Anaphoricity, Presuppositions, and Memory Retrieval Processes

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Language comprehension involves establishing linguistic dependencies:

- To study comprehension, we can look at real-time processing, partly because its inherently linear organization mirrors speech in some ways.

- To establish linguistic dependencies, the comprehender must successfully retrieve the memory representation of an antecedent.

- How is the representation of an antecedent retrieved from memory?
ROADMAP

- Presuppositions and memory retrieval
- Drift Diffusion Modelling (DDM)
- Experimental design
- Results & Conclusions
- Discussions
Too as an Anaphoric Trigger

- Treating presuppositions analogously to anaphoric expressions such as pronouns (Kripke, 1990/2009; van der Sandt, 1992; Beck, 2007; a.o.).

- “Anaphoric” is taken to mean “requiring a contextually provided antecedent”.

- *too* establishes an anaphoric dependency between the trigger and the presupposed content.
**Too: Focus Sensitivity**

- For example:
  - John went swimming. Mary went swimming too.

- Note: *too* is actually Focus sensitive and is not restricted to VPs (e.g. John went swimming; he went dancing too), but this use is not our concern here.
PREDICTION FOR TOO

- We expect to see that the processing of *too* would share the same processing signature as other anaphoric expressions.
  - e.g. Pronoun resolution, VP ellipses, Sluicing constructions

- We use a specific memory retrieval model to investigate the processing of *too*.

- Question: what is the memory retrieval mechanism that underlies the processing of *too*?
Overview of the memory retrieval model:

(1) A memory retrieval process is initiated.

(2a) The memory retrieval process of many anaphoric dependencies uses “direct access mechanism”.

(2b) A key property of a direct access mechanism is that it is cue-based.
(1) A memory retrieval process is initiated in order to establish an anaphoric dependency.

- John went swimming. Mary went swimming *too*.
- John went swimming. Mary went dancing.
HYPOTHESIS FOR THE RETRIEVAL PROCESS

Trigger ➔ Retrieving presupposed content

- Successful
  - Update context
    - Successful
      - Update context
    - Unsuccessful
      - Accommodate
        - Successful
          - Update context
        - Unsuccessful
          - Ignore?
            - Successful
            - Unsuccessful
              - Reject utterance
TODAY’S FOCUS:

- We experimentally investigate this process.
Direct access mechanism: when retrieving the memory representation of an antecedent, only the target representation is considered (Foraker & McElree, 2007; Martin & McElree, 2008, 2011).

Quality of the representation for remote antecedents are decayed.

But increased distance between the antecedent and the retrieval site has no effect on retrieval speed.
Set of representations being inspected: \{Mary\}

Decayed quality

- **Mary**
  - [SG]
  - [F]

- **John**
  - [SG]
  - [M]

- **herself**
  - [SG]
  - [F]
MEMORY RETRIEVAL MECHANISMS: TWO HYPOTHESES

- **Serial search** mechanism: multiple representations are inspected; irrelevant intermediate contents are necessarily accessed before finding the target representation (Dillon et al, 2014).

- Perhaps not possible to immediately identify the target representation.

- Structural properties of an antecedent may be relevant for determining which representation is the target.
Set of representations being inspected: \{Mary, John\}

- Intermediate contents might be unsuitable as antecedents, but very relevant for determining whether the dependency is legitimate.
- e.g. c-commanding relations can be easily checked via a serial walk through the structure
(2a) The memory retrieval process of many anaphoric dependencies is via **direct access**.

- Pronoun resolution (Foraker & McElree, 2007)
- VP ellipsis (Martin & McElree, 2008)
- Sluicing (Martin & McElree, 2011)

- We may expect to see that a direct access memory retrieval mechanism also underlies the processing of an anaphoric trigger, such as **too**.
(2b) A direct access model is cue-based.

- Cues are hypothesised to be information such as “grammatical constraints”: e.g. morpho-syntactic cues.
To distinguish *serial search* from *direct access*, we need to tease apart retrieval speed and accuracy……

But they are confounded in simple reaction time measures:

- Longer reaction times may be due to the time it takes to access a more remote antecedent (i.e. extra processing steps are required).

- Or it may simply reflect the decayed quality of the representation of a more remote antecedent (but retrieval speed is not necessarily slowed!).
DRIFT DIFFUSION MODELLING

- DDM jointly models accuracy and response time distributions, with parameters that reflect distinct underlying memory retrieval processes (Ratcliff 1978; Ratcliff, et al., 2016; McElree & Dosher 1989)

- From these measurements, a retrieval function is estimated that relates accuracy to elapsed processing time.

- End product: A best-fit model with several key parameters
DRIFT DIFFUSION MODELLING

- \( \tau \), nondecision time: the time required for memory access
- $\delta$, drift rate: the asymptotic accuracy
DRIFT DIFFUSION MODELLING

- \( \alpha \), boundary separation: the retrieval speed & the asymptote
Drift Diffusion Modelling

- $\beta$, response bias

![Changes in Beta (Response Bias)](image)
THE TAKE-HOME MESSAGE

- A difference in $\tau$ or $\alpha$ can be used to infer that a serial search retrieval process is at play.
- The lack of this difference indicates a direct access retrieval process.
EXPERIMENTAL DESIGN

- Speeded acceptability judgement study (N = 64):
  - An experimenter-paced sentence reading task
  - Phrase-by-phrase with RSVP presentation (400 msec/phrase)
  - Followed by an end-of-sentence acceptability judgment with binary choices.
### EXPERIMENTAL DESIGN

- Distance was manipulated as **Near** or **Far**.
- Context (the VP) was **Same** or **Different**, satisfying or failing to satisfy the presuppositions respectively.

<table>
<thead>
<tr>
<th></th>
<th>Same</th>
<th>Different</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Near</strong></td>
<td>If the editor resigned, then the critics resigned <strong>too</strong>.</td>
<td># If the editor plagiarized, then the critics resigned <strong>too</strong>.</td>
</tr>
<tr>
<td><strong>Far</strong></td>
<td>If the editor resigned, then everyone from the publishing house would be shocked to hear that the critics resigned <strong>too</strong>.</td>
<td># If the editor plagiarized, then everyone from the publishing house would be shocked to hear that the critics resigned <strong>too</strong>.</td>
</tr>
</tbody>
</table>
PREDICTIONS

- Accuracy:
  - A distance effect, with higher accuracy in the Near condition.

- Response time:
  - No distance effect is expected.
  - If there are (hints of) distance effects, DDM is useful to check whether it’s due to a difference in retrieval speed or just the quality of memory representation.
RESULTS: ACCURACY

- Participants were more accurate in the **Near** condition, suggesting **accuracy** differences.

- A main effect of Distance ($t = 4.769$, $p < .001$) and Context ($t = 3.604$, $p < .001$).

- Their interaction was non-significant ($t = 0.671$, $p = .502$).
A marginally significant interaction between Distance and Context ($t = 1.799, p = .079$), and a main effect of Context ($t = -2.755, p = .007$).

Planned comparison revealed no effects of Distance within the Context types.
RESULTS: DDM ANALYSIS

- Presupposition & Memory
- Drift Diffusion
- Experiments
- Results
- Discussion
## RESULTS: DDM ANALYSIS

<table>
<thead>
<tr>
<th></th>
<th>$\tau$ (retrieval speed)</th>
<th>$\alpha$ (rate)</th>
<th>$\delta$ (accuracy)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Distance</strong></td>
<td>1.691</td>
<td>0.863</td>
<td>-1.725</td>
</tr>
<tr>
<td><strong>Context</strong></td>
<td>2.100*</td>
<td>0.821</td>
<td>4.261***</td>
</tr>
<tr>
<td><strong>Interaction</strong></td>
<td>0.941</td>
<td>-0.051</td>
<td>-0.310</td>
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</table>

- DDM revealed no effect of *Distance* on $\tau$ or $\alpha$.
- No significant effects of *Distance* was found in terms of speed of retrieval.
The memory retrieval process of the presupposition trigger *too* shares the processing signature of many anaphoric expressions:

- (1) A memory retrieval process is initiated.
- (2a) This process is via direct access.
- (2b) What **cues** are being exploited for *too* to identify the target representation remains to be explored.
The conclusion for a direct access retrieval process is based on the lack of any difference in $\tau$ or $\alpha$.

Could it be due to the lack of statistical power?

A general concern for the studies on memory retrieval process.

Being less resource-intensive and time consuming technique compared to Multiple-Response SAT paradigm, DDM offers more opportunities for replication.
One concern in our current design:

- The same VP was used to satisfy the presupposition of *too*.
- The same “form” may serve as a cue, making it possible to directly identify the target antecedent.

Next step: using synonymous verbs to satisfy the presupposition (see also Göbel (2018)).

- e.g. *If the editor resigned, then the critics quit too*.

This may shed light on what cues are actually available during the retrieval of the representation of a presupposed content.
What is a possible antecedent for *too*?

- We could need to add another propositional-level antecedent between the presupposed content and *too*.

- *e.g.* *If the editor resigned and the writers went on a strike, then everyone from the publishing house would be shocked to hear that the critics quit too.*

- This will then help us fully consider the sophisticated version of the serial search model, and understand the extent to which the memory retrieval process of *too* is directly accessible.
Three relevant dimensions for considering which memory retrieval mechanism is at play:

- What is a suitable antecedent in a particular type of dependency?
- How much information is available for identifying the target antecedent?
- What are the structural properties of an antecedent that need to be taken into consideration?
SELECTED REFERENCES


THANK YOU!

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