The Processing of Backward Sluicing

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1. Introduction: Backward Sluicing

2. Experiment 1: Active Antecedent Search in Backward Sluicing

3. Experiment 2: Antecedent Search and Islands

4. Discussion
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4. Discussion
(Backward) Sluicing

Antecedent
the editor notified the writer about a new book

Sluiced Clause
but I don’t remember which book
ELLIPSIS
(Backward) Sluicing

- A clausal portion of the sentence is omitted (= Ellipsis)
- The wh-phrase normally has the corresponding indefinite phrase.
- The content of the ellipsis must be recovered/copied from the antecedent.
- Any clause that can supply an appropriate content, can be an antecedent.

In the online processing, the parser must ‘find’ the antecedent for the ellipsis.
(Backward) Sluicing

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In the online processing, the parser must ‘find’ the antecedent for the ellipsis.
The Problem of Antecedent Search

Q: How does the parser find the antecedent for the ellipsis?

• For an ellipsis, there are in principle multiple possible antecedents

I don’t remember which book but ...
The Problem of Antecedent Search

Q: How does the parser find the antecedent for the ellipsis?

• For an ellipsis, there are in principle multiple possible antecedents

I don’t remember which book \textit{ELLIPSIS} but ...

the editor notified the publisher about a new book
The Problem of Antecedent Search

Q: How does the parser find the antecedent for the ellipsis?

- For an ellipsis, there are in principle multiple possible antecedents

I don’t remember which book... but...

the editor notified the publisher about a new book

because the famous write wrote a new book
Q: How does the parser find the antecedent for the ellipsis?

- For an ellipsis, there are in principle multiple possible antecedents.

I don’t remember which book..., but...

- the editor notified the publisher about a new book...
- because the famous writer wrote a new book...
- when...
The Problem of Antecedent Search

Q: How does the parser find the antecedent for the ellipsis?

- For an ellipsis, there are in principle multiple possible antecedents

I don’t remember which book but ...

- The antecedent can be
  a clause that follows “but”
  or
  a clause that comes later on

- The indefinite phrase can be a reliable cue.

- the editor notified the publisher about a new book

  because the famous write wrote a new book

  when ...

Two possible strategies

I don’t remember which book, but the editor notified the publisher about a new book
Two possible strategies

I don’t remember which book, but the editor notified the publisher about a new book

Delay Strategy

• An indefinite phrase can tell that the clause that contains it is likely to be the antecedent for the ellipsis.

• The parser does not start ‘recovering’ the content of the ellipsis before it finds a decisive information such as an Indefinite phrase.
Two possible strategies

I don’t remember which book, but the editor notified the publisher about a new book.

Delay Strategy

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Active Strategy

• The parser starts searching for the antecedent upon encountering the ellipsis site.

• The parser assumes that the closest clause as the antecedent for the ellipsis.
Two possible strategies

• Delay strategy
Two possible strategies

• Delay strategy
Two possible strategies

- Delay strategy

I don’t
Two possible strategies

- Delay strategy

I don’t know
Two possible strategies

• Delay strategy

I don’t know which
Two possible strategies

- Delay strategy

I don’t know which book
Two possible strategies

• Delay strategy

I don’t know which book but
Two possible strategies

- Delay strategy

I don’t know *which book*

A clause is missing!

!! but
Two possible strategies

• Delay strategy

I don’t know which book \textit{Ellipsis} but

A clause is missing!
Two possible strategies

- Delay strategy

I don’t know which book [Ellipsis] but the
Two possible strategies

- Delay strategy

I don’t know which book • Ellipsis but the editor
Two possible strategies

- Delay strategy

I don’t know *which book* [Ellipsis] but the editor notified
Two possible strategies

- Delay strategy

I don’t know which book... but the editor notified the
Two possible strategies

- Delay strategy

I don’t know which book [Ellipsis] but the editor notified the publisher
Two possible strategies

- Delay strategy

I don’t know which book but the editor notified the publisher about
Two possible strategies

• Delay strategy

I don’t know which book but the editor notified the publisher about a new book.
Two possible strategies

- Delay strategy

I don’t know which book [Ellipsis] but the editor notified the publisher about a new book.
Two possible strategies

- Delay strategy

I don’t know which book, Ellipsis but the editor notified the publisher, Indefinite phrase about a new book.
Two possible strategies

- Delay strategy

I don’t know *which book*  

but the editor notified the publisher !! about a new book.

Ellipsis

Copy

Indefinite phrase

Antecedent clause!
Two possible strategies

- Delay strategy
  
  copy

- Active Strategy

  I don’t know which book
  
  ellipsis

  but the editor notified the publisher about a new book.

  indefinite phrase
Two possible strategies

- Delay strategy

I don’t know which book but the editor notified the publisher about a new book.

- Active Strategy

I don’t know which book but
Two possible strategies

- **Delay strategy**

  I don’t know *which book* Ellipsis but the editor notified the publisher about a new book.

- **Active Strategy**

  A clause is following

  I don’t know *which book* Ellipsis but
Two possible strategies

- Delay strategy

  I don’t know which book but the editor notified the publisher about a new book.

- Active Strategy

  I don’t know which book but [s Subject [VP Verb Object]]

  A clause is following Potentially an antecedent

  Indefinite phrase

  Ellipsis

  Copy
Two possible strategies

• Delay strategy

  I don’t know which book

  but the editor notified the publisher about a new book.

  Ellipsis

  Indefinite phrase

• Active Strategy

  I don’t know which book

  but the
Two possible strategies

• Delay strategy

I don’t know which book Ellipsis but the editor notified the publisher about a new book.

• Active Strategy

I don’t know which book the but the
Two possible strategies

• Delay strategy

I don’t know which book but the editor notified the publisher about a new book.

• Active Strategy

I don’t know which book the but the editor
Two possible strategies

- **Delay strategy**

  I don’t know *which book* but the editor notified the publisher about a new book.

  - Ellipsis
  - Copy
  - Indefinite phrase

- **Active Strategy**

  I don’t know *which book* the editor but the editor

  - Indefinite phrase
Two possible strategies

- Delay strategy
  - I don’t know which book but the editor notified the publisher about a new book.

- Active Strategy
  - I don’t know which book the editor but the editor notified
Two possible strategies

• Delay strategy

I don’t know which book but the editor notified the publisher about a new book.

• Active Strategy

I don’t know which book the editor notified but the editor notified
Two possible strategies

- Delay strategy
  
  I don’t know *which book* but the editor notified the publisher about a new book.

- Active Strategy
  
  I don’t know *which book* the editor *notified* but the editor notified
Two possible strategies

• Delay strategy

I don’t know *which book* but the editor notified the publisher about a new book.

• Active Strategy

I don’t know *which book* the editor *notified* but the editor notified

Notify a book??
Two possible strategies

• Delay strategy
  
  I don’t know which book but the editor notified the publisher about a new book.

• Active Strategy
  
  I don’t know which book the editor notified but the editor notified

• Two important points:
  1) Ellipsis resolution is carried out online, incrementally
  2) Linking of wh-phrase with the verb is part of the ellipsis resolution process
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4. Discussion
Experiment 1: Self-Paced Reading
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(1)a. I don’t know which **book**, but the editor **notified** the publisher about a new book…

(1)b. I don’t know which **author**, but the editor **notified** the publisher about a new author …
(1)a. I don’t know which book, but the editor notified the publisher about a new book…

(1)b. I don’t know which author, but the editor notified the publisher about a new author …

(1)c. I don’t know which book the editor notified the publisher about __ …

(1)d. I don’t know which author the editor notified the publisher about __ …
Experiment 1: Self-Paced Reading

(1)a. I don’t know which **book**, but the editor **notified** the publisher about a new book…

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(1)c. I don’t know which **book** the editor **notified** the publisher about __ …

(1)d. I don’t know which **author** the editor **notified** the publisher about __ …

2X2 design; 24 items; 40 participants
Experiment 1: Self-Paced Reading

Sluicing

**notified**
The plausibility effect is observed right after the verb region.

The parser tries to connect the wh-phrase with the verb as soon as possible.
Experiment 1: Self-Paced Reading

**WH-FGD**

- The similar Plausibility effect is observed right after the verb region
Summary

• Both in Sluicing conditions and FGD condition, the plausibility penalty was observed.

• The plausibility effect suggests that the parser tries to connect (and license/interpret) the wh-phrase as soon as possible.

• The plausibility effect in Sluicing condition suggests that the parser actively searches for the antecedent clause, and the ‘copying’ (or ellipsis resolution) is going on online (on word-by-word basis).
Summary

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1. The parser employs the very similar mechanism for the search for the licensing verb for Wh-phrase in Sluicing and WHFGD. (cf. Gullifer 04)

2. Like other cases (WhFGD (Stowe 86, Phillips 06 A.O.) and Cataphoric Dependencies (Kazanina et al., 07)), Active Strategy is used also for ellipsis resolution.
Further Questions

- It seems that both in sluicing and WhFGD the parser actively forms a dependency between the wh-phrase and the licensing verb.

- We know that the Wh-Verb/Gap dependency formation is constrained by islands: The parser does not form a dependency across island domains.

- Is the dependency formation in the processing of Sluicing also constrained by Islands?

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2. Like other cases (WhFGD (Stowe 86, Phillips 06 A.O.) and Cataphoric Dependencies (Kazanina et al., 07)), Active Strategy is used also for ellipsis resolution.
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4. Discussion
(Broadly) Two Approaches to Islands

Q. Is the dependency formation in the processing of Sluicing also constrained by Islands?

**Sluicing**

I don’t know which book, but the editor that notified the publisher about

**WhFGD**

I don’t know which book the editor that notified the publisher about
(Broadly) Two Approaches to Islands

Q. Is the dependency formation in the processing of Sluicing also constrained by Islands?

**Sluicing**

I don’t know **which book** but **the editor that** notified **the publisher about** ...

**Wh-phrase** **Island domain** **Licensing verb**

**WhFGD**

I don’t know **which book** **the editor that** notified **the publisher about** ...

- Very similar ingredients (wh-filler, islands, and licensing verb) in both constructions.
- Both shows active the search effect for the verb in non-island environment.
- Do islands block the wh-verb dependency formation?
(Broadly) Two Approaches to Islands

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Processing capacity/complexity approach
(Broadly) Two Approaches to Islands

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Island effects = Storage + Interveners (+ retrieval)
(Broadly) Two Approaches to Islands

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Which book... [[NP the editor [CP who notified __ ...]]]

Too much!
(Broadly) Two Approaches to Islands

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Which book... [NP the editor [CP who notified __ ...]]

Too much!

- The parser should not try to find the licenser of the Wh-phrase in an island
(Broadly) Two Approaches to Islands

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Processing capacity/complexity approach

Island effects = Storage + Interveners (+ retrieval)

Grammarmatical approach

- The parser should not try to find the licenser of the Wh-phrase in an island

Which book... [[[NP the editor [CP who notified ___ ...]]]

Too much!
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Processing capacity/complexity approach

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Which book... [[NP the editor [CP who notified __ ...]]] Too much!

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Grammatical approach

Island effects = violation of a formal constraint
Q. Is the dependency formation in the processing of Sluicing also constrained by Islands?

Processing capacity/complexity approach

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Which book... \([\text{NP the editor [CP who notified ...]}]\) 

Too much!

Grammatical approach

Island effects = violation of a formal constraint

Which book... \([\text{NP the editor [who [S notified ...]}]}\) 

Subjacency violation

- The parser should not try to find the licenser of the Wh-phrase in an island
(Broadly) Two Approaches to Islands

Q. Is the dependency formation in the processing of Sluicing also constrained by Islands?

Processing capacity/complexity approach

Island effects = Storage + Interveners (+ retrieval)

Which book... \([\text{NP the editor [CP who notified } \underline{\ldots}\text{]}}\]

Too much!

Grammatical approach

Island effects = violation of a formal constraint

Which book... \([\text{NP the editor [who [S notified } \underline{\ldots}\text{]}}\]

Subjacency violation

- The parser should not try to find the licenser of the Wh-phrase in an island
- Different structures are subject to different constraints
- Sluicing and WhFGD have different structure: sluicing is not sensitive to islands
- The parser tries to find the licenser of the wh-phrase in an island
Experiment 2: Self-Paced Reading
(2)a. I don’t know which book,
    but the editor who notified the publisher about a new book recommended a new mystery novel…

(2)b. I don’t know which author,
    but the editor who notified the publisher about a new author recommended a new mystery novel…
Experiment 2: Self-Paced Reading

(2)a. I don’t know which book,
   but the editor who notified the publisher about a new book recommended a new
   mystery novel…

(2)b. I don’t know which author,
   but the editor who notified the publisher about a new author recommended a new
   mystery novel…

(2)c. I don’t know which book the editor who notified the publisher about a new book
   recommended __ …

(2)d. I don’t know which author the editor who notified the publisher about a new author
   recommended __ …

2X2 design; 24 items; 40 participants
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(2)a. I don’t know which book, but the editor who notified the publisher about a new book recommended a new mystery novel…

(2)b. I don’t know which author, but the editor who notified the publisher about a new author recommended a new mystery novel…

(2)c. I don’t know which book the editor who notified the publisher about a new book recommended __ …

(2)d. I don’t know which author the editor who notified the publisher about a new author recommended __ …
Experiment 4: Self-Paced Reading

Sluicing

![Graph showing reading times for 'notified' in plausible and implausible contexts.](image-url)
Experiment 4: Self-Paced Reading

Sluicing

• The plausibility effect is seen inside an island (a relative clause in subject position)

• The parser forms the dependency across an island domain.

The graph shows the response times (in milliseconds) for different words, with error bars indicating variability. The word "notified" is highlighted, showing a significant difference between the plausible and implausible conditions.
Experiment 4: Self-Paced Reading

- No plausibility effect is observed
- The parser respects island when the FGD is processed
Summary

• The plausibility effect was observed in the relative clause island.

• The parser tries to find the licensing verb for the wh-phrase even within an island when dealing with sluicing.

• The active search process is sensitive to differences between sluicing and non-ellipsis wh-filler-gap constructions.
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4. Discussion
Discussion

• The plausibility effect was observed in the relative clause island.

• This result can potentially support grammatical approaches to islands.

• Still we have to ask the following questions:

Q: *From the processing capacity point of view*
   - Why do island domains in a sluicing context not cause the processing difficulty, even though the wh-phrase and the verb are connected online (cost of holding wh-phrase and island domain)?
   - Does the ellipsis resolution process make sluicing easier? But how/why?

Q: *From the grammatical accounts’ point of view*
   - Why are island violations acceptable under sluicing?
   - What is the relation between the parser and the grammar?
     The parser must be sensitive to the details grammatical differences of WhFGD & Sluicing.
Thank you!!
(3a) I don’t know which author, but the editor who notified the publisher about a new author recommended …

(3b) I don’t know which author the editor who notified the publisher about __ recommended …
Acceptability Rating

(4)a. I don’t know which *book*, but the editor *notified* the publisher about a new book …

(4)b. I don’t know which *author*, but the editor *notified* the publisher about a new author …

(4)a. I don’t know which *book* the editor *notified* the publisher about __ …

(4)b. I don’t know which *author* the editor *notified* the publisher about __ …
(5a). I don’t know which book, but the editor who notified the publisher about a new book recommended a new mystery novel…

(5b). I don’t know which author, but the editor who notified the publisher about a new author recommended a new mystery novel…

(5a). I don’t know which book the editor who notified the publisher about a new book recommended __ …

(5b). I don’t know which author the editor who notified the publisher about a new author recommended __ …
A possible account of island insensitivity

- What sort of structure building process is working?

- The parser respects a distinction between sluicing and WhFGD
- Still the parser tries to form a ‘dependency’ between the wh-phrase and the verb

- Upon recognizing the ellipsis, the parser builds the clausal structure of ellipsis

- In Merger-Type sluicing, the parser posits the indefinite/variable in the thematic position (Chung et al., 1995)

- Because the parser forming a ‘binding’ like dependency, islands do not matter

I don’t know which book but...

I’m not sure how the structure building mechanism looks like under ‘deletion’ approaches (e.g., Merchant 01)
A possible account of island insensitivity

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- The parser respects a distinction between sluicing and WhFGD
- Still the parser tries to form a ‘dependency’ between the wh-phrase and the verb

\[ \text{I don’t know} \quad \text{which book} \quad \text{but…} \]

\[ \text{some book} \]

\[ \text{Binding} \]

• Upon recognizing the ellipsis, the parser builds the clausal structure of ellipsis

• In Merger-Type sluicing, the parser posits the indefinite/variable in the thematic position (Chung et al., 1995)

• Because the parser forming a ‘binding’ like dependency, islands do not matter

I’m not sure how the structure building mechanism looks like under ‘deletion’ approaches (e.g., Merchant 01)