







TECHNOLOGY

Sandra INVERNIZZI*¹, Alice BODART², Laurent LEFEBVRE³, Isabelle SIMOES LOUREIRO Departement of Cognitive Psychology and Neuropsychology, UMONS, Belgium (Ph.D Student F.N.R.S¹, Ph.D Student², Full Professors UMONS³,)

Depression, and especially the "lack of energy factor" does affect semantic cognition through impairment of inhibitory processes but not through activation

*Corresponding author: Sandra.Invernizzi@umons.ac.be

LATE LIFE DEPRESSION AND SEMANTIC TASKS

The performances at Semantic Tasks can be affected by

- > Impaired access to the content of semantic memory relying on executivesemantic processes (Exe-S)³
- → Impaired activation of semantic links and concepts in the semantic memory ⁴ Late-life depression (LLD) is not reported as affecting semantic cognition.

However, we recently published a meta-analysis^{4B} showing that this condition has a significant effect on performances at semantic tasks involving Exe-S (Phonemic and Semantic Fluencies, Naming)⁵, but not on other tasks relying on fewer executive resources (semantic choices, vocabulary descriptions,...).

Due to the dysexecutive nature of depression⁶, it is proposed that these results can be explained by LLD:

- → Affecting Exe-S
- → Not affecting semantic links and concepts in the semantic memory

SUBPROCESSES OF SEMANTIC COGNITION

SRS ACTIVATION¹ (temporal cortex)

Based on perception <u>or</u> on volitional retrieval, a concept is activated in the semantic representation systems and an automatic spreading of this activation reaches the closest elements in its **semantic network** (features, thematic neighbours, semantic associates)⁷

Exe-S SELECTION-INHIBITION^{2, 3} (Inferior frontal gyrus)

According to the coherence with the context, only the pertinent elements remains activated and selected by inhibition of the unnecessary elements being activated by the automatic spreading. It can also be called frequency-based meaning suppression.^{8,9}

Exe-S **CONTROLLED** RETRIEVAL³ (prefrontal cortex)

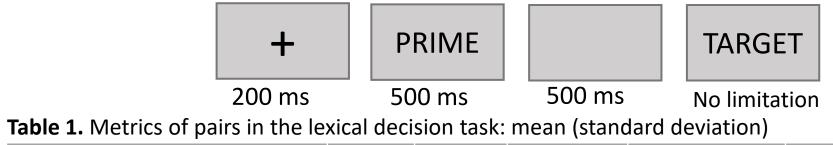
When the first activation was not effective enough to retrieve task-relevant knowledge, controlled retrieval is as top-down mechanism relying on ventro-lateral prefrontal cortex 9

EXPERIMENTAL TASKS

Lexical decision task with priming

inspired by Copland et al. (2007)

In this task design to measure activation of the semantic memory and selection-inhibition (Exe-S), participants face a screen where sequences of prime/blank/target are presented and have to judge for every target if it is a word or not. Four contrebalanced versions of the task were created with 4 conditions of interest (blue lines of the Table 1).



Prime – target relationship	N (task)	N (corpus)	Length	Book frequency	LSA (0 /1)
Homonym/Dominant e.g. Bank/money (HD)	8	32	6,09 (1,67)	42,74 (36,98)	0,33 (0,20)
Homonym – Subordinated e.g. Bank/river (HS)	8	32	6,06 (1,81)	34,19 (38,43)	0,14 (0,08)
Word – semantic associate e.g. Desk/screen (SA)	16	64	6,09 (1,87)	39,52 (39,82)	0,26 (0,14)
Word - non related word e.g. River/money (NR)	32	32	6,45 (1,91)	34,66 (33,56)	-
Fill-in unrelated pairs	20	20			
Word – Non-word	84	84			
TOTAL	168	264			

Note. There were no significant differences of metrics between conditions, except for LSA (strengh of lexico-semantic association)

Cue to target association task

inspired by Badre et al. (2007) and Hoffman (2018)

In this task, the participant had to associate the word (cue) above with one (target) of the 4 propositions bellow according to an instruction. (or on the correspondence of the global meaning, or on a shared feature).

In the global meaning instruction, half of the trials are weak semantic associates to enhance the demand for controlled retrieval (Exe-S).

Association on a shared feature is designed to enhance the demand for selection-inhibition (Exe-S).

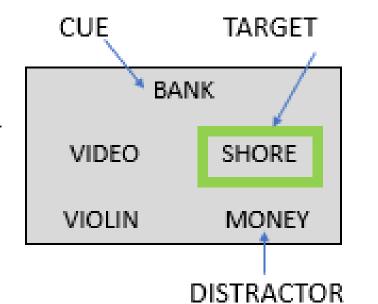
In half of the trial, one distractor is semantically associated to the cue, which also enhanced the demand for selectioninhibition (Exe-S).

2 conditions:

Group: $F_{(2)}$ = 12.05, p<.001, η ²=0,05

Cue-target relationship (4 levels) HD: Global Strong semantic associate: Homonym dominant meaning (e.g. BANK – TREASURY) **HS: Global Weak** semantic associate: Homonym – subordinated meaning (e.g. BANK – SHORE) **Feature** (color): e.g. COFFEE – PANTHERA Feature (size): e.g. COIN - TOOTH

Cue-distractor relationship (2 levels) Semantic distractor (e.g. BANK – MONEY) **Distractor not related** (e.g. SUN – PAPER)



PARADIGMA AND HYPOTHESIS

Elderly participants with LLD (N=10) or without LLD (N=74) Tested with:

- A lexical decision task with priming (experimental task)

- A cue to target association task (experimental task)
- The Camel and Cactus test (normed assessment of semantic association)
- The Geriatric depression scale (GDS 30)
- The Spielberger anxiety scale (STAI)

Hypothesis:

- → According to the hypothesis of a preserved activation in semantic memory in LLD, in a Lexical decision task with priming, healthy control, with or without depressive symptoms and depression group will equally benefit of the priming effect of HD and SA conditions with significantly faster answers.
- → In a Cue to target association task, depression group will show significanlty slower answers in the HS condition, confirming that they experiment an impairment of the **controlled retrieval (Exe-S)**
- → In a Cue to target association task « depression » group will respond significantly slower and make more mistakes than control in presence of a semantic distractor, showing that selection-inhibition (Exe-S) is impaired.

Exploratory question:

Are the results at the experimental tasks more specifically associated with one or several particular factors of depression (according to the classification of depressive symptoms proposed by Sheikh et al. (1991)?

RESULTS

depression Control Table.1. Samples data, in mean (SD) 74 (44) 10 (9) n (women) 0.13 66.58 (4.27) 64.20 (7.19) age Education 0.07 12.19 (2.21) 11.60 (2.67) **Depression scale (GDS 30)** 17.30 (4.60) 4.20 (4.26) < 0.001 General score Factor 1: sad mood and pessimistic outlook 1.30 (1.87)5.20 (2.04) < 0.001 20 Factor 2: lack of mental and physical energy 1.08 (1.35)4.60 (0.84) < 0.001 2.90 (1.73) < 0.001 0.93 (1.36) Factor 3: positive or happy mood 0.002 0.49 (0.67) 1.30 (1.25) Factor 4: agitation and restlessness 0.09 (0.34) 1.10 (0.88) < 0.001 Factor 5: social withdrawal factor 28.27 (10.00) 46.40 (9.05) < 0.001 Anxiety scale (State) 48.00 (5.21) Anxiety scale (Trait) 33.86 (8.52) < 0.001 Camel and Cactus tree test 56.29 (3.36) 54.50 (6.62)

DISCUSSION & CONCLUSION

The results in Fig. 1 show that both depression and control groups had a

larger SPE (Semantic priming effect) (close to sign P=.07) when the

homonymous prime was followed by a word with a dominant meaning, in

comparison with the subordinated meaning, confirming a preserved

activation in semantic memory. In the association task (Fig. 2), both groups

were more accurate but slower at associating items on a shared feature

(color or size) than a global meaning, with no difference between

dominant or subordinated meanings. These results do not support an

effect of depression on controlled retrieval. In the presence of a semantic

distractor, the depression group was slower to associate items on a

common feature compared to any other condition. Although the

interaction effect was not statistically significant, this result suggests that

depression affects selection inhibition. The P.C.A. (Table.2.) applied to all

the results shows a factor combining the RT on the association task and

the global score on the depression scale, as well as the depression factor

"lack of mental and physical energy" and the trait score on the anxiety

scale. This result indicates that in the depression group, it is most likely the

lack of energy trait that is related to the general slowing in performing the

association task, but that this trait is not related to the performance at the

priming task.

Note: GDS factors are determined according to the classification by Sheikh et al. (1991),

Fig. 1 Lexical decision task with priming

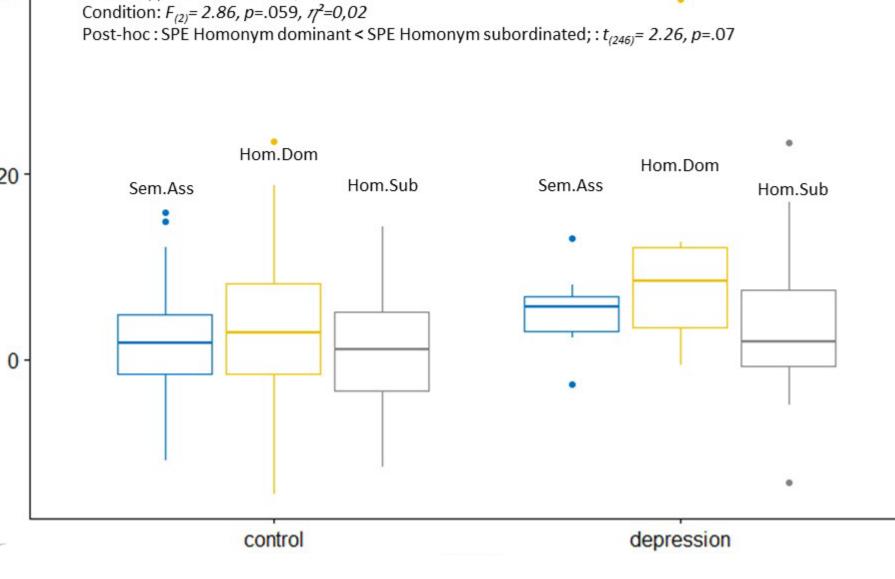


Table.2. P.C.A	Factor1 (25%) Fact	or2 (16,7 %)	
RT Ass. color / no dist. sem.	0,88	0,27	
RT Ass. size / + dist. sem.	0,82	0,29	
RT Ass. size / no dist. sem.	0,82	0,25	
RT Ass. color / + dist. sem.	0,80	0,41	
RT Ass. HS / no dist. sem.	0,77	0,44	
RT Ass. HD / + dist. sem.	0,72	0,55	
RT Ass. HS / + dist. sem.	0,71	0,00	
RT Ass. HD / no dist. sem.	0,67	0,56	
GDS30 - score	0,61	-0,71	
GDS Factor 2	0,59	-0,57	
Trait of anxiety (STAI)	0,56	-0,54	
GDS Factor 3	0,47	-0,50	
GDS Factor 5	0,43	-0,55	
GDS Factor 1	0,41	-0,58	
M	eta-analysis ^{4B} Refere	References and detailed	

Invernizzi et al., 2023





outcomes

15000

10000

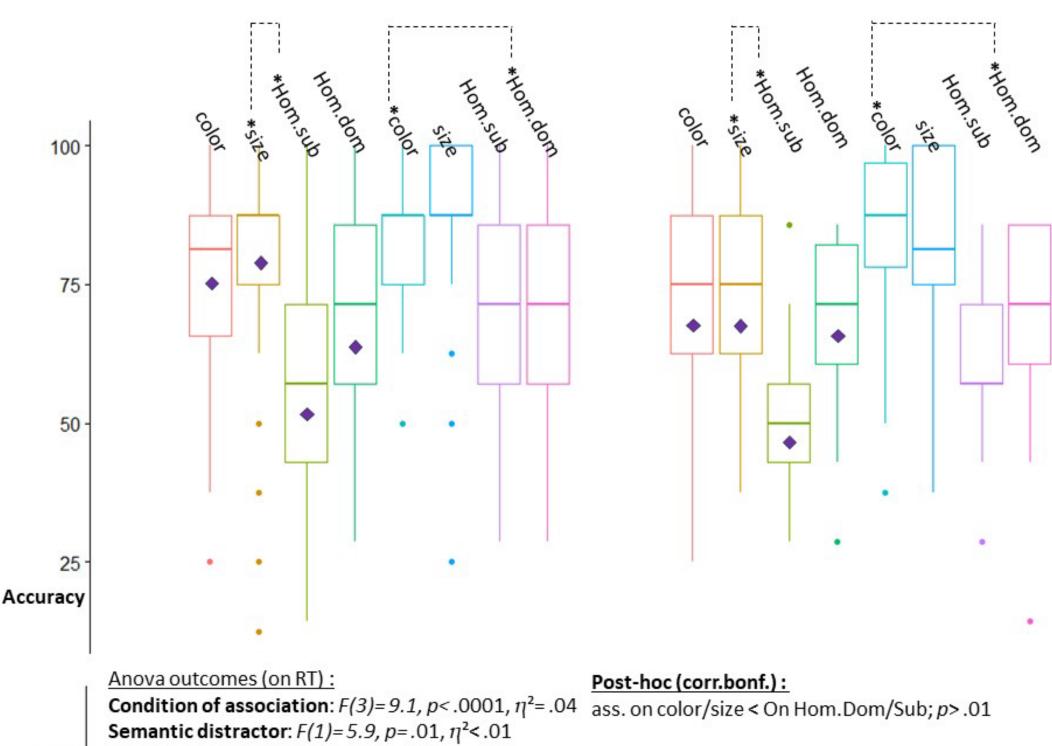
5000

R.T.

Fig2. Cue to target association task

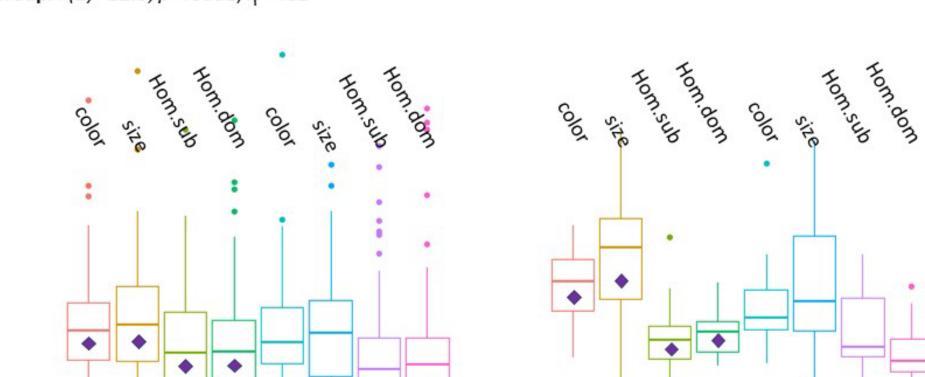
Anova outcomes (on Accuracy): Interaction (Condition of association* Semantic distractor): **Condition of association**: F(3) = 30.58, p < .0001, $\eta^2 = .13$ $F(3)=3,9, p<.01, \eta^2=.02$ **Semantic distractor**: F(1) = 19, p < .0001, $\eta^2 = .03$ Post-hoc (corr.bonf.): **Group:** $F(1)=7,36, p<.01, \eta^2=.01$

+ sem. dist.: ass. on Hom.Sub < on size; t(365)=8,65, p>.0001(*)No sem. dist.: ass. On Hom. Dom < on color; t(365)=8,65, p > .0001(*)



Group: F(1)=12.5, p<.0001, $\eta^2=.02$

control



depression + semantic distractor