



Dmytro Khanzhyn's dissertation

'Semantic processing in the native and non-native language: The role of working memory and the type of semantic relations'

05 September 2023.

Dear Pr. Joanna Pawelczyk,

I have read the dissertation submitted by Dmytro Khanzhyn in order to obtain a Doctoral diploma at Adam Mickiewicz University.

It clearly merits a public defense (I explain why below).

The dissertation of Dmytro Khanzhyn corresponds to a volume of 219 pages written in English (including the bibliography and the appendices presenting the linguistic materials). The bibliography contains about 260 references, including a reference to his own work "in press" in the excellent journal *Psychonomic Bulletin & Review*.

The dissertation starts with a brief Introduction followed by six chapters. Chapters 1 and 2 entitled respectively 'Lexico-semantic processing and semantic priming' and 'Working memory' provide a theoretical background and an overview of literature on the topic. Chapter 3 entitled 'Polish word associations (study 1)' presents the first empirical study of the dissertation. Chapter 4 entitled 'The impact of spatial and verbal working memory load on relatedness judgments (study 2)' corresponds to an article "in press" in *Psychonomic Bulletin & Review* and presents the second empirical study (three experiments) of the dissertation. Chapter 5 entitled 'Relatedness judgments of English word pairs with forward, backward and symmetric association by native and non-native speakers (study 3)' presents the third empirical study (two experiments) of the dissertation. Finally, Chapter 6 (General Discussion) discusses the results in the context of previous findings in the literature and theoretical models and ends by a general conclusion.

The main objective of the author was to investigate the impact of working memory load and different types of semantic relations on semantic processing in the native (L1) and non-native language (L2). Study 1 (based on 484 Polish participants) investigated whether semantically related pairs from a Polish dataset (Rataj et al., 2021) were also associatively related. These stimuli were intended to be used in Study 2. The results of Study 1 confirmed that the word pairs used in Study 2 were mostly semantically related and not associated. This was crucial to demonstrate since the experiments tested in Study 2 were designed to investigate the influence of various factors on the processing of **semantic relations** *per se*.

Another research question in Study 1 was to address the relationship between human-obtained association norms and vector-based semantic similarity measures. Study 1 found a strong correlation between semantic relatedness measures derived from corpus-based semantic spaces and associative relatedness measures obtained from human data.

In follow-up studies, the semantic relatedness task (Balota & Paul, 1996) was used to investigate how semantic processing of words with different types of relatedness is impacted by additional working memory load in the verbal and spatial domain (Study 2). In particular, Study 2 consisted of three experiments using the semantic relatedness task to investigate the impact of the type of working memory (spatial vs. verbal) and working memory load (low vs. high) on semantically related word pairs (strongly related vs. weakly related vs. unrelated). The results showed that strongly and weakly semantically related pairs were processed differently (facilitation vs. inhibition), and that semantic relatedness judgments were modulated by working memory load, especially in the verbal domain.

Study 3 focused on semantic relatedness judgments of word pairs with different types of association (forward, backward, and symmetrical) in the L1 and L2. The results showed a facilitation effect for all types of association, in both groups of participants, with an additive effect for symmetric associates, suggesting similar semantic activation mechanisms in both native and non-native language. Distributional analyses showed larger facilitation effects for symmetric associates in non-native compared to native participants, especially for faster responses.

Overall, this is a very interesting dissertation. Important questions are addressed, and clever tests are devised, combining classic chronometric analyses with more sophisticated distribution analyses such as delta plots (Figures 17, 18, 20, 27 and 30 are particularly informative). The results appear to be unambiguous and show that semantic relatedness judgments is modulated by the type of working memory load (with verbal working memory having a stronger effect relative to spatial working memory) and that this modulation differs in size and direction depending on the degree of semantic relatedness between word pairs. The manipulation of the Working Memory variable (and especially the differential effect of spatial and verbal working memory) in the design of Study 2 is a real novelty (as far as I know, this is a premiere). The investigation of semantic relatedness judgments of words with different types of association (forward, backward, and symmetrical) in the L1 and L2 in two different groups of participants in Study 3 is also totally new and original (no previous studies ever compared semantic processing of symmetric and asymmetric associates in a semantic relatedness task in the native and non-native language). All the presented results appear to be solid. Finally, the different theoretical frameworks used (e.g., Baddeley's theoretical model of working memory; Neely & Hutchison's general framework of semantic and associative priming; van Heuven & Dijkstra's Bilingual Interactive Activation model-BIA+; etc.) nicely package these and related findings.

In the present dissertation, Dmytro Khanzhyn has conducted a series of 6 experiments, on a total of 761 participants. Overall, the methodology of the experiments is very sound, and a particular care has been applied to select the linguistic materials in Polish. The approach adopted by the author is an excellent illustration of how Psycholinguistics and Cognitive Science can be conducted with success. The results obtained are particularly informative and will be very useful to constrain the functional architecture of models of visual word recognition at the semantic level of processing.

Of course, some points can be raised in the dissertation. I list some of them below:

-Models of semantic memory: In the dissertation, there is only a very brief mention of embodied models of semantic memory (on page 22). It would have been interesting to describe these theories of embodied cognition more deeply because they become more and more influential nowadays (see, e.g., Lakhzoum, Izaute, & Ferrand, 2021a, *Behavior Research Methods*, for a brief review of these models in relation to semantic processing). Also, I am curious to see how these theories can account for the results obtained in the present dissertation (to me, these results seem very challenging for models of embodied cognition).

-Concrete words: It seems that most of the words used and tested in the three experiments of Study 2 were concrete words (see Appendix A); what about abstract words such as 'freedom', 'mind', 'justice', etc. Do they behave like concrete words in terms of semantic similarity? Are they processed like concrete words at the semantic level? (see, e.g., Lakhzoum et al., 2021a, *Behavior Research Methods*; Lakhzoum et al., 2021b, *PsyArXiv*; Lakhzoum et al., 2023, *Quarterly Journal of Experimental Psychology*). It would be interesting to study these abstract words in future studies (maybe during a postdoc?) and check if the results obtained with concrete words generalize to abstract words as well.

-The semantic relatedness task: Only one task was used in the present studies (i.e., the semantic relatedness task). While this task seems to produce consistent and robust results, it would be interesting to generalize the obtained results to different tasks (such as the semantic priming lexical decision task or the semantic priming naming task, for instance). The focus on semantic processing is explicit in the semantic relatedness task whereas it is implicit in the semantic priming lexical decision task and therefore the depth of processing is different. Said differently, it is not surprising to obtain semantic priming effects in a task focusing **explicitly** on semantic relatedness. What is surprising however is to obtain facilitation effects for strongly related pairs and inhibition effects for weakly related pairs (see my point just below). Also, the semantic relatedness task might generate more strategic processing whereas the lexical decision task combined with priming might tap more automatic processes (especially masked priming).

-The (intriguing) semantic inhibition effect for weakly related pairs: The results obtained in Study 2 (Experiment 2.1) show that weakly related pairs were judged significantly longer than unrelated pairs (an inhibition effect) in all working memory conditions. This semantic inhibition effect for weakly related pairs was confirmed in two control experiments (Experiments 2.2 and 2.3) replicating Experiment 2.1 but without any working memory manipulations. The distributional analysis (delta plot; Figure 18) seems to show that this inhibition effect emerges only for Bins 4 and 5 (i.e., the longest reaction times) but not for Bins 1, 2 and 3 (the shortest reaction times). This is really intriguing because semantic inhibition effects in silent reading (i.e., lexical decision) are usually very scarce. I was expecting a weak facilitation effect for weakly related pairs or not effect at all, but not an inhibition effect. Finding semantic facilitation and semantic inhibition within the same experiments (and with the same participants) is intriguing and represents a real challenge for current models dealing with semantic processing in (silent) reading (mainly because most current models of visual word recognition do not have inhibitory links between semantic representations in their architecture for a start). Also, I wonder if these results would replicate with a classic semantic priming lexical decision task.

Despite the few points of discussion raised above, Dmytro Khanzhyn's experimental work is clearly and concisely exposed, the theoretical interpretations are convincing, and his work will be of great value for our scientific community. Furthermore, the dissertation is very well-written, and I was impressed by the quality of the work. Therefore, it clearly merits a public defense.

Yours sincerely,

A handwritten signature in black ink, consisting of the letters 'L.F.' followed by a stylized flourish that extends to the right and then curves upwards.

Ludovic FERRAND