Processing of thematic and taxonomic relationships in ageing and in Alzheimer's disease:
Evidences from an EEG study and a semantic priming task

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

1.Cognitive Psychology & Neuropsychology Department, UMONS, Belgium;

2. Neurosciences Department, UMONS

aurelie.miceli@umons.ac.be

INTRODUCTION

The knowledge stored in **semantic memory** includes information about categories and features, as well as semantic relationships between concepts. In the semantic network, **taxonomic** (i.e. relations between objects of the same category) and **thematic** (i.e. contiguity relations based on co-occurrence in events or scenari) links are both salient (Mirman et al., 2017). In **Alzheimer's disease** (AD), there are contrasting results regarding the pattern of taxonomical and thematical deterioration in the semantic network (Simoes Loureiro & Lefebvre, 2016 ; Merck et al., 2019). Also, a remaining issue is to determine whether semantic processing of both kinds of links is embodied, as suggested by the upholders of the embodied cognition (e.g. Barsalou, 1999, 2008) and if **the sensorimotor system** takes differentially part in the semantic process in ageing and in AD. To describe the thematic vs taxonomic patterns and identify the involvement of sensorimotor processes and the network underlying them, electroencephalography (EEG) and semantic priming paradigm will be used.

MAIN HYPOTHESIS

1. Priming effect

<u>Taxonomic condition</u> : A hyperpriming effect (abnormal increase in semantic priming) is expected in AD representing the degradation of distinct attributes of the concepts in the <u>mild stage</u> of AD (Laisney et al., 2004)

<u>Thematic condition</u> : A decrease in the priming effect (priming effect progressively disappears) is expected in the <u>moderate stage</u> of AD, as in Simoes & Lefebvre (2013)

2. Event-related potentials

Target words related to prime words should elicit a reduced N400 for unrelated target words ➔ an increase in latency and decrease in amplitude of the N400 is expected demonstrating semantic deterioration

POPULATION
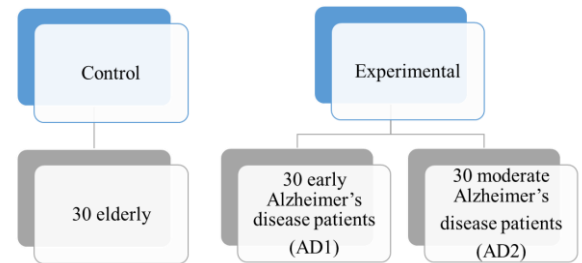
- Groups matched by age, gender and socio-cultural level
- Alzheimer's patients recruited from hospitals:
  Incl. criteria : MMSE 20-25 (AD1), 19-15 (AD2); right-handed
  Excl. criteria : cerebrovascular, neurological or psychiatric history
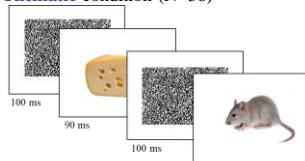
MATERIAL

1. Semantic priming paradigm – semantic decision task
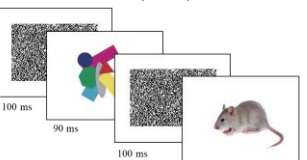
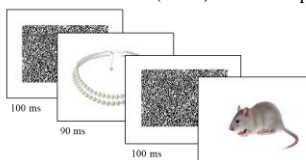- N = 380 trials divided into 4 conditions:

1) **Taxonomic** condition (N=38)
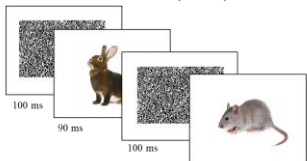
2) **Thematic** condition (N=38)

3) **Neutral** condition (N=38)

4) **Unrelated** condition (N=38) and Fillers pairs (N=228)

- Task : pressing a button to answer the question "is it natural or manufactured" (counterbalanced left-right buttons)
- RT analyzes as Lecardeur et al. (2007)

Semantic association priming = RT unrelated – RT thema-taxo
Facilitation effect = RT neutral – RT thema-taxo
*Inhibition effect* = RT unrelated – RT neutral

- Task pre-tested with 15 subjects (5 from each group)
- Stimuli have been controlled and all the primes of different conditions were similar for this variables :

	Cond. 1		Cond.2		Cond.3		Statistics
	M	SD	M	SD	M	SD	
AoA	4,64	1,71	5,41	1,84	4,4	1,51	X^2= 7,185 ; p= .0528
Familiarity	3,13	0,74	3,18	1,01	3,36	0,84	X^2= 1,808 ; p= .405
Movie frequency *	6,88	7,524	17,17	24,66	11,85	13,26	X^2= 3,521 ; p= .172
Book frequency*	10,80	14,52	26,05	40,626	18,63	27,30	X^2= 2,774 ; p= .250
Visual complexity	2,70	0,94	2,54	1,02	2,45	0,74	X^2= 1,309 ; p= .520

*Lexique380 ; New et al., 2001

2. EEG[1] throughout the semantic decision task

- BrainVision Recorder
- 64 active electrodes + 4 exogenous electrodes (3 electro-oculogram and 1 reference mastoid)
- Event-related potentials analyzes (N400)
- Frequency analysis of **sensorimotor sensitive EEG rhythms** :
  - Alpha
  - Beta
  - Mu

1.
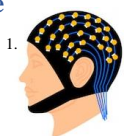
CONCLUSION

The objective was to present the study project, data will be collected later. Our research will contribute to a better understanding of taxonomical and thematical deterioration in the semantic network in AD and the contribution of sensorimotor processing in this deterioration.

Barsalou, L. W. (1999). Perceptions of perceptual symbols. *Behavioral and Brain Sciences*, 22(4), 637–660. ; Barsalou, L. W. (2008). Grounded cognition. *Annual Review of Psychology*, 59, 617–645.

Laisney, M., Giffard, B., & Eustache, F. (2004). La mémoire sémantique dans la maladie d'Alzheimer: apports de l'étude des effets d'amorçage. *Psychologie & NeuroPsychiatrie du vieillissement*, 2(2), 107-115.

Lecardeur, L., Giffard, B., Laisney, M., Brazo, P., Delamillieure, P., Eustache, F., & Dollfus, S. (2007). Semantic hyperpriming in schizophrenic patients: Increased facilitation or impaired inhibition in semantic association processing? *Schizophrenia Research*, 89(1–3), 243–250.

Mirman, D., Landrigan, J-F & Britt, A.E. (2017). Taxonomic and thematic semantic systems. *Psychological Bulletin*. Advance online publication.

Merck, C.,Noël, A., Jamet, E. et al. (2019). Identification of taxonomic and thematic relationships: Do the two semantic systems have the same status in semantic dementia? Journa of Clinical and Experimental Neuropsychology. Advance online publication.

New, B., Pallier, C., Ferrand, L., & Matos, R. (2001). Une base de données lexicales du français contemporain sur internet : LEXIQUE. A lexical database for contemporary french. *L'année Psychologique*, 101(3), 447–462.

Simoes Loureiro, I. & Lefebvre, L. (2016). Distinct progression of the deterioration of thematic and taxonomic links in natural and manufactured objects in Alzheimer's disease. *Neuropsychologia*, 91, 426–434.