context of AD and aMCI and how the research conducted can transform the current theoretical understanding of the most effective markers of AD. Also demonstrated, was a very good understanding of the complex neuroscience knowledge relevant to this study. In addition

There were many specific examples of where sound and insightful knowledge of the literature was demonstrated. For example, the section within the thesis introduction that reviewed the literature on the need to develop sensitive measures of spontaneous retrieval. In particular within this section, there was the excellent coverage of the need to refine measures to ensure that reduction in spontaneous

task-unrelated thoughts are not obscured by unreduced number of deliberate thoughts in early phases of AD.

(3) Ability to conduct independent research

I assess this doctoral dissertation to have demonstrated the ability of the doctorate degree candidate to conduct research independently to a high level.

As already noted, I find it impressive that the dissertation includes two studies where one is already published and the other accepted for publication- both in the journal *Scientific Reports*. Generally, it is the aim to complete the PhD with publishable studies but to have two separate papers accepted for publication well within time constraints of the PhD program is no mean feat. It is particularly impressive given that the candidate has published in such a high-ranking journal as *Scientific Reports*. It is particularly noteworthy that the papers reported novel studies involving rigorous experiments with sophisticated behavioural measures requiring individual testing. To further illustrate the substantial nature of the research that was conducted, I suggest considering how Study 1 thoroughly measured mind wandering with the Man-Made/Natural task. This substantial task with 242-slide presentation of pictures of natural objects and man-made objects was impressively modified and two versions were developed following careful piloting. So the thesis involved conducting the development of the mind wandering measure, recruiting participants, conducting demanding individual testing sessions, complex analysis of a very rich data sets, the preparation and submission of papers to journals that were accepted. The completion of all this in a timely fashion within the constraints of the PhD, demonstrates the ability to conduct research independently at a very high level.

I have some additional observations to support my assessment that the thesis demonstrates this high level of ability to conduct independent research. Firstly, the research design and testing procedures show much attention to detail and experimental rigour. For example, in study 1 special care seems to have taken to ensure the aMCI participants met all the diagnostic criteria for aMCI. Secondly, I highlight the very sound analysis of the data in study 1 that I have already observed was a very rich and complex data set comparing the aMCI and the HC groups. The data was soundly analysed with MANOVAs with the significance levels and effect sizes thoroughly reported and importantly the various factors systematically analysed. The initial analysis appropriately involved grouping the responses into 4 response to test the spontaneous retrieval hypothesis. The second set of analyses appropriately compared the meaningful and unmeaningful stimuli for the two participant groups. Interestingly the results showed as predicted the aMCI reported fewer spontaneous task-unrelated thoughts than HC when exposed to highly meaningful stimuli but not when exposed to unmeaningful stimuli. The third analyses appropriately compared the spontaneous retrieval of the two groups on temporal orientation of future vs past vs present. This took up the insightful and well-made observation in the thesis of the possible connection of this research to Tulving

and others on mental time travel. Finally, the analysis focused on potential confounds with some rigorous analysis of some well-considered possible confounds. Importantly the analysis robustly excluded these confounds

(4) Novelty of this research.

I assess this doctoral dissertation to be a timely original solution to a scientific problem.

As I have outlined in the overview, the main and novel objective was to test the SRD hypothesis in groups with elevated risk of developing AD. Also as outlined, this was successfully achieved with the excellent outcome of two papers accepted for publication in a highly ranked journal. These two papers report two very novel and complementary studies that have made substantial and timely theoretical contributions. They also have made important applied contributions to inform clinical practice in relation to AD and cognitive decline. In particular, they provide strong evidence indicating reductions of spontaneous retrieval to be very promising early markers of AD and cognitive decline. The conclusions in the thesis were appropriately measured but may have been somewhat understated as I think identifying early markers is almost the holy grail in this field!

In further justifying my assessment, I note that the novelty of the thesis research seems to have been accepted by the reviewers of both papers that report the two studies in thesis. Indeed, both papers explicitly recognize the novelty of the research reported. The first paper for example states in abstract conclusion: "... findings provide strong support for this novel hypothesis ..."

The second paper clearly states in the abstract the study investigates for the first time the relationship between dental health and mind wandering.

(5) Questions for candidate

I do not have any issues of concern to raise or matters that need to be addressed in the viva. If I am able to observe the viva then I would be very interested to hear further discussion on future research that could arise from the thesis. I have an interest in prospection and future thinking involving mental mind travel. I think it would be interesting to consider these as possible avenues for future research. I do note that the thesis did appropriately consider past and future oriented thoughts. Also on page 20 there was discussion of past and future oriented thoughts and how this relates with mental mind travel.

(6) Conclusion

I have outlined how the thesis: (i) demonstrates a very high level of theoretical knowledge and understanding of the relevant literature, (ii) demonstrate to a very impressive level the ability to conduct research independently (iii) demonstrates novelty and originality as was explicitly recognized in the papers that arise from this thesis.

My overall evaluation of this thesis is that it is an outstanding thesis. I have noted that this has also been shown by having two separate papers arising from this thesis accepted in a high-quality international research journal. Importantly, I have in my review outlined how the papers have made outstanding theoretical and applied contributions to the literature. The thesis has really progressed the key theory of focus, spontaneous retrieval deficit and has the potential to inform clinical practice with the promising evidence on SPD being early marker of AD.

Therefore, I strongly recommend the award of distinction.