# Change in lexical retrieval skills in adulthood

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# Overview

1. Foundations
2. Tests and Experiments
3. Results
4. Discussion

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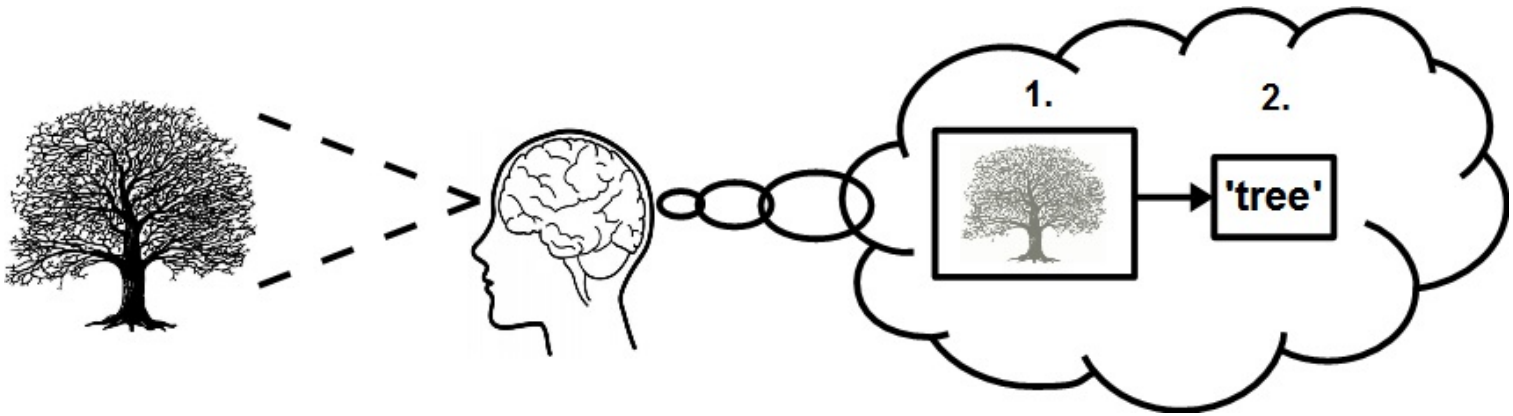
# Lemma Retrieval and Lexeme Retrieval

- Assumption: 2-stage-process:
  1. Retrieval of semantic information, abstract representation: **Lemma Retrieval**
  2. Retrieval of morphologic/word form information, concrete representation: **Lexeme Retrieval**




- Additionally: phonological retrieval
- Evidence in labeling tasks

# Serial vs. Cascaded Retrieval

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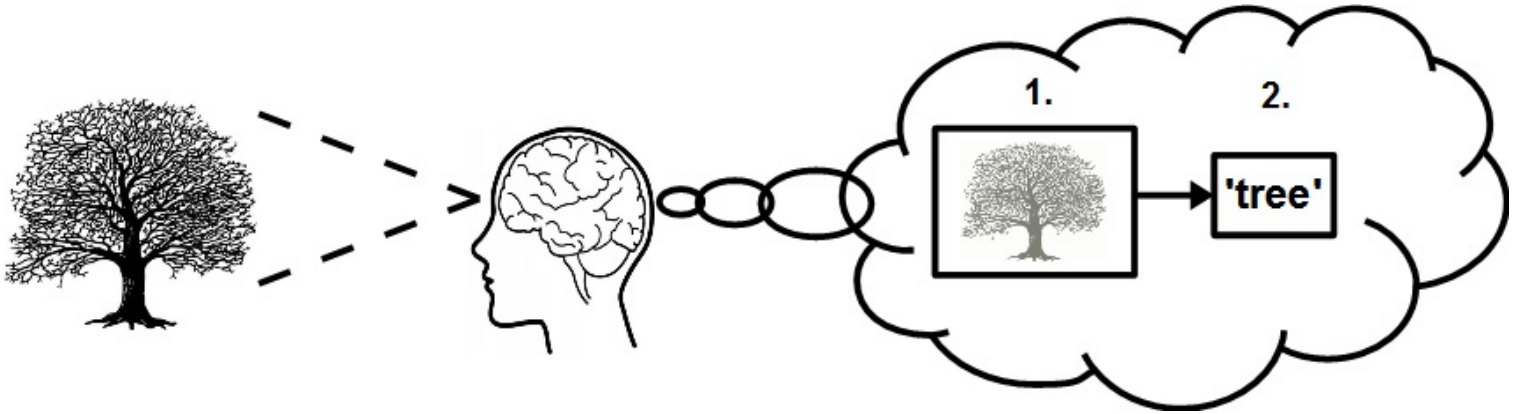

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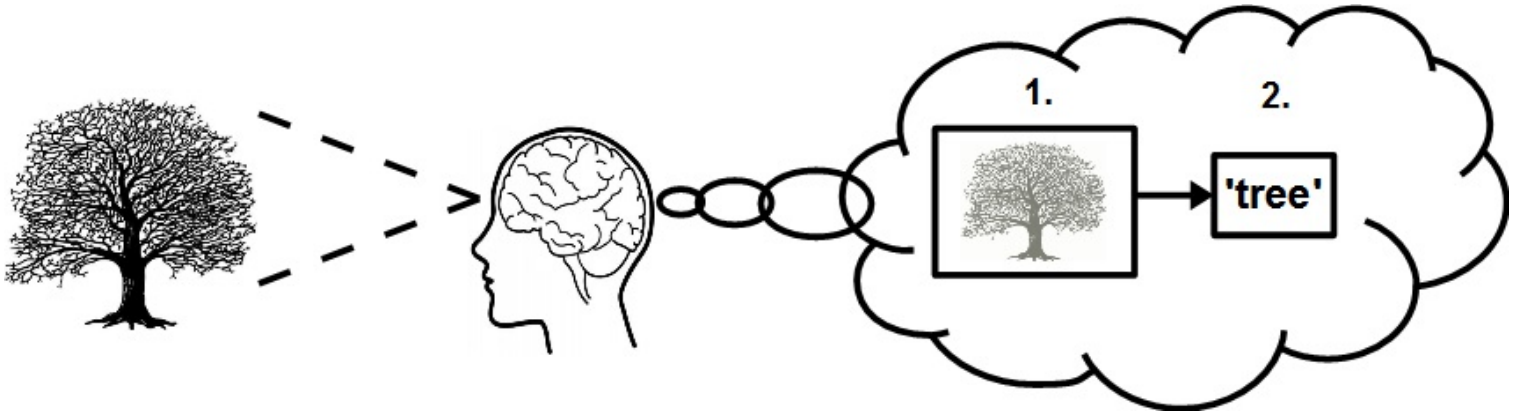
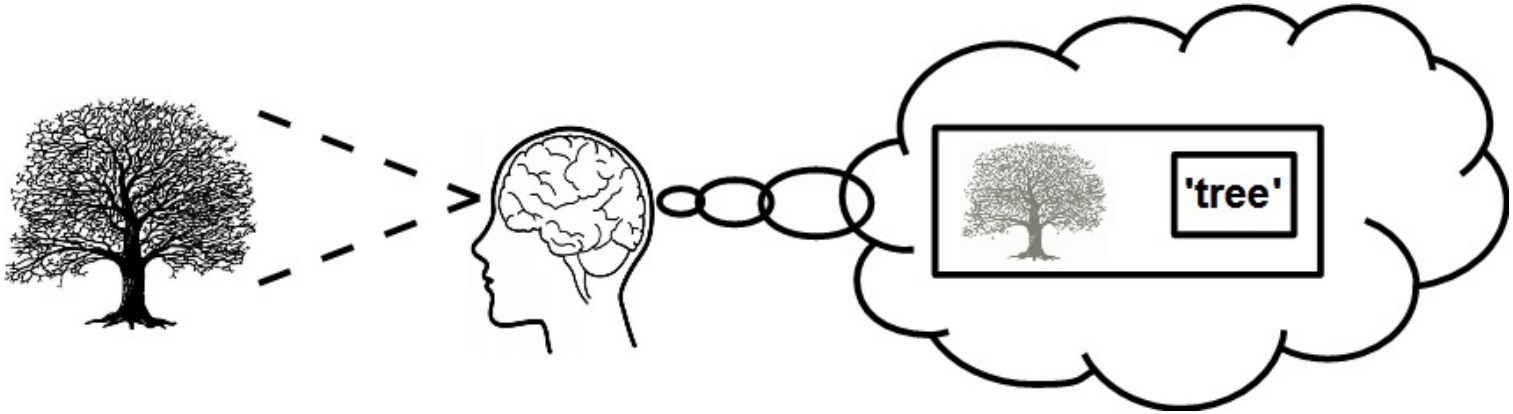



**Cascaded**: Only 1 continuous process with 2 stages



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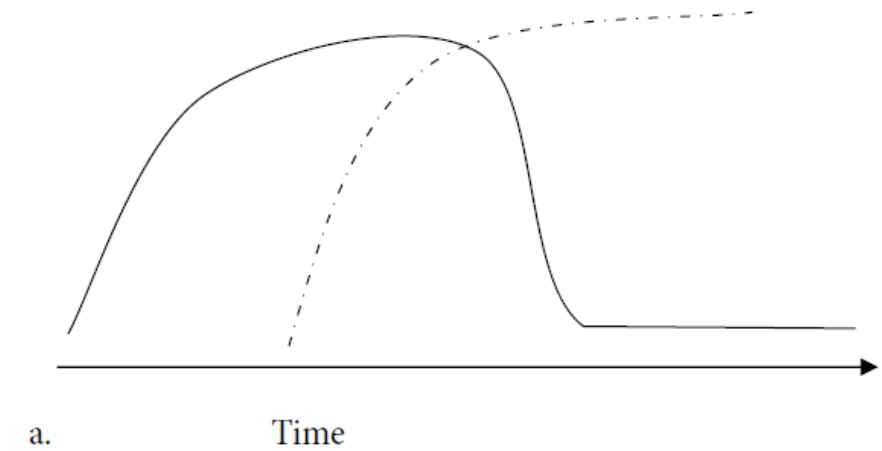
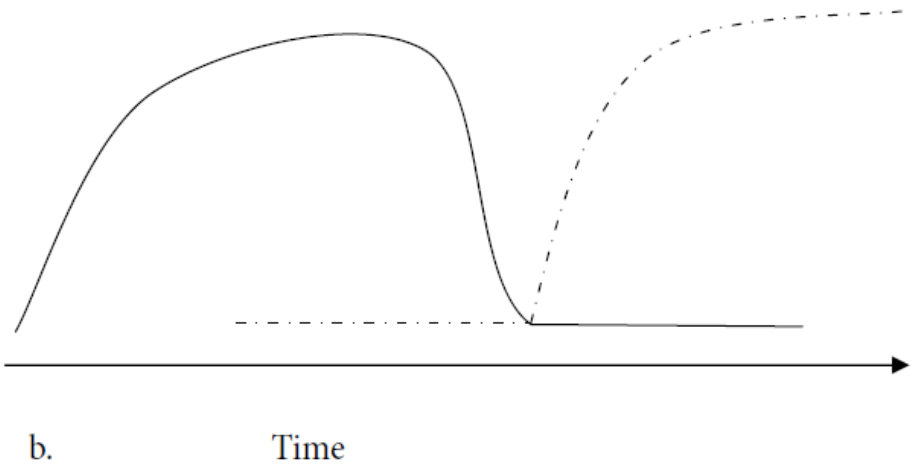



Evidence for both:

- Experiments show that various lexical items are activated during lemma retrieval, even if they are not the target items

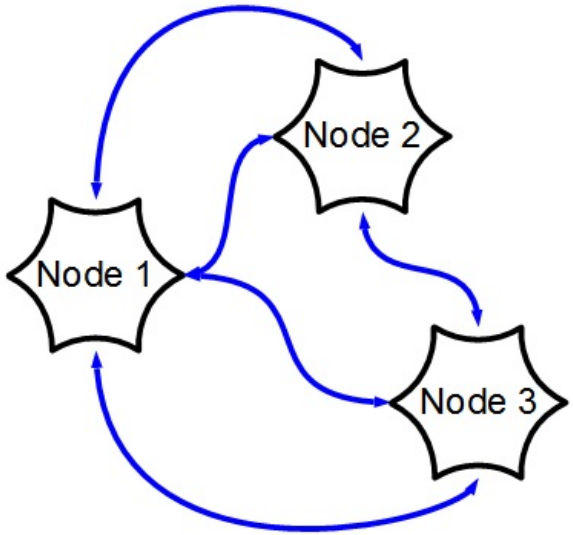
→ pro cascaded

- "Early" distractors interfere with lemma retrieval
- "Late" distractors interfere with lexical retrieval

→ pro serial

# The Transmission Deficit Hypothesis

- Former experiments: old people have problems with lexeme selection
- Possible Explanation: **Transmission Deficit Hypothesis (TDH)**
- Interactive lexical model
- Connections between "computation nodes" in the brain are damaged/weakened over lifetime
- Leads to higher processing time, blocks lexical/phonological retrieval



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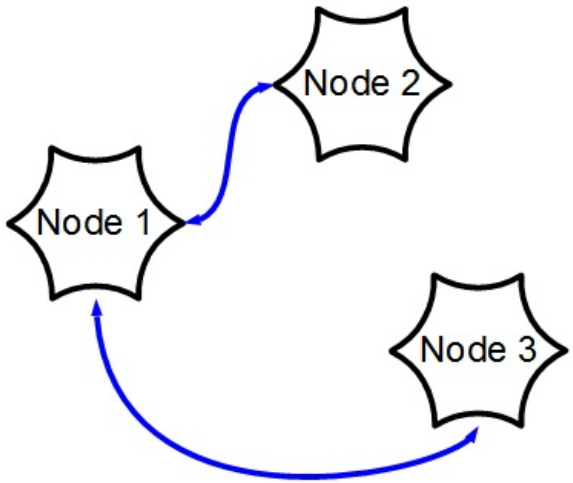

# Reformulation of Motivational Ideas

1. Do humans perform lexical retrieval in a serial or cascaded manner?

2. Depending on the result, which part of the retrieval is most likely affected in old people?

3. Can the TDH account for the results?

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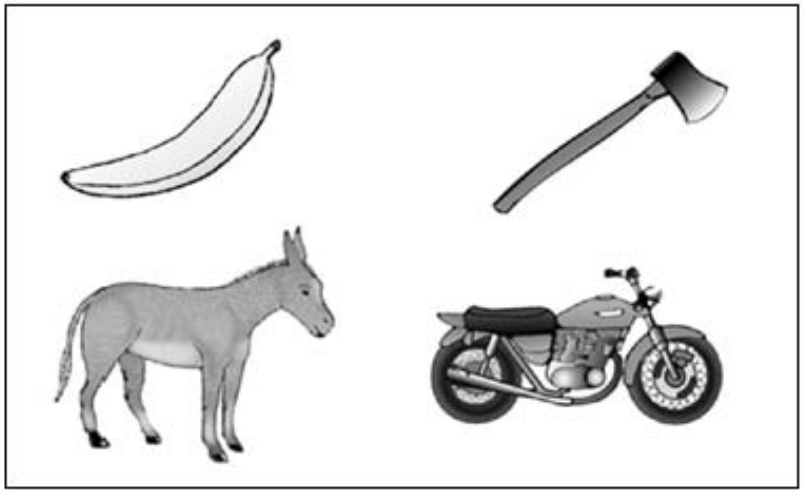
# Tests

1. Boston naming test



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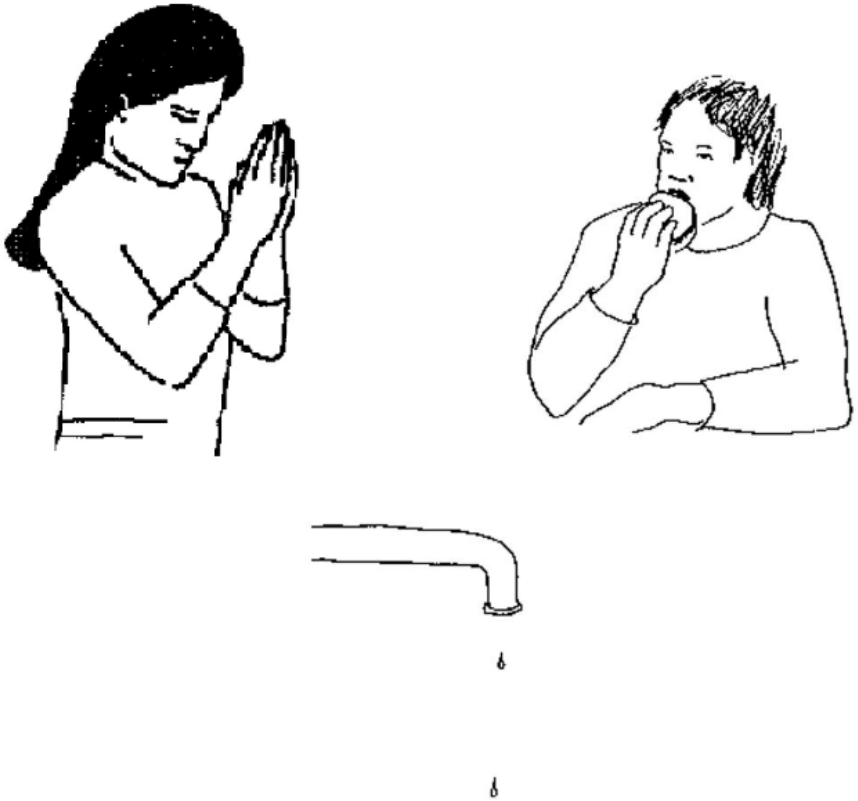
1. Boston naming test
2. Action naming test



# Tests

1. Boston naming test
2. Action naming test
3. Animal word list generation
4. Letter word list generation

**“Animals”**

- Horse
- Rabbit
- Cow
- ...

**Words starting with “F”**

- Fire
- find
- Fly
- ...

# Tests

1. Boston naming test
2. Action naming test
3. Animal word list generation
4. Letter word list generation
5. Vocabulary test (control)

**"Sofa"**: Furniture for two or more people with a comfortable seat, often made out of leather...

# What do we expect?

**Naming tests ...**

- ... require a unique label with a unique lexical representation
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**Word list generation tests ...**

| *serial* | *cascaded* |
|---|---|
| ... require several non-specified labels within one semantic category | |
| ... are expected to show performance problems for older people (lexeme selection is crucial for *every* produced item) | **... are not expected to show any particular performance problems for older people (various lexemes are activated in parallel)** |

# What do we expect?

**The vocabulary test ...**

- ... is not expected to show a worse performance in older people
- ... is rather a test of lexical knowledge than lexical retrieval
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**Apart from this ...**

- Gender and education are expected to have an impact on the performance
- Different patterns of change are expected in different tasks (i.e. no tasks will have a parallel outcome of performance over the ages)

# Experiments

Participants:

- 238 healthy people
- Ages from 30 to 94 (mean 61.7)
- 8 to 25 years of formal education

Experiments:

- Time period of 21 years
- 576 observations

Analysis:

- Random effect models
- Univariate/Multivariate analysis

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# Univariate Results

| | Estimate (AIC) | *SE* | *p* | *n* | nobs |
|---|---|---|---|---|---|
| Fixed effects | | | | | |
| ANT | (3738.0) | | | 238 | 540 |
| intercept | 49.740 | 0.753 | <.001 | | |
| cage | −3.274 | 0.367 | <.001 | | |
| cage2 | −0.649 | 0.164 | <.001 | | |
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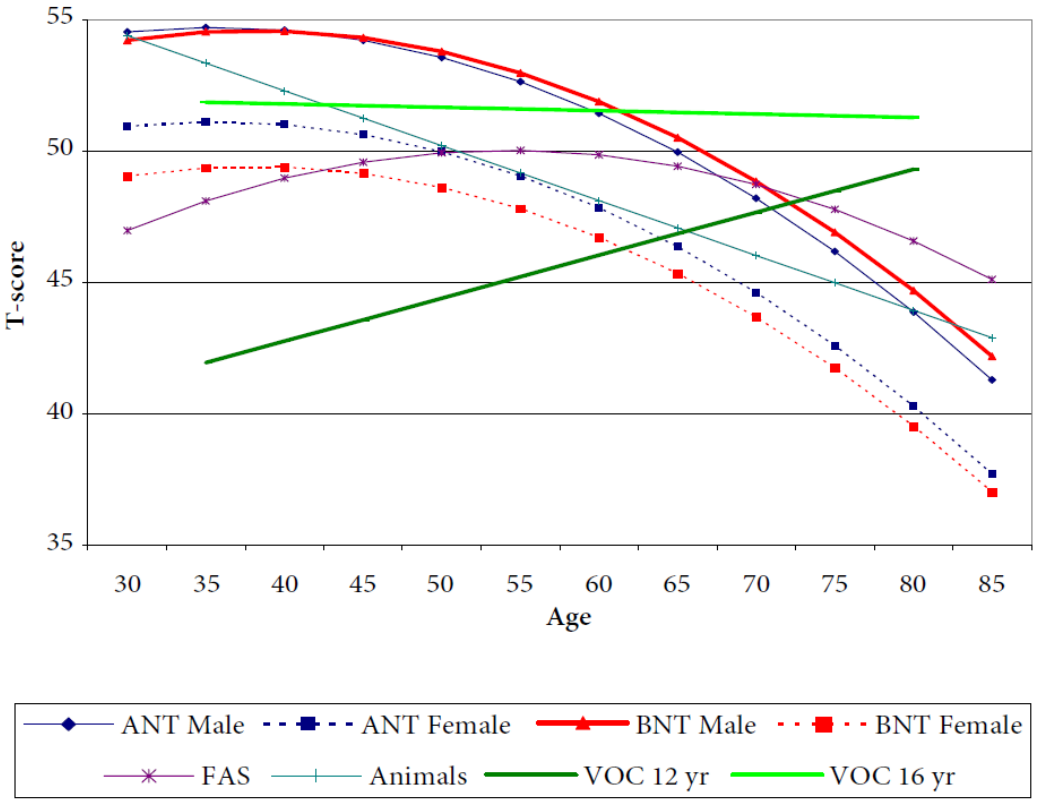
- Decreasing performance with age, except for vocabulary
- Increasing performance with increasing number of years of education
- Women perform worse than men

# Multivariate Results




- Quadratic decrease for BNT and ANT

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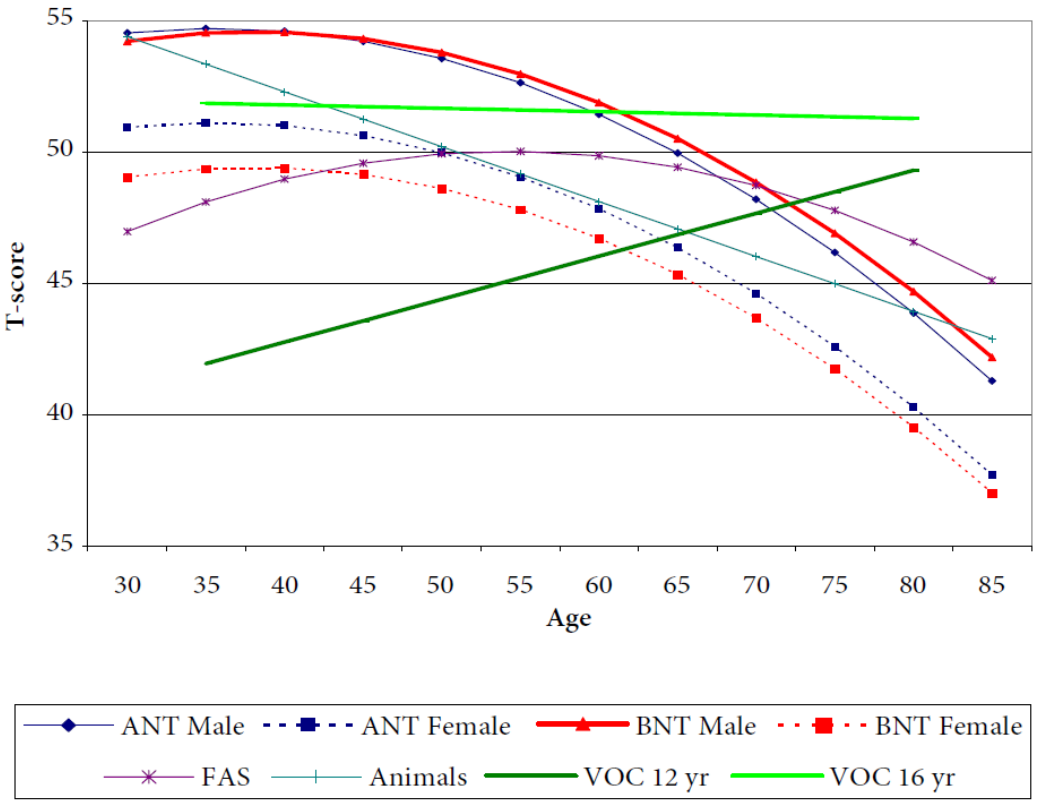


- Quadratic decrease for BNT and ANT
- Linear decrease for Animal list generation

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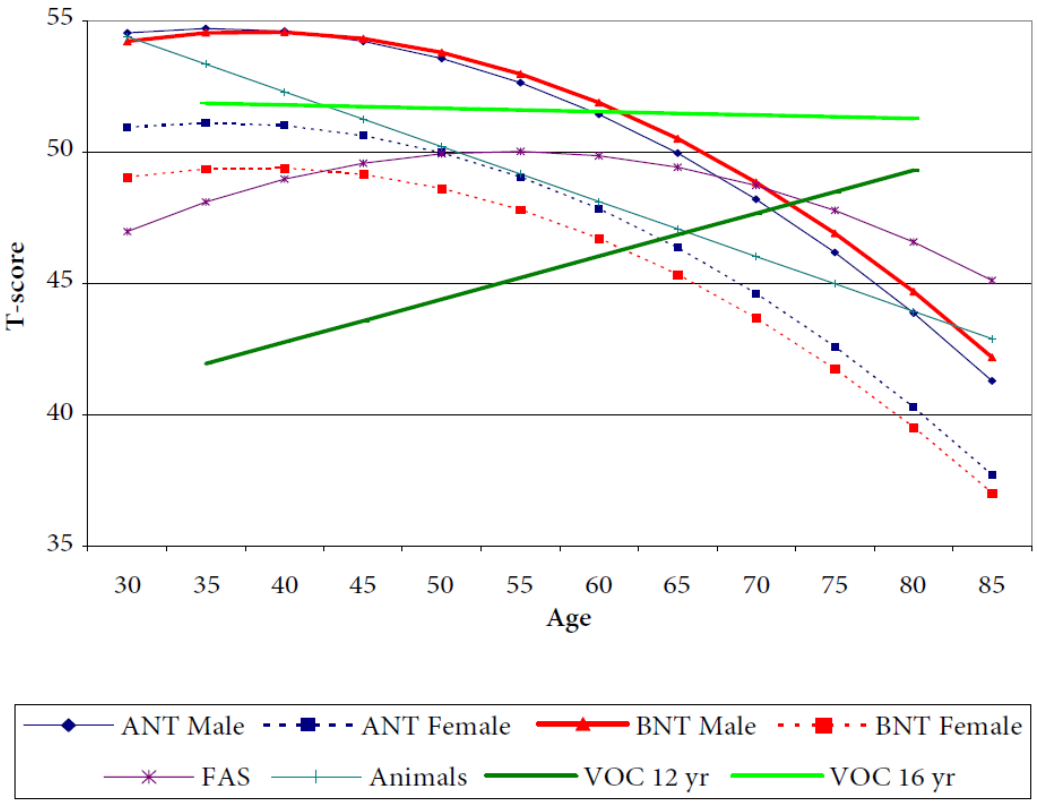


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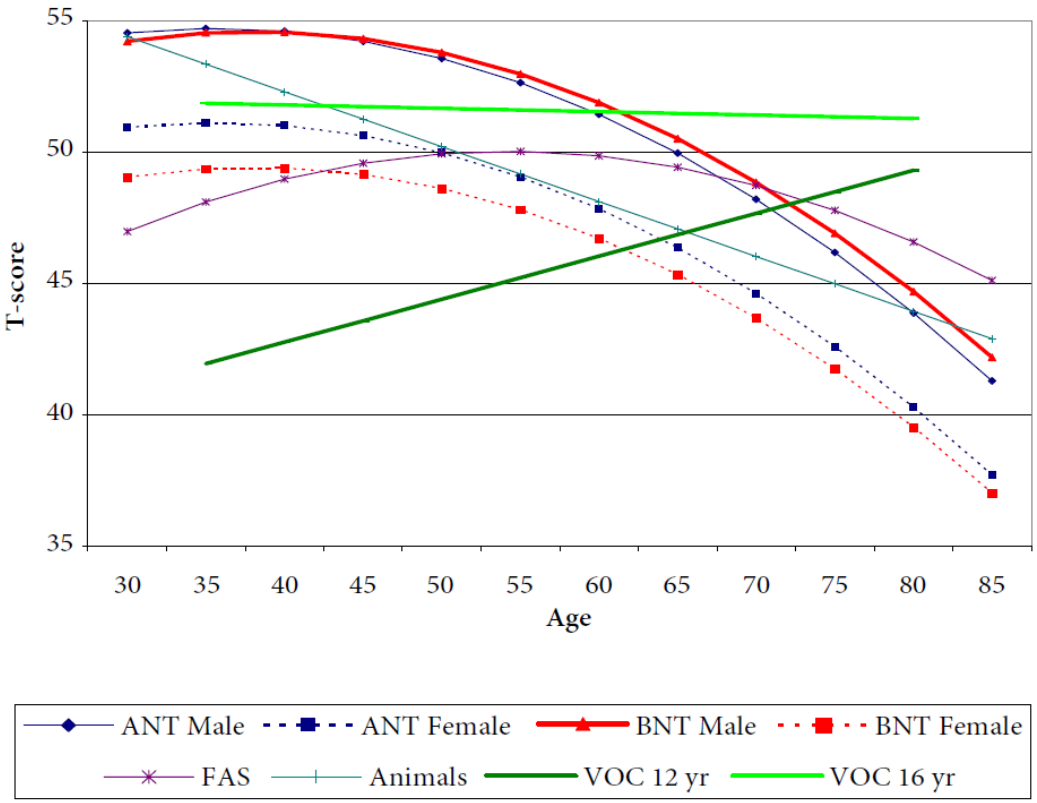


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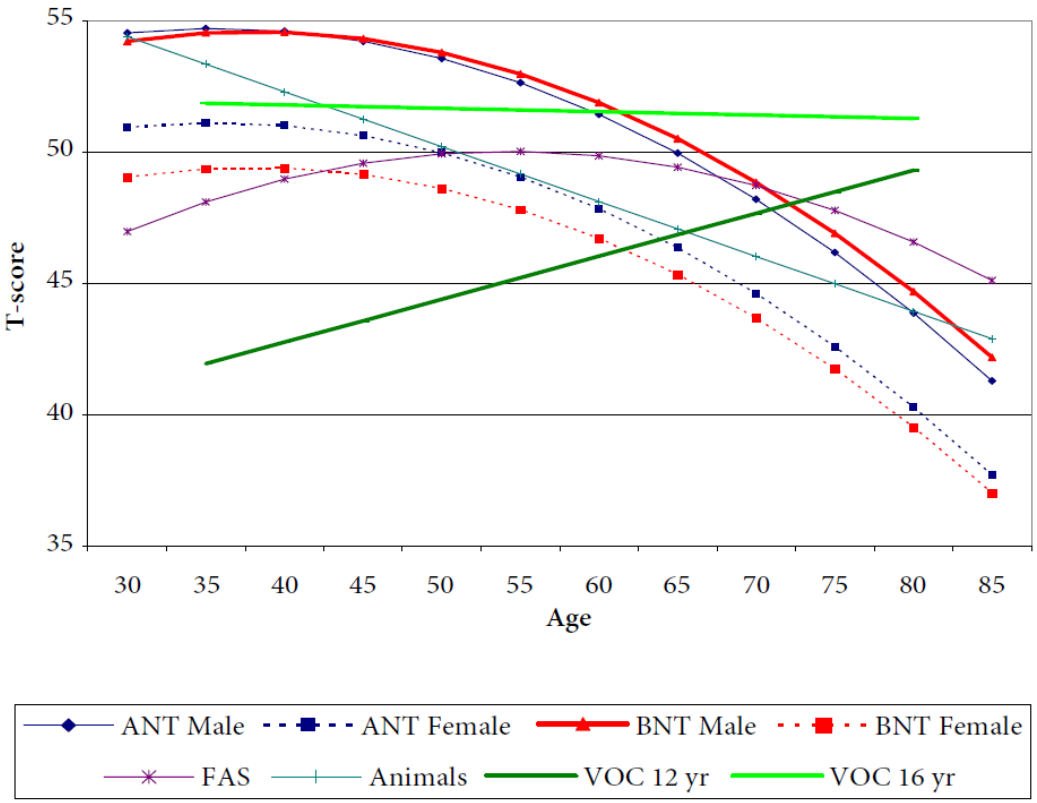


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- Peak for letter word list generation in the middle ages

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# Univariate Results

- Expected Results
- Decreasing retrieval abilities
- Increasing vocabulary abilities

# Multivariate Results

- Evidence for cascaded retrieval: non - similar patterns between picture naming and list generation
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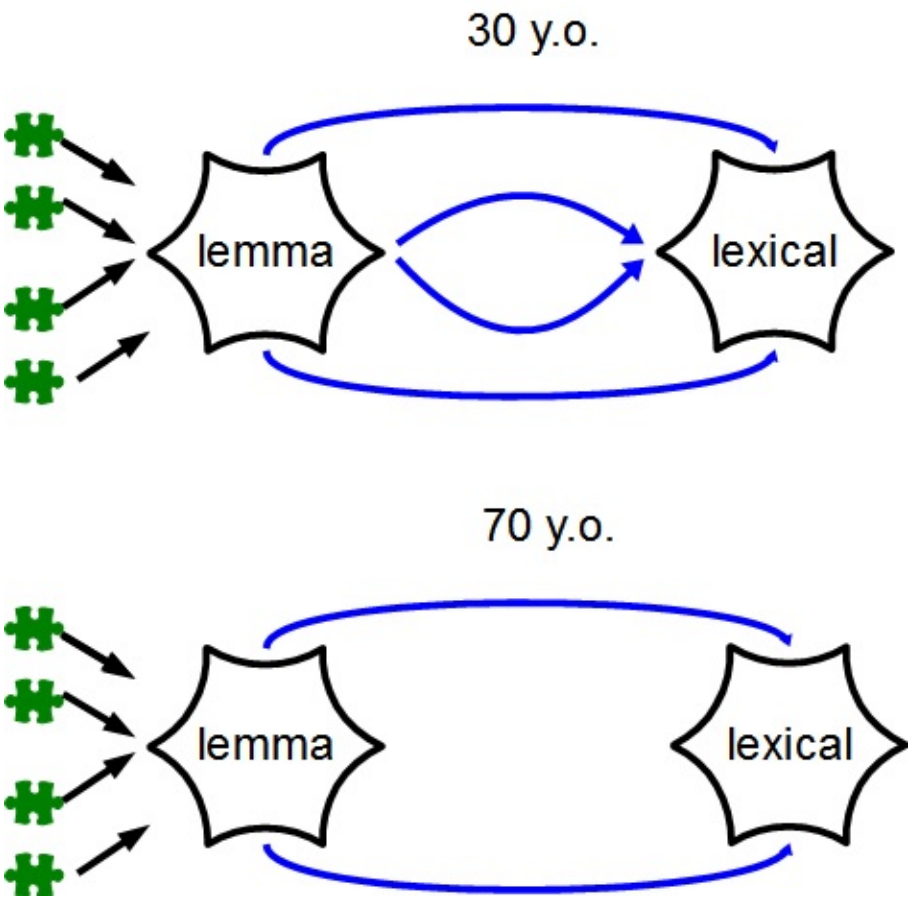
  - Linear vs. quadratic decrease
  - More constant decrease vs. specifically strong decrease in higher ages
- Only partially explainable: peak form in letter based generation
  - Very unnatural way of retrieval
  - Therefore maybe not useful for this study?
- Vocabulary increases with increasing education
  - Effect of education

# TDH and lexical retrieval in aging

Word list generation:




- Name animals!
- 4 impulses might be: donkey, monkey, rabbit, horse

# TDH and lexical retrieval in aging

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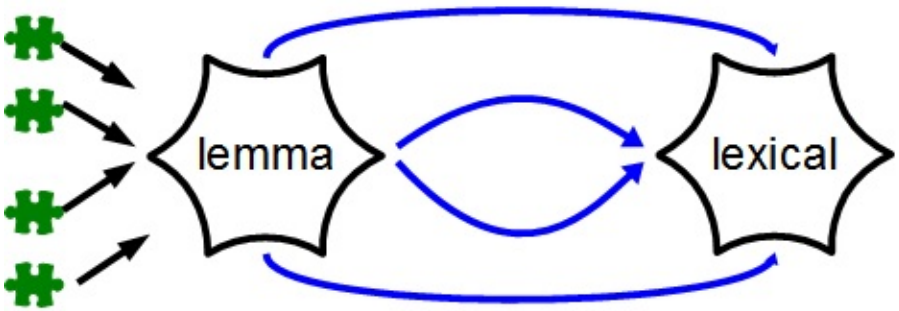
30 y.o.

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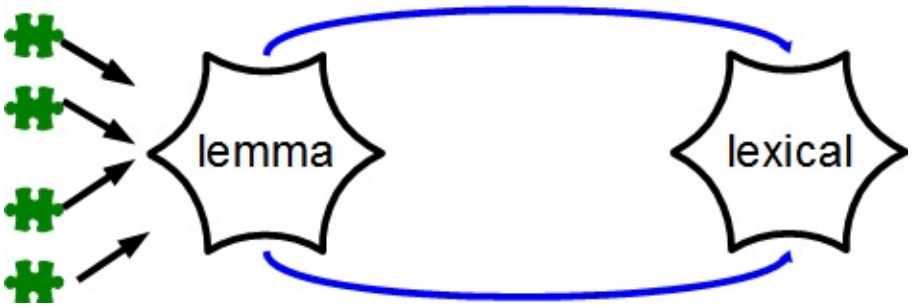


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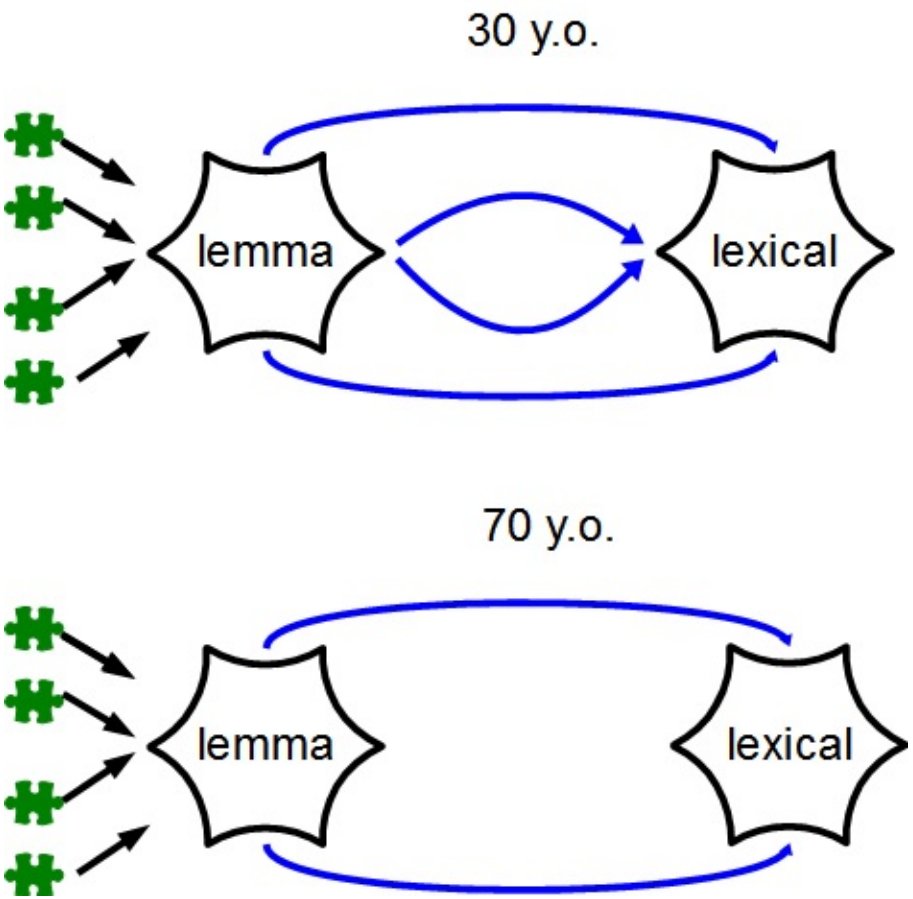


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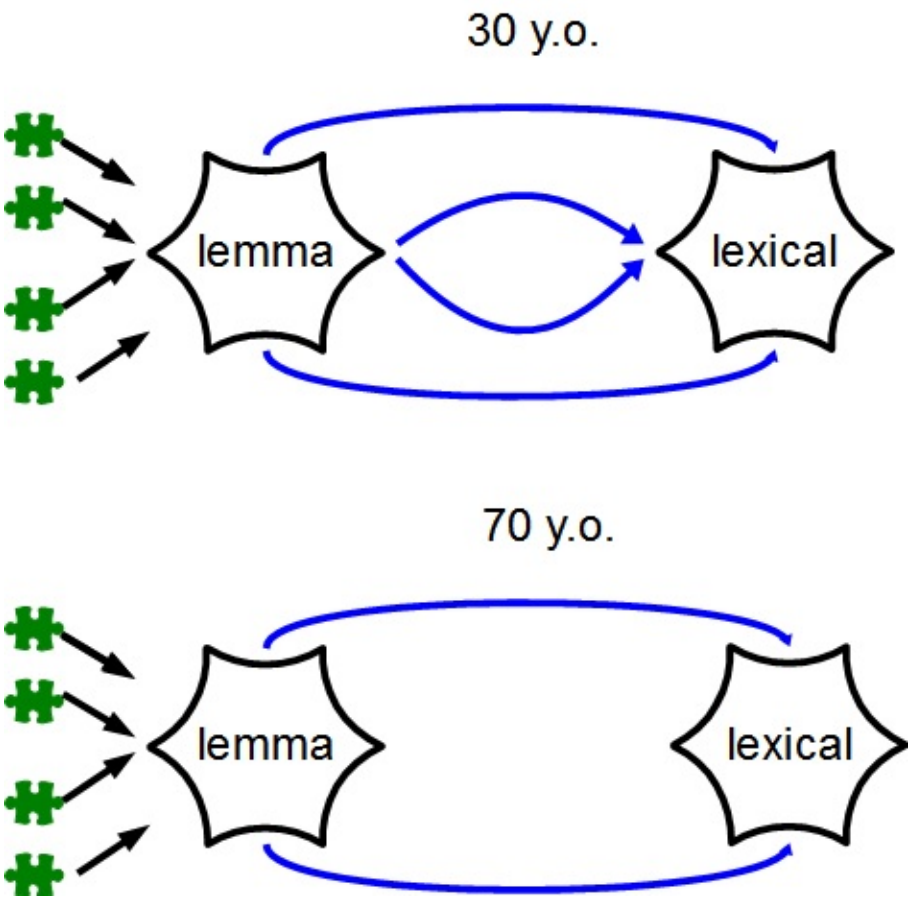


- Name animals!
- 4 impulses might be: donkey, monkey, rabbit, horse
- activation of various lexemes
- all activations lead to a successful item
- lexical retrieval of no particular importance

# TDH and lexical retrieval in aging

Picture naming:

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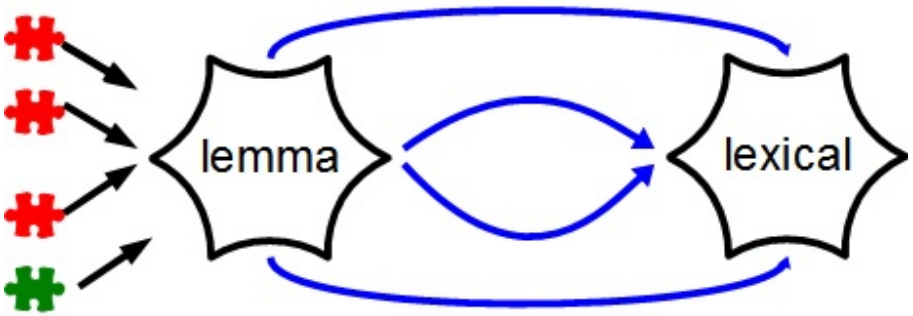


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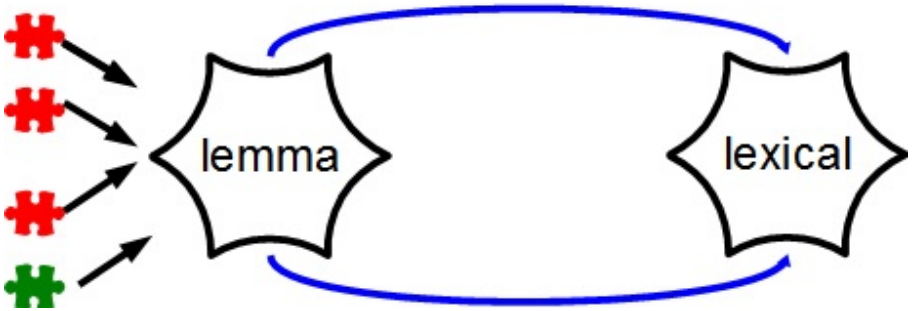


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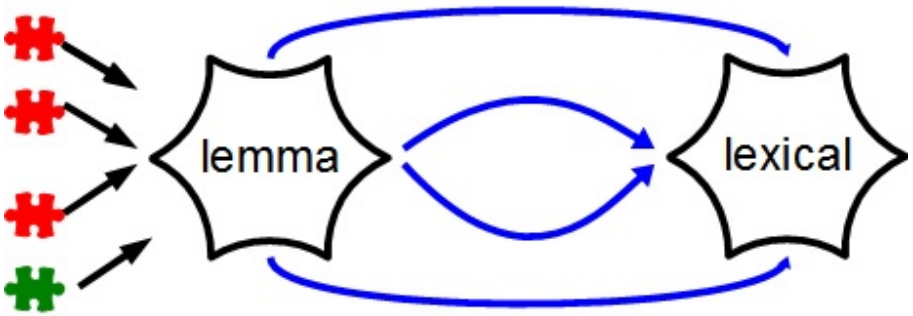


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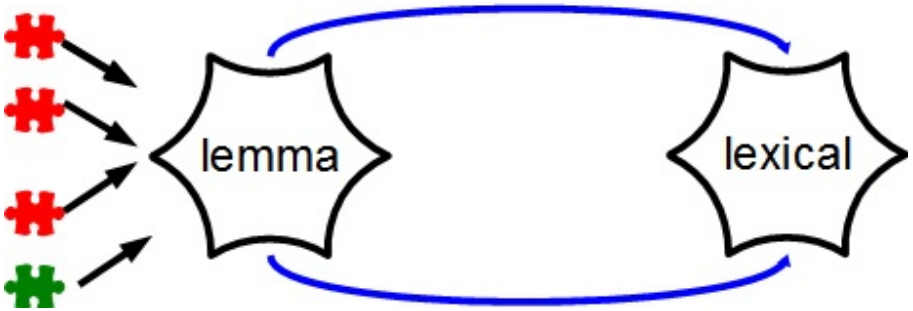


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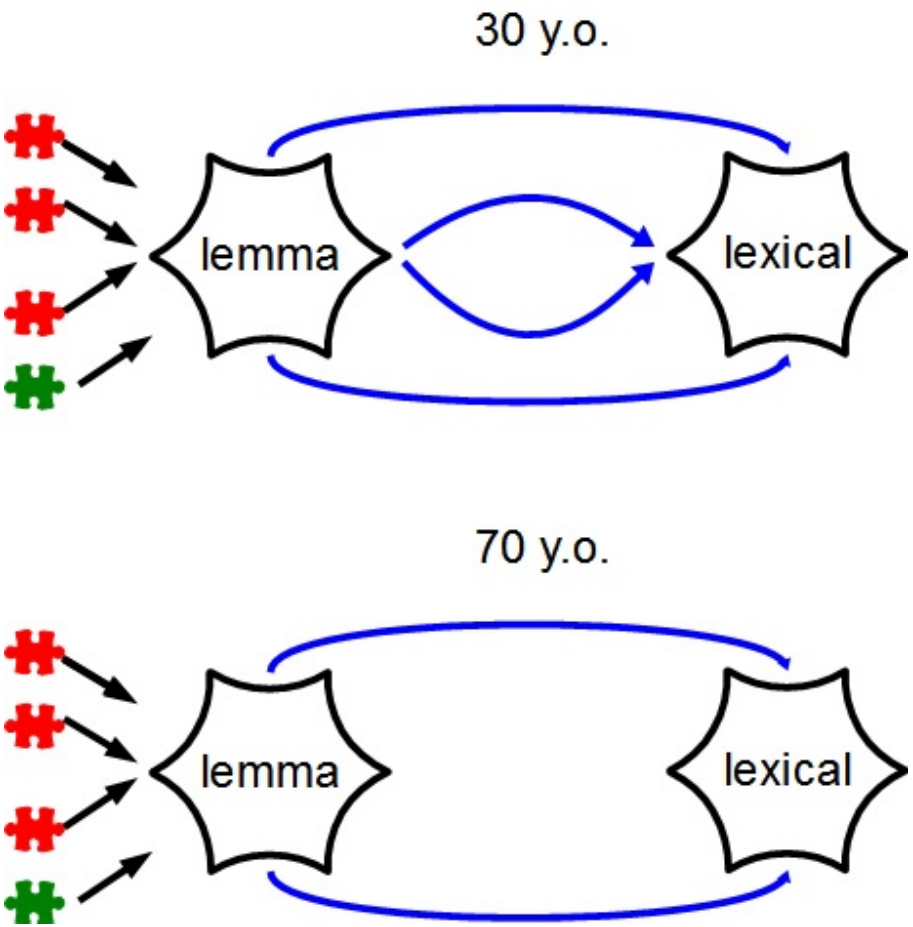


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- Activation of various lexemes
- *Only one* correct lexeme

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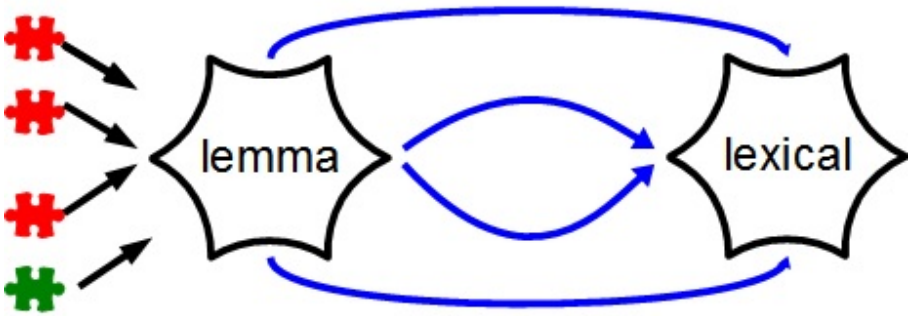
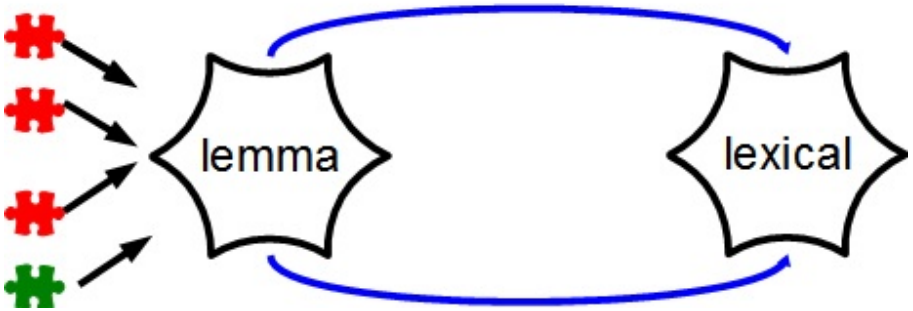



70 y.o.

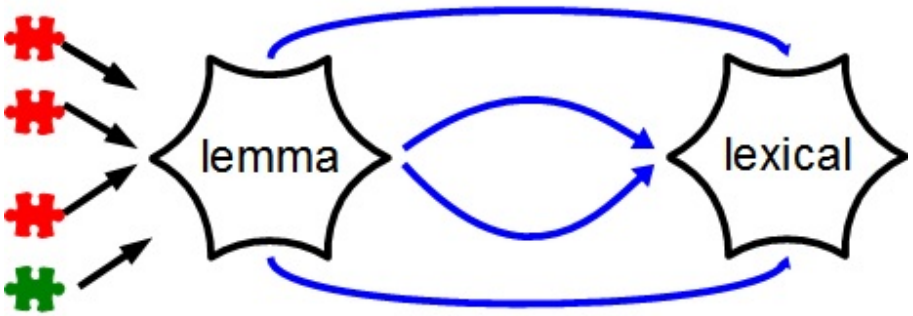



- Given the picture of a horse
- 4 impulses might be: donkey, monkey, rabbit, horse
- Activation of various lexemes
- *Only one* correct lexeme
- Fewer lexemes processable at one point in time

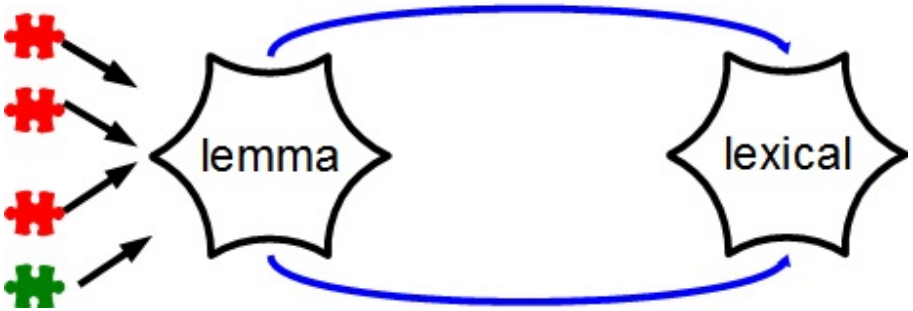
# TDH and lexical retrieval in aging

Picture naming:

30 y.o.




70 y.o.




- Given the picture of a horse
- 4 impulses might be: donkey, monkey, rabbit, horse
- Activation of various lexemes
- *Only one* correct lexeme
- Fewer lexemes processable at one point in time
- **Incorrect lexemes "block" the correct interpretation**

# Summary

1. Do humans perform lexical retrieval in a serial or cascaded manner?
→ *Probably cascaded.*

2. Depending on the result, which part of the retrieval is most likely affected in old people?
→ *Lexical retrieval plays the key role.*

3. Can the TDH account for the results?
→ *Yes, worse performance due to transmission problems.*