Impact of perceptual strength on lexical processing in Alzheimer's disease

A.Miceli[1], E.Wauthia[1], L.Lefebvre [1], L. Ris[2], & I. Simoes Loureiro[1]

[1] *Cognitive Psychology and Neuropsychology Department, Faculty of Psychology and Educational Sciences, University of Mons*

[2] *Neuroscience Department, Faculty of Medecine and Pharmacy, University of Mons, Belgium*

Introduction

The intervention of sensorimotor processes in lexical-semantic representation is widely highlighted [1]. However, there is still very little work supporting this view of cognition in healthy and pathological aging. The **aim** of this study is to explore the impact of **perceptual strength** (PS) - the extent to which a word can be experienced by multiple sensory modalities, i.e. visual, auditory, haptic, gustative and olfactive [2] in visual word recognition in Alzheimer's disease (AD). We would like to explore if high PS words could be processed faster and more accurately because they are semantically richer, contrary to low PS words which would be processed less quickly and precisely.

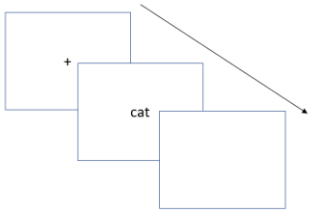
Population

Healthy control (**HC**)	Mild stage of AD (**AD1**)	Moderate stage of AD (**AD2**)
N= 36	N= 22	N= 20
73.78 years ± 7.26	77.5 years ± 6.85*	80.8 years ± 6.65*
20♂/16♀	5♂/17♀*	6♂/14♀
MMSE 29.1 ±.79	MMSE 22.91 ±1.57*	MMSE 16.65 ±1.39*

*Differ significantly from HC

Task

Lexical decision task



Is it a real word? YES or NO

56 stimuli of interest :
- 28 Low (L)PS words
- 28 High (H)PS words* [3]

+ 56 non-words (fillers)

Accuracy (ACC) + Reaction Times (RTs)

*Matched for 15 psycholinguistic/semantic variables like frequency, concreteness, imageability, familiarity, arousal,…

Cognitive assessment : global (MMSE), executive (BREF), episodic memory (5 words test), and lexical-semantic (TCD-MA, Mini-QCS, phonological and semantic fluency)

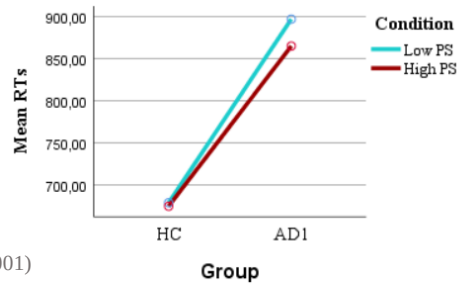
Results

We ran a **linear/logistic mixed effects model** that predicted RTs and ACC to compare 1) HC vs AD1 and 2) HC vs AD2.

1) HC vs AD1

ACC : non significant (p>.05)
RTs :
- Condition [$\chi2(1) = 1.82$, p =.177]
- Group [$\chi2(1) = 23.86$, p **<.001**]
- Interaction [$\chi2(1) = 8.09$, p **=.004**]

* Impact of demographic variables : age effect (p<.001) but no condition*age (p>.05), group*age (p=.006)

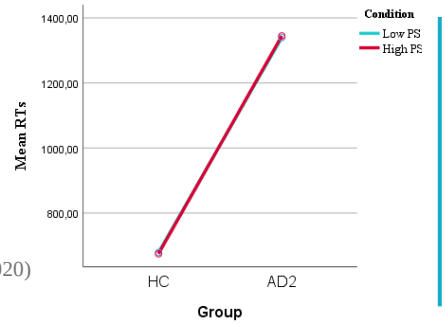


➔ AD1 presented a significant distinction between LPS vs HPS words whereas HC processed the 2 conditions similarly.

2) HC vs AD2

ACC : non significant (p>.05)
RTs :
- Condition [$\chi2(1) = 0.00$, p =.971]
- Group [$\chi2(1) = 60.46$, p **<.001**]
- Interaction [$\chi2(1) = 0.03$, p =.869]

* Impact of demographic variables : age effect (p=.020) but no condition*age (p>.05), group*age (p=.043)



<u>Complementary analysis:</u>

We calculate the difference in RTs between the LPS and HPS condition (= *the index*), for each participant individually (HC and AD1) and observed significant positive **correlation between the index and all cognitive assessment questionnaires** (p<.05).

Regression analyses were performed to determine which cognitive questionnaires were most relevant in explaining the index. TCD-MA (p =.001), Mini QCS (p =.036) and BREF (p =.025), were found to be the most relevant.

Discussion

In this study, we found a group*condition effect for HC vs AD1 showing that AD1 processed LPS and HPS differently, whereas this was not the case in HC. The lack of distinction between the 2 conditions in HC would occur because older adults have such extensive sensorimotor experiences with the concepts that they reach a ceiling effect in PS processing. However, the semantic degradation of AD1 reveals this distinction. The semantically richer words (HPS words) are probably processed faster because they are better preserved, leading to faster activation because the connections between semantic and orthographic units are greater for these words (feedback activation framework [4]). Conversely, less semantically rich words (LPS words) are processed slowly in AD1 because they are more vulnerable given their impoverished semantic representation. Complementary analysis corroborate the fact that it is cognitive deterioration (in particular lexical-semantic and executive) that influences the results, i.e. a PS effect condition would appear only when cognitive scores fall. No results were observed in AD2 probably because of the more severe lexical-semantic degradation. The analyses also excluded an effect of demographic factors on outcomes.

1. Meteyard, L., Cuadrado, S.R., Bahrami, B., & Vigliocco, G. (2012). Coming of age: A review of embodiment and the neuroscience of semantics. *Cortex, 48*(7), 788-804 **2.** Lynott, D., & Connell, L. (2013). Modality exclusivity norms for 400 nouns: The relationship between perceptual experience and surface word form. *Behavior research methods, 45*(2), 516-526 **3.** Miceli, A., Wauthia, E., Lefebvre, L., Ris, L., & Simoes Loureiro, I. (2021). Perceptual and Interoceptive Strength Norms for 270 French Words. *Frontiers in psychology, 12*, 2018 **4.** Pexman, P.M., Lupker, S.J., & Hino, Y. (2002). The impact of feedback semantics in visual word recognition: Number-of-features effects in lexical decision and naming tasks. Psychonomic bulletin & review, 9(3), 542-549.