From construction to deterioration of the lexico-semantic network: a priming paradigm study

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Introduction

According to Rubial-Alvarez et al. (2013), the comparison of cognitive functioning between children and patients with an Alzheimer’s disease (AD) shows a reverse evolution pattern that supports the hypothesis of retrogenesis. The aim of our research is to analyze the retrogenesis of the lexico-semantic network in order to better understand the conceptual organization of semantic memory.

Hypotheses

- The lexico-semantic disorganization evolution observed in AD presents reverse profile of the lexico-semantic development in childhood:
  - Young children firstly develop thematic schemas (carrot-rabbit), taxonomic ones (carrot-tomato) appearing more later;
  - AD patients firstly lost taxonomic schemas, thematic ones being more robust.

- There is an evolutionary profile of priming effects in AD patients:
  - A taxonomic hyperpriming effect is observed at the early stage of AD, linked to the loss of specific attributes of concepts;
  - All observed priming effects progressively disappear with the evolution of the disease. This phenomena is correlated with the progressive lexico-semantic impairment;
  - The thematic priming effect disappears later than the taxonomic one in AD patients.

Population

<table>
<thead>
<tr>
<th>90 healthy children</th>
<th>30 healthy old subjects</th>
<th>90 AD patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 children (4,5 to 5,5)*</td>
<td>30 children (6,5 to 7,5)*</td>
<td>30 DS1 patients **</td>
</tr>
<tr>
<td>30 children (6,5 to 9,5)*</td>
<td>Control group</td>
<td>30 DS2 patients **</td>
</tr>
<tr>
<td>Paired on age, sex and socio-cultural level</td>
<td></td>
<td>30 DS3 patients **</td>
</tr>
</tbody>
</table>

Two software programs were developed, an amusing one for children (« a travel on earth ») and another one for AD patients.

In both version, the Laiacina et al.’s questionnaire, including 80 items initially, was reduced to the 30 most discriminant items: 15 naturals (5 fruits, 5 vegetables and 5 animals) and 15 non-naturals (5 tools, 5 furnitures and 5 transports)

In the children’s version, a character asks 4 questions for each item

Experimental design

Global cognitive functioning (for all subjects)
- MMSE
- Agnosia evaluation (only for AD patients)
- Embedded figures test (PEGV)

Implicit investigation of semantic memory (for all subjects)
Semantic priming paradigm in an oral naming task
- The semantic priming paradigm includes 22 target pictures associated with 22 taxonomic primes pictures and 22 thematic primes pictures. The following variables were controlled:
  - Age of acquisition (< 55 months (Bonin et al. 2003) and Chalard et al. (2003))
  - Frequency (ManuLex/Lexique)
  - Conceptual relation strength (evaluated by 36 healthy adults)
  - Verbal association strength (evaluated by 76 healthy children aged from 5 to 9 and 105 healthy adults)
  - Perceptual and phonological similarities

Explicit investigation of semantic memory (for all subjects)
- Semantic sorting card test
- Criteria: Taxonomic (carrot-tomato)/Thematic (carrot-rabbit)/Visuo-perceptual (carrot-rocket)

Prime | Target
-----|-------
Thematic | ![Thematic](carrot)
Taxonomic | ![Taxonomic](rabbit)
Unrelated | ![Unrelated](tomato)

250 ms 150 ms
SOA=400 ms