Forgetting effects due to Local Coherence in Hindi

Question: What is the nature of prediction in head-final languages?

- This study:
  - Prediction is fallible: prediction of a head/structure in the main clause is forgotten in sentences with a center-embedded relative clause in the language Hindi.
  - Local coherence effect [1].
  - Current results are not explicable by expectation-based accounts [2, 3].

Prediction: what we know

- Speakers of head-final languages are assumed to be good at making predictions about the upcoming material based on the input received so far [4].
- Inclusion of pre-verbal elements facilitates processing at the predicted clause-final verb [5].
- The 'boy who saw the paper (fallen behind the table)' was very inquisitive.

Explanation: expectation based accounts [2, 3]

The FORGETTING hypothesis

The prediction of the main clause verb by the head noun is forgotten in the presence of a locally coherent parse.

EXPERIMENT: Local Parse type × post-RC Clause Type

- Ungrammatical sentences with center-embedded relative clauses (RC) where the post RC material cannot be integrated with the head noun across all conditions.

Local Parse type: 
- Locally coherent, -Locally coherent
  - In the +Locally coherent conditions, post RC material can be integrated with RC internal object noun in a locally coherent parse.
  - This manipulation utilizes Canonical(=SVO) word order in RC for +Locally coherent and Non-canonical (=SOV) word order for -Locally coherent (based on [6]).
- post-RC Clause Type: Copula, Transitive.
  - Copula: agreement morphology does not match the head noun
  - Transitive: the transitive verb cannot be integrated thematically with the head noun & agreement morphology does not match the head noun

Main effect of Local Parse Type: Reading Times at the post RC verb for +Locally Coherent < -Locally Coherent if the prediction of the main clause verb is forgotten and the RC internal NP is integrated with the post-RC material in a locally coherent parse.

- A significant interaction: the effect of Local Parse type on RTs may differ across the two structures.
- An expectation-based account [2, 3] predicts no difference in RTs between the conditions at the post RC verb.

Since the critical verb-forms in the experimental items are ungrammatical, their probability of occurrence given prior words ought to be close to zero across all conditions.

Methods

- Centered self-paced reading + Acceptability rating
- 24 latin-squared items, 56 fillers
- Experiments were conducted in a quiet room.
- Three native speakers of Hindi from the University of Delhi.
- Participants were given a 24-item experimental test.
- Each item was presented on a computer screen.
- Participants were asked to indicate whether the sentence was grammatical or not.
- The experimental items were presented in a Latin square design.
- The items were divided into four sets of six items each.
- The order of presentation of the sets was randomized across participants.
- The acceptability ratings were used to evaluate the effect of Local coherence on RTs.
- The RTs were recorded using a reaction time clock.
- The RTs were measured from the onset of the sentence to the moment of the target word recognition.

RESULTS: RTs

- Linear-mixed effects models were used for all statistical analyses.
- RTs at the critical region:
  - a significant main effect of Clause Type (t=4.06): RTs for Transitive > Copula.
  - a significant interaction effect (t=2.56) driven by the Transitive condition: RTs for +Locally coherent < -Locally coherent.
- RTs at the post-critical region:
  - a significant effect of Local Parse type (t=4.32): RTs for +Locally coherent < -Locally coherent.

Figure 1. RTs for the Copula condition Figure 2. RTs for the Transitive condition

RESULTS: Ratings

<table>
<thead>
<tr>
<th>Table 1. Experimental items</th>
<th>Rating</th>
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<tbody>
<tr>
<td>a. +Locally coherent, Copula</td>
<td>4.4</td>
</tr>
<tr>
<td>b. -Locally coherent, Copula</td>
<td>3.8</td>
</tr>
<tr>
<td>c. +Locally coherent, Transitive</td>
<td>4.2</td>
</tr>
<tr>
<td>d. -Locally coherent, Transitive</td>
<td>3.8</td>
</tr>
</tbody>
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<table>
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<tr>
<th>Table 2. Filler sentences</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clearly grammatical fillers</td>
<td>5.2</td>
</tr>
<tr>
<td>Clearly ungrammatical fillers</td>
<td>2.4</td>
</tr>
<tr>
<td>All fillers</td>
<td>4.3</td>
</tr>
<tr>
<td>(1 to 7 scale, 7=highest)</td>
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</table>

CONCLUSION

- Local coherence occurs with a non-canonical word order (SVO) in the RC:
  - Role of head-finality – the finite verb in the RC could be a strong cue for a clause boundary and the RC-final NP can be treated as being beyond this boundary allowing integration of NP in the upcoming string.
  - Role of revision within the RC – more time in RC, more decay of NPs.
- Combining RTs for RC-Object & RC-verb:
  - a significant effect of Local Parse type in a Post hoc t-test (p<0.05).

Further issues

- The results demonstrate fallibility in prediction processes in a head-final language using a relatively simple structure.
- Therefore, it is important to further investigate broad claims about the absence of forgetting effects caused by memory constraints in head-final languages [7].

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References