1. Introduction

- Language production is multi-stage & incremental.[1]

  (1) Message Formulation:
  Speakers pull together unordered, pre-linguistic concepts they intend to communicate

  (2) Linguistic Encoding:
  Pre-linguistic concepts assigned to lexical representations and grammatically encoded

  Functional Processing:
  Lexical representations assigned syntactic role (e.g. subject, object)

  Positional Processing:
  Lexical representations assigned position/order in the sentence

  (3) Phonological Encoding & (4) Articulation:
  Sound units assembled & Speech Begins

- The linearization problem: How does linguistic encoding start going from unordered concepts to sequentially produced utterances?

- Functional Processing (Label-then-Linearize): Lexical representations directly assigned to subject role; subject placed sentence-initially.[2]

- Positional Processing (Linearize-then-Label): Lexical representations assigned to first linear slot in sentence; incidentally, becomes subject.[3]

- How do we tease these apart if subjects are the first elements in sentences? Left- vs Passive: Subjecthood, not semantic Agenthood, drives encoding, but subject still linearly-initial in actives and passives.[4]

- Free word order (Russian, Finnish)[5] or Verb-initial (Taeltai, Tagalog)[6]

- But, results complicated by discourse and/or morphological factors

2. Current Study

Research Question: Is linguistic encoding driven by functional or positional processing?

Investigate: Emergence of syntactic structure effects (functional processing) relative to linear word order effects (positional processing) during linguistic encoding.

We use object wh-questions: The subject in these structures is not linearly initial.

3. Experiment Design

- Participants first saw sentence type cue, then saw image; produced the cued sentence type

  Statement (S)
  The nurses tickled the chefs.

  Object Wh-Question (Q)
  Which chefs did the nurses tickle?

- Verbs indicated by instruments (e.g. feather), instrument location indicated subject character

  To encourage object wh-questions, examples/practice included only object wh-questions; participants told to ask 'who the action is happening to'

- Visual World Eye-tracking Paradigm: Measured proportion of fixations to subject, object and verb, & Sub-Obj Difference Scores; 33 target items

- Key time window for Linguistic Encoding: 400-800 ms

4. Hypotheses & Predictions

<table>
<thead>
<tr>
<th>Declaratives</th>
<th>Object wh-questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The nurses tickled the chefs.</td>
<td>Which chefs did the nurses tickle?</td>
</tr>
</tbody>
</table>

- Functionally-driven: Encoded driven by subjecthood
  - Subject
  - Object

- Positionally-driven: Encoded driven by linear word order
  - Subject
  - Object

5. Exp. 1. English: Subjecthood vs Linear Word Order

![Fig1: Eye-Movements Immediately After Image Onset](image1)

- Before linguistic encoding (0-400 ms), speakers (n=30) look to verb first to determine Subj/Obj
- During linguistic encoding (400-800 ms), differences between Decl & Object wh-Ques emerge in declaratives larger than in object wh-questions (t=2.67)
- Key Pattern: Speakers look to the subject before object in decl. & ques. (~400ms), but consider the object more in ques than in decl
- Decl: Rapid rise in looks to subject only ~400ms
- Ques: Rise in looks to subject & object ~400ms
- Linguistic encoding may be primarily – but not exclusively – driven by functional processes
- Speakers juggle functional and positional demands at the same time: Looks to subject and object rise in parallel in object wh-questions
- Subjecthood assignment is privileged: Looks to subject emerge first and proportion of looks to subject greater than proportion of looks to object

6. Exp. 2. Mandarin: Word Order vs Information Focus

![Fig2: Eye-Movements After Encoding](image2)

- Research Questions: Wh-words are informationally focused elements. To what extent did information focus drive looks to the object in Exp 1?
- Exp 2 conducted in Mandarin Chinese (Subject-Verb-Object)
  - Mandarin wh-questions and declaratives have the same linear word order

- Declaratives: The nurses shot the chefs.
  - Subject
  - Object

- Object Wh-Question: Which chefs? The nurses shot which chefs?
  - Subject
  - Object

- Eye-movements differences cannot be due to surface word order

7. Discussion & Conclusion

- First look at real-time production of questions
- Differences between declaratives and questions emerge during Linguistic Encoding
  - No differences emerge before encoding (e.g. Message Formulation)
  - To what extent does propositional content of messages in declaratives vs questions differ?

- Encoding is multi-factorial: Takes into consideration competing structural and positional demands simultaneously

- Linguistic encoding can start with syntactic roles even when it conflicts with linear word order

- Open question: Why don’t we see information focus effects during production planning?
  - Information focus (e.g. from prior discourse context) can affect conceptual accessibility
  - Focus also affects speakers’ choice of structure (e.g. free word order languages, It-clfts, etc.), suggests role for focus in positional processing

- BUT, Mandarin questions have strict SVO order: Effect of information focus may be restricted

References

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