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Introduction

According to the retrogenesis hypothesis (Reisberg, 1982; 1988; 2002) the comparison of cognitive functioning between children and Alzheimer's disease patients (AD) shows an inverse evolution pattern. Many studies have already demonstrated some simplifications in the language of AD (Forbes, Venneri & Shanks, 2002 ; Ska & Duong, 2005; Kemper, Marquis, Thompson, 2001). Nevertheless, to our knowledge, no research have already investigated the lexico-semantic network retrogenesis. The purpose of this study is to contribute, by three different approaches, to a better understanding of semantic memory by comparing its evolution in childhood and its involution in Alzheimer disease patients. In that vein, by three different approaches, we postulate that lexico-semantic deterioration in the course of the AD should reverse the lexico-semantic acquisition stages in childhood.

Experimental Studies

Fluency task

Hypothesis

Because early acquired words (EAW) in childhood are more connected than late acquired words (LAW) in lexico-semantic network (Steyvers & Tenenbaum, 2005), AD patients should produce less LAW and more EAW in a fluency task (Forbes-McKay, Ellis, Shanks & Venneri, 2005).

Population

One experimental AD group and one normal control group were created :

- 20 AD (MMSE \leq 24)
- 20 Normal control (MMSE \geq 27)

Material

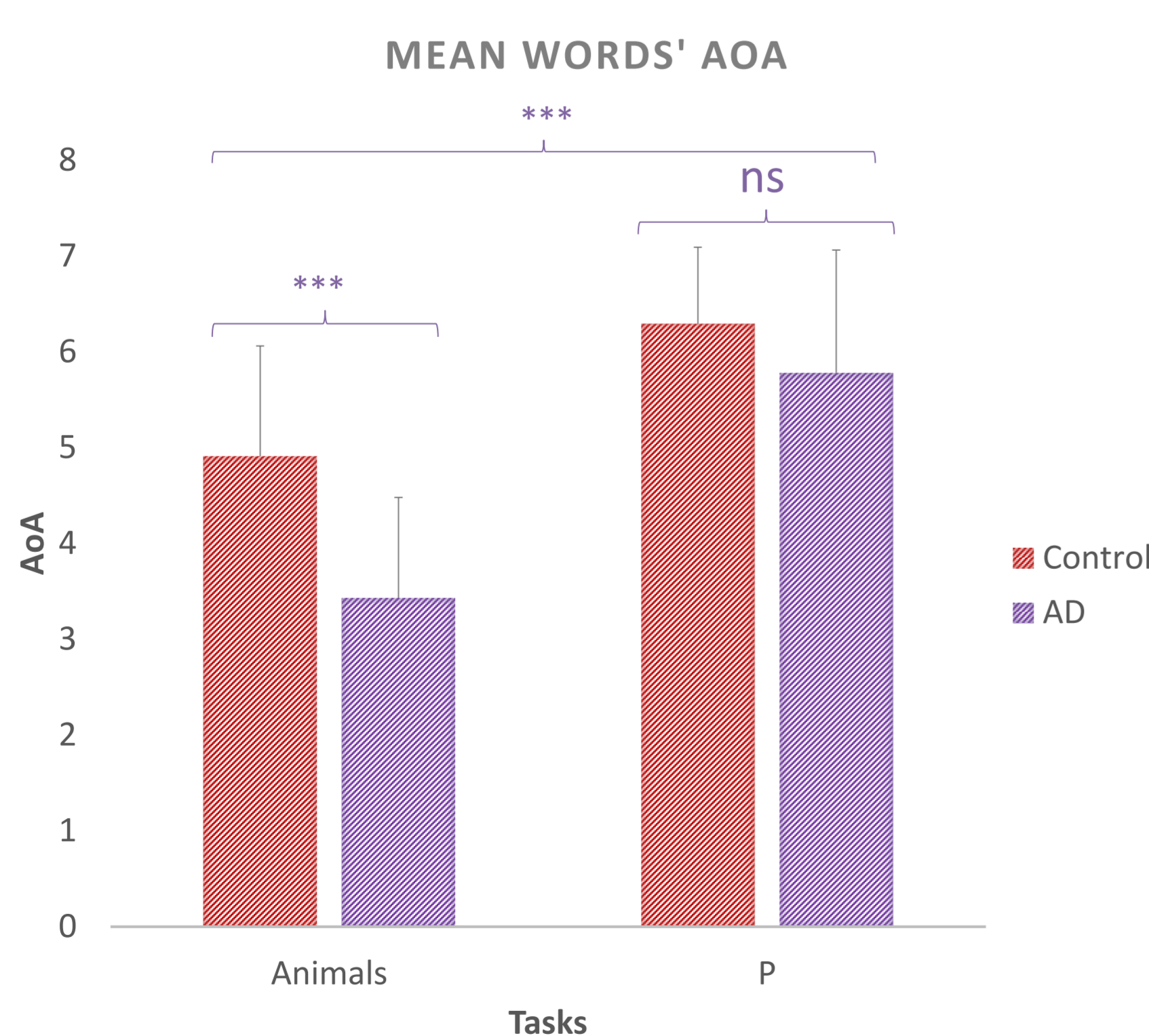
2 one-minute fluency tasks were administered. These categories were chosen because they are among the richest in the French language :

- 1 min semantic fluency task (SF) : "animals"
- 1 min litteral fluency task (LF) : "P"

Mean AoA for each subject productions was calculated, according to the task and to the group.

Results

An ANOVA shows a group effect ($F=12,12$; $p=.001$), meaning that AD and control groups don't produce words acquired at the same age, and a task effect ($F=65,79$; $p<.0001$) reflecting a more difficult activity for semantic than litteral fluency. The interaction between both factors is significant ($F=4,04$; $p=.05$). AD produce earlier acquired words than controls but the difference occurs only during the semantic fluency.

* = $p<.05$; ** = $p<.001$; *** = $p<.0001$

Picture naming task

Hypothesis

The multi-connected words (which are also the EAW), representative of the facility of access in semantic memory, should be easier to retrieve than the LAW in a picture naming task, as children would do (Kremin, Hamerel, Dordain, De Wilde & Perrier, 2000).

Population

Two experimental AD groups and one normal control group were created :

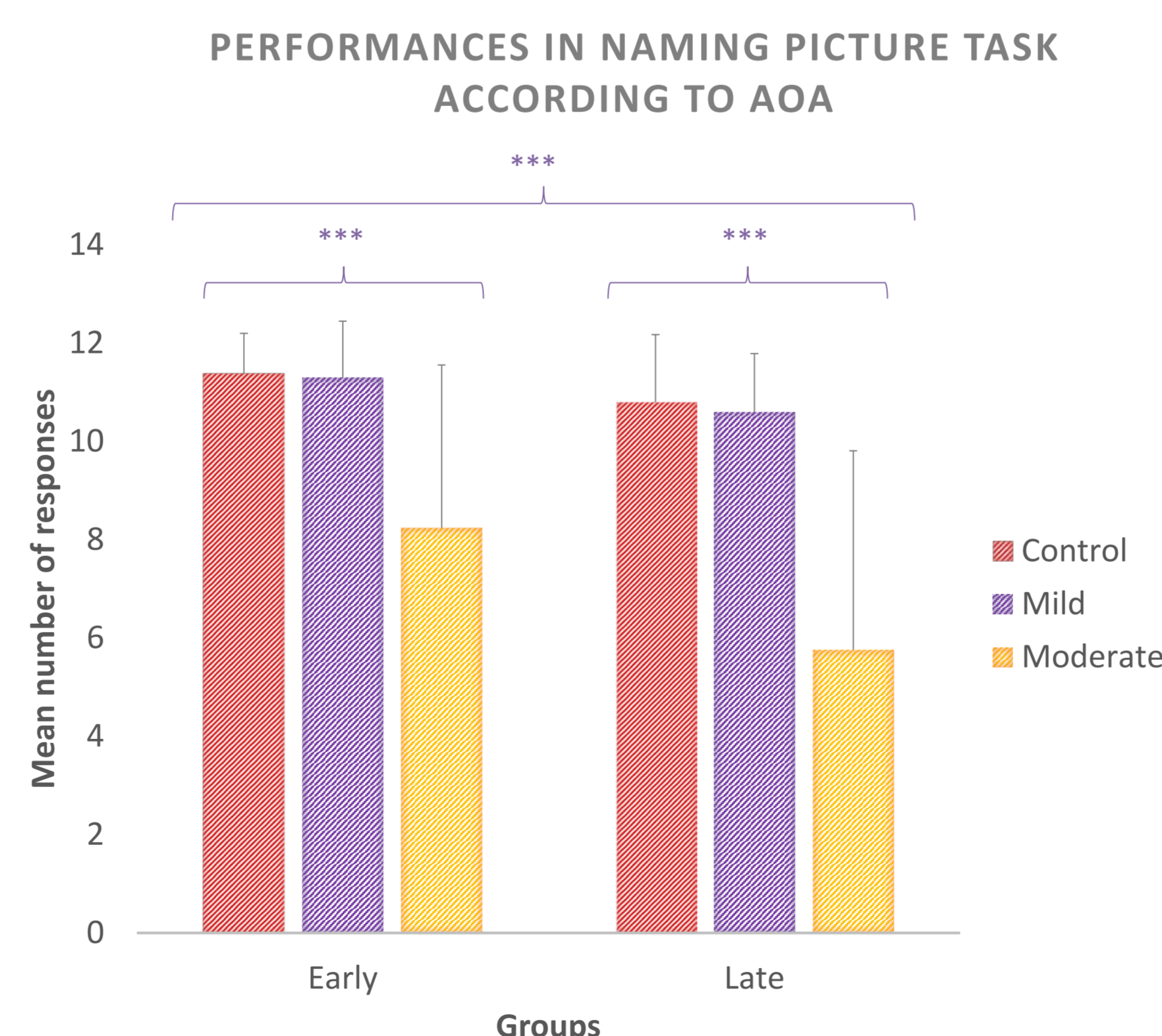
- 20 Mild AD ($20 \leq$ MMSE \leq 16)
- 20 Moderate AD (MMSE \leq 15)
- 29 Normal Control (MMSE \geq 27)

Material

24 colored pictures (Rossion & Pourtois, 2004; from Snodgrass & Vanderwart, 1980), controled for word frequency, familiarity, name agreement and visual complexity (Alario & Ferrand, 1999). Pictures were chosen for AoA; two groups of pictures were created : EAW and LAW. We compared the mean number of correct answers in both EAW and LAW's pictures categories.

Results

We submitted our parameters to a 2 (group) \times 2 (picture's AoA) ANOVA. We observe effects of group ($F=26.79$; $p<.0001$), meaning that groups don't perform equally in picture naming, and pictures' AoA ($F=43.32$; $p<.0001$), showing that LAW are more difficult to process. The interaction is significant ($F=11.03$; $p<.0001$). AD can name fewer pictures than control do, particularly for LAW.



Semantic priming

Hypothesis

In a semantic priming procedure, thematical links (acquired earlier in childhood) should be better preserved in the early stage of the disease, comparatively to the taxonomical links (later acquired in development).

Population

Three experimental AD groups were created :

- 24 AD1 subjects (MMSE \geq 20)
- 21 AD2 subjects ($16 \leq$ MMSE \leq 19)
- 30 AD3 subjects (MMSE $<$ 16)

A control group of 32 healthy elderly people was added (MMSE $>$ 28)

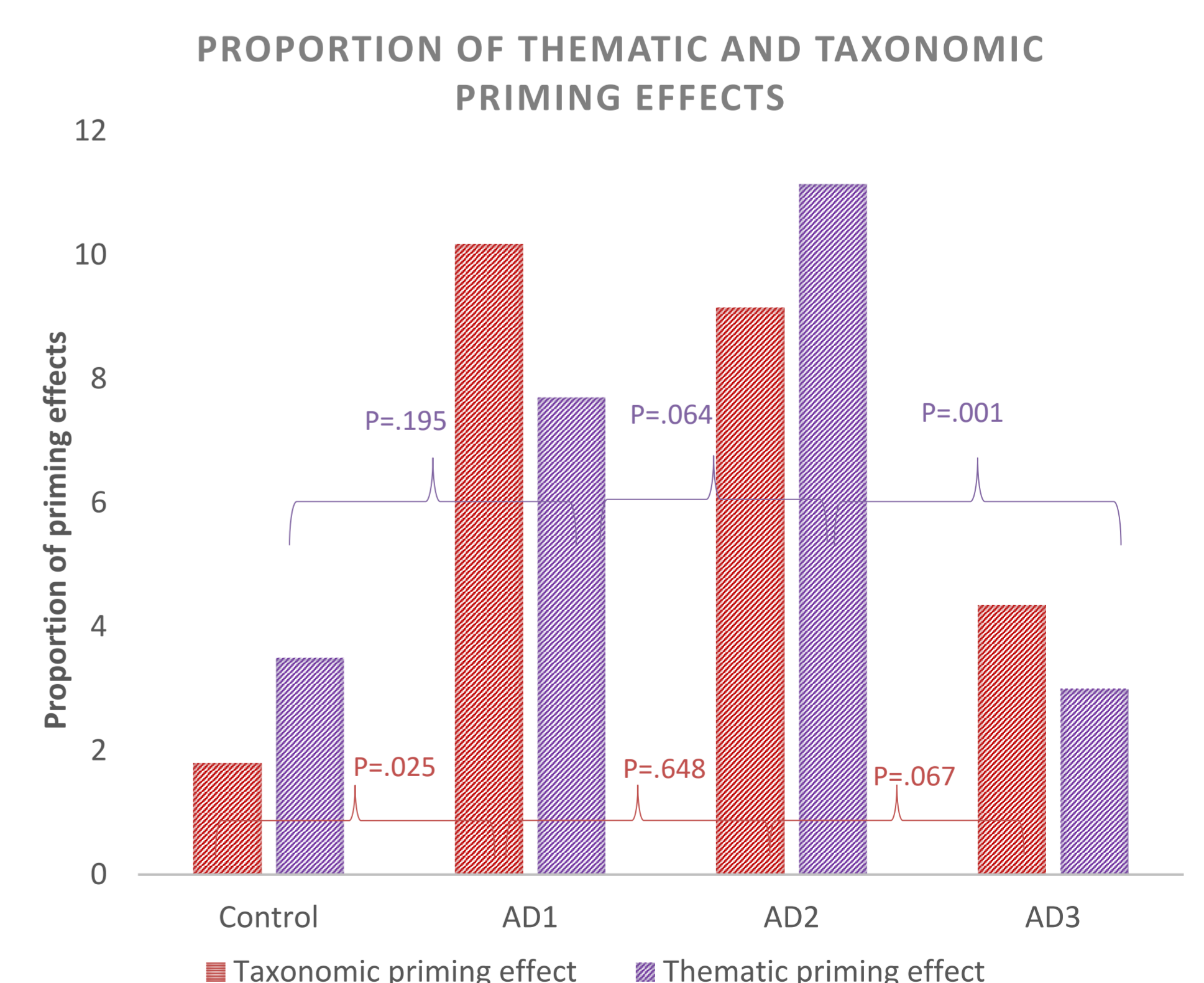
Material

A priming procedure with 2 related conditions (taxonomic and thematic), a neutral condition and an unrelated condition were performed.

Reaction times were expressed as a proportion to take into account speed processing (Laisney et al., 2011) :
[Unrelated / Unrelated+related]*100

Results

An ANOVA shows an intergroup taxonomic ($F=3.07$; $p=.032$) and thematic effect ($F=4.731$; $p=.004$). Post-hoc intergroups comparisons show that AD1 patients differ significantly from the control group for the taxonomic condition ($p=.025$) but not for thematic condition ($p=.195$). Nevertheless, AD2 differs significantly from AD3 for thematic condition ($p=.001$) but not for taxonomic condition ($p=.067$).



Discussion

As expected, AD patients show a different lexico-semantic pattern from the control group and tends to progress inversely than children evolve. Indeed, in the first two tasks, we demonstrate that semantic research and access are more and more difficult in the course of AD for late acquired words. Also, In the semantic priming task, we observe a hyperpriming taxonomic effect in AD1, that supports the deterioration of attribute of concepts and also suggests that later acquired connections in children network, are more vulnerable to the disease, contrary to thematic links that are more robust and deteriorate later.

Our results sustain the idea that the lexico-semantic network in AD suffers from alterations reversing the acquisition processes in children.