THERE IS NO WH-MOVEMENT IN SPROUTING

Duk-Ho Jung & Grant Goodall

University of California, San Diego
Sluicing & Sprouting

**Sluicing**

A(ntecedent)-Clause

That frog will go extinct very soon, though it’s not clear [how soon <E>].

**Sprouting**

Reduced wh-question

[how soon that frog will go extinct ___]

That frog will go extinct __________, though it’s not clear [how soon <E>].
Sluicing & Sprouting

That frog will go extinct very soon, though it’s not clear [how soon <E>].

Q. Is the REMNANT of sprouting derived by wh-movement?
That frog will go extinct very soon, though it’s not clear

**[how soon that frog will go extinct]***

**YES, Full but invisible syntax**

(Ross 1969)
Sluicing & Wh-Movement

• In **sluicing**, the traits of the purported wh-movement is **not detected**.

Jack believes [*the rumor that* that frog will go extinct *very soon*], though it’s not clear…

* ...how soon *Jack believes [*the rumor that* that frog will go extinct __].

✓ ...how soon *Jack believes [*the rumor that* that frog will go extinct __].

- **FULL-SOURCE + REPAIR BY PF-DELETION** (e.g., Ross 1969, Kim 1997, Merchant 2001)

✓ *how soon* *Jack believes [*the rumor that* that frog will go extinct __].

- **SHORT-SOURCE** (Merchant 2001, Barros et al. 2014)

✓ *how soon* *that frog will go extinct__.*

- **LF-COPY + MERGER** (Chung et al. 1995)

✓ *how soon* *Jack believes [*the rumor that* that frog will go extinct *very soon*]*

“**Merger**: BINDING-like dependency”
That frog will go extinct very soon, though it’s not clear

[how soon that frog will go extinct]

? Wh-Movement

(e.g., AnderBois 2014)

Question under Discussion (QuD)

Why will it go extinct?

How soon will it go extinct?

YES, Full but invisible syntax

FULL-SOURCE + REPAIR BY PF-DELETION
SHORT-SOURCE  cf. LF-COPY + MERGER

NO, No syntax

Nothing  (e.g., Culicover & Jackendoff 2005)
or Referential element (proTP)
(e.g., Jäger 2005, Barker 2013, Poppels 2020)

Referential inference
(Anaphora)

Sprouting & Wh-Movement

NELS 51, 6-8 November 2020, UQAM
**Sprouting & Wh-Movement**

- **In sprouting**, the purported wh-movement *preserves its properties*.  
  
  
  Jack believes [*the rumor that* that frog will go extinct]  
  
  *...how soon* Jack believes [*the rumor that* that frog will go extinct __].

- **Full-source ± repair by PF-deletion** (e.g., Kim 1997, Merchant 2001)
  
  *how soon* Jack believes [*the rumor that* that frog will go extinct __].

- **Short-source** (Merchant 2001, Barros et al. 2014)
  
  \(\sqrt{\text{how soon}}\) that frog will go extinct __.  

- **LF-Copy + Sprout + Form-Chain** (Chung et al. 1995)
  
  *how soon* Jack believes [*the rumor that* that frog will go extinct __].

  “Form-Chain”: movement-like dependency
Sprouting & Wh-Movement

That frog will go extinct ________, though it’s not clear how soon ________?

[how soon that frog will go extinct ________]

Why will it go extinct? How soon will it go extinct?

QuDs

Referential inference (Anaphora)

YES, Full but invisible syntax

(e.g., Chung et al. 1995, Kim 1997, Merchant 2001)
(cf. Barros et al. 2014: fn. 7)

NO, No syntax

Nothing (e.g., Culicover & Jackendoff 2005)
or Referential element (proTP)
(e.g., Jäger 2005, Barker 2013, Poppels 2020)
## Sprouting & Wh-Movement

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<th>Predictions</th>
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**Assumptions**

- `<E>`
- `Wh-Movement`

**Predictions**

- Island-sensitivity?

- According to **Classic Observations**
Sprouting & Wh-Movement

• **Classic observations:** Sprouting is *island-sensitive*

  (e.g., Chung et al. 1995, Merchant 2001; Yoshida et al. 2013)

  (1) * Tony sent Mo *a picture that he painted __*, but it’s not clear *with what*.  
    cf. (Tony believes that) Mo painted a picture __*, but it’s not clear *with what*.

• **Data dispute:** Sprouting is *island-immune*

  **Counter-examples** (Culicover & Jackendoff 2005: 258; Kim & Kuno 2012: 317)

  (2) Bob found *a plumber who fixed the sink __*, but I’m not sure *with what*.

  (3) Mary met *a man who claimed he could turn copper into gold __*, but she couldn’t find out from him *with what kind of technique*. 
## Sprouting & Wh-Movement

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According to counter-examples.
Sprouting & Wh-Movement

• **Another major property of wh-movement:** **Distance-sensitivity**

  **Distance-related degradation** (e.g., Phillips et al. 2005, Sprouse et al. 2012)

  (1) It’s not clear *to what extent* Jack believes [that Jill bought a Ferrari].

  (2) ? It’s not clear *with what money* Jack believes [that Jill bought a Ferrari __ ].

• **FULL-SOURCE:** **Sprouting** will also exhibit distance-sensitivity

  (3) Jack believes [that Jill bought a Ferrari],
  though it’s not clear *to what extent* Jack believes [that Jill bought a Ferrari].

  (4) ? Jack believes [that Jill bought a Ferrari __ ],
  though it’s not clear *with what money* Jack believes [that Jill bought a Ferrari __ ].

  (5) Though it’s not clear *to what extent* Jack believes [that Jill bought a Ferrari],
  Jack believes __ [that Jill bought a Ferrari].

  (6) ? Though it’s not clear *with what money* Jack believes [that Jill bought a Ferrari __ ],
  Jack believes [that Jill bought a Ferrari __ ].
Sprouting & Wh-Movement

- **ANAPHORA** (No-Source): Only *backward sprouting* will be sensitive to distance

  - Where did he hear that?  
    With what money did she buy it?

  - (7) Jack believes ___ [that Jill bought a Ferrari], though it’s not clear \( \text{to what extent } O_{\text{proTP}} \).
  - (8) Jack believes [that Jill bought a Ferrari ___ ], though it’s not clear \( \text{with what money } O_{\text{proTP}} \).

  - (9) Though it’s not clear \( \text{to what extent } O_{\text{proTP}} \), Jack believes ___ [that Jill bought a Ferrari].
  - (10) Though it’s not clear \( \text{with what money } O_{\text{proTP}} \), Jack believes [that Jill bought a Ferrari __ ].

Unlike anaphora, CATAPHORA shows **SIMILARITIES** with wh-movement

- **ACTIVE SEARCH** for catacedent  
  (Kazanina et al. 2007)

- **parallel BRAIN RESPONSE**  
  (Matchin et al. 2014)

- **ACTIVE SEARCH in BACKWARD SLUICING**  
# Sprouting & Wh-Movement

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<td>✗ (only bwd.)</td>
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Experiments

- Comparison: **Wh-Movement** vs. **Backward Sprouting** vs. **Forward Sprouting**

**Wh-Movement**
It’s not clear *with what money* Jack believes *[the rumor that* Jill bought a Ferrari __ ].

**Backward Sprouting**
Though it’s not clear *with what money*, Jack believes *[the rumor that* Jill bought a Ferrari __ ].

**Forward Sprouting**
Jack believes *[the rumor that* Jill bought a Ferrari __ ], though it’s not clear *with what money*.

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Design of Experiments

**Island-sensitivity** in *wh*-movement = **Super-additive Degradation** (e.g., Sprouse et al. 2012)

Higher processing costs = lower acceptability

- complex structure (*islands*)
- longer-*distance* dependency

**Super-additive interaction** Distance \( \times \) Structure = greater degradation than the sum of the two individual effects (*island effect*)
Method

**EXPERIMENT [ I ]**

*Wh-movement vs. Backward Sprouting*

<table>
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<th>Gap.Position</th>
<th>Example</th>
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<tr>
<td>Non-Island</td>
<td>matrix</td>
<td>It’s not clear <em>to what extent</em> Jack believes __ [that Jill bought a Ferrari].</td>
</tr>
<tr>
<td>Non-Island</td>
<td>embedded</td>
<td>It’s not clear <em>with what money</em> Jack believes [that Jill bought a Ferrari __ ]</td>
</tr>
<tr>
<td>Island</td>
<td>matrix</td>
<td>It’s not clear <em>to what extent</em> Jack believes __ [the rumor that Jill bought a Ferrari].</td>
</tr>
<tr>
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<td>embedded</td>
<td>It’s not clear <em>with what money</em> Jack believes [the rumor that Jill bought a Ferrari __ ]</td>
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<td>embedded</td>
<td>Though it’s not clear <em>with what money</em>, Jack believes [the rumor that Jill bought a Ferrari __ ]</td>
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- 2 × 2 × 2 design
  - Structure × Gap.Position/DISTANCE
  - × Construction (*wh-movement* vs. *backward sprouting*)

- 4 tokens per condition (32 lexical sets)
- 2:1 filler:target ratio (64 fillers + 32 targets)
- 8 counterbalanced (Latin square) lists
- Pseudo-randomization for each participant
- 80 native speakers
- 7-point Likert scale (‘very bad’ 1—7 ‘very good’)

**Method**

**SPROUTING & WH-MOVEMENT**

**EXPERIMENTS**

**DISCUSSIONS**

NELS 51, 6-8 November 2020, UQAM
Method

**EXPERIMENT [ II ]**  
*Backward Sprouting vs. Forward Sprouting*

<table>
<thead>
<tr>
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<th>Gap.Position</th>
<th>Example</th>
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<tbody>
<tr>
<td>Backward Sprouting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Non-Island</td>
<td>Though it’s not clear to what extent, Jack believes [that Jill bought a Ferrari __].</td>
</tr>
<tr>
<td>6</td>
<td>Non-Island</td>
<td>Though it’s not clear with what money, Jack believes [that Jill bought a Ferrari __].</td>
</tr>
<tr>
<td>7</td>
<td>Island</td>
<td>Though it’s not clear to what extent, Jack believes [the rumor that Jill bought a Ferrari __].</td>
</tr>
<tr>
<td>8</td>
<td>Island</td>
<td>Though it’s not clear with what money, Jack believes [the rumor that Jill bought a Ferrari __].</td>
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| Forward Sprouting |             |                                                                                             |
| 9          | Non-Island   | Jack believes [that Jill bought a Ferrari __], though it’s not clear to what extent.         |
| 10         | Non-Island   | Jack believes [that Jill bought a Ferrari __], though it’s not clear with what money.        |
| 11         | Island       | Jack believes [the rumor that Jill bought a Ferrari __], though it’s not clear to what extent.|
| 12         | Island       | Jack believes [the rumor that Jill bought a Ferrari __], though it’s not clear with what money.|

- **2 x 2 x 2 design**  
Structure x Gap.Position/DISTANCE x Construction (backward vs. forward sprouting)  
- Same lexical sets from Experiment [ I ]  
- Same task & procedure with Experiment [ I ]  
- 80 native speakers
Predictions

- **A**: It’s not clear *to what extent* Jack believes ___ [that Jill bought a Ferrari].
- **B**: It’s not clear *with what money* Jack believes [that Jill bought a Ferrari ___].
- **C**: It’s not clear *to what extent* Jack believes ___ [the rumor that Jill bought a Ferrari].
- **D**: It’s not clear *with what money* Jack believes [the rumor that Jill bought a Ferrari ___].
Predictions

- **wh-movement**
  - Full Source
  - backward sprouting
  - forward sprouting

- **Acceptability Matrix**
  - Distance-sensitive
  - Island-sensitive
  - Island-immune

- **Sprouting & Wh-Movement Experiments**
  - NELS 51, 6-8 November 2020, UQAM

- **Backward Sprouting**
  - Island-sensitive
- **Forward Sprouting**
  - Island-immune
Results: ISLAND

- **Wh-movement** showed island-sensitivity, as expected
- **Neither backward nor forward sprouting** showed island-sensitivity

**Both forward and backward sprouting were not sensitive to islands.**
Results: DISTANCE

EXPERIMENT [I]

- Wh-movement
- Backward sprouting

Mean acceptability

Distance-sensitive

EXPERIMENT [II]

- Backward sprouting
- Forward sprouting
Results: DISTANCE
Results: DISTANCE

EXPERIMENT [I]

EXPERIMENT [II]

Mean acceptability (z-scores)

wh-question
backward sprouting
matrix  embedded

forward sprouting
backward sprouting
matrix  embedded
Results: DISTANCE

- Wh-movement showed DISTANCE-related degradation, as expected
- Backward sprouting showed DISTANCE-related degradation, although it was milder than wh-movement \((p = 0.009)\)
- Forward sprouting showed no such degradation

Unlike forward sprouting, backward sprouting was sensitive to distance
Discussion: ISLAND

Both forward and backward sprouting are not sensitive to islands.

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Wh-Movement
Unlike *forward* sprouting, *backward* sprouting is sensitive to distance.

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ANAPHORA ACCOUNT TO SPROUTING

- Why is sprouting **not sensitive to islands?**
  - because **there is no syntactic wh-movement**

**Anaphora**

Jack believes [the rumor that Jill bought a Ferrari __ ] while it’s not clear **with what money Ø**.

- QuDs
- With what money did she buy it?
- Anaphora

**Cataphora**

While it’s not clear **with what money Ø**, Jack believes [the rumor that Jill bought a Ferrari __ ].

- QuDs
- With what money did she buy it?
- Cataphora
A Sketch

**ANAPHORA ACCOUNT TO SPROUTING**

- Why does only backward sprouting show *sensitivity to DISTANCE*? because it forms **CATAPHORA** with the upcoming **QuD**
A Sketch

**ANAPHORA ACCOUNT TO SPRouting**

- Why does only backward sprouting show sensitivity to DISTANCE?
  
  because it forms **CATAPHORA** with the upcoming **QuD**

(FORWARD) SPRouting
A Sketch

**Anaphora account to Sprouting**

- Why does only backward sprouting show **sensitivity to distance**?

  because it forms **cataphora** with the upcoming QuD

Jack believes [*the rumor* that Jill bought a Ferrari __],
A Sketch

**ANAPHORA ACCOUNT TO SPROUTING**

- Why does only backward sprouting show *sensitivity to DISTANCE*?
  
  because it forms **CATAPHORA** with the upcoming QuD

**FORWARD SPROUTING**

Jack believes *[the rumor that Jill bought a Ferrari __]*
A Sketch

**Anaphora account to Sprouting**

- Why does only backward sprouting show sensitivity to Distance?
  
  because it forms *Cataphora* with the upcoming *QuD*

**(Forward) Sprouting**

Jack believes [*the rumor* that Jill bought a Ferrari __]

**QuDs [matrix] + [embedded]**

- Why does he believe that?
- How much does he believe that?

  With what money did she buy it?
A Sketch

**Anaphora Account to Sprouting**

- Why does only backward sprouting show sensitivity to Distance?

  because it forms **Cataphora** with the upcoming QuD

Jack believes *[the rumor that Jill bought a Ferrari __]* while it’s not clear *[with what money Ø]*.

**Sprouting**

**QuDs [matrix] + [embedded]**

Why does he believe that?  
How much does he believe that?  
With what money did she buy it?
A Sketch

**ANAPHORA ACCOUNT TO SPROUTING**

- Why does only backward sprouting show sensitivity to DISTANCE?
  
  because it forms **CATAPHORA** with the **upcoming QuD**

Jack believes [the rumor that Jill bought a Ferrari __] while it’s not clear [with what money ØTP].

QuDs [matrix] + [embedded]

Why does he believe that?  
How much does he believe that?  
With what money did she buy it?

= EQUALLY ACCESSIBLE  
= NO DISTANCE-SENSITIVITY
A Sketch

**ANAPHORA ACCOUNT TO SPROUTING**

- Why does only backward sprouting show sensitivity to DISTANCE?

  because it forms **CATAPHORA** with the **upcoming QuD**

Jack believes [the rumor that Jill bought a Ferrari __] while it’s not clear [with what money Ø].

**QuDs [matrix] + [embedded]**

- Why does he believe that?
- How much does he believe that?
- : 
- : With what money did she buy it?

**EQUALLY ACCESSIBLE**

**NO DISTANCE-SENSITIVITY**

Anaphora
A Sketch

**ANAPHORA ACCOUNT TO SPROUTING**

- Why does only backward sprouting show sensitivity to DISTANCE?

  because it forms **CATAPHORA** with the upcoming QuD

Jack believes [the rumor that Jill bought a Ferrari ___] while it’s not clear [with what money Θ̈TF].

QuDs [matrix] + [embedded]

Why does he believe that?
How much does he believe that?
:
:
With what money did she buy it?

Anaphora

= EQUALLY ACCESSIBLE
= NO DISTANCE-SENSITIVITY

While it’s not clear [with what money Θ̈TF],
A Sketch

**Anaphora account to Sprouting**

- Why does only backward sprouting show sensitivity to Distance?
  - because it forms **Cataphora** with the upcoming QuD

(FORWARD) SPROUTING

Jack believes [*the rumor* that Jill bought a Ferrari __] while it’s not clear [*with what money Ø*].

QuDs [matrix] + [embedded]

Why does he believe that? \[\] ... With what money did she buy it?

How much does he believe that? \[\] ...

(BACKWARD) SPROUTING

While it’s not clear [*with what money Ø*],

Cataphora

= EQUALLY ACCESSIBLE = NO DISTANCE-SENSITIVITY

Anaphora
A Sketch

**ANAPHORA ACCOUNT TO SPROUTING**

- Why does only backward sprouting show sensitivity to DISTANCE? because it forms CATAPHORA with the upcoming QuD

Jack believes [*the rumor* that Jill bought a Ferrari __] while it’s not clear [with what money Θ_{TP}].

QuDs [matrix] + [embedded]

Why does he believe that? How much does he believe that? With what money did she buy it?

Anaphora

While it’s not clear [with what money Θ_{TH}], Jack believes [*the rumor*]

Cataphora
A Sketch

**Anaphora Account to Sprouting**

- Why does only backward sprouting show sensitivity to Distance?
  
  because it forms **Cataphora** with the upcoming QuD

Jack believes *[the rumor that Jill bought a Ferrari __ ]* while it’s not clear *[with what money Ø]*.

while it’s not clear *[with what money Ø]*.  

For (forward) sprouting:

- Why does he believe that?
- How much does he believe that?
- ...

With what money did she buy it?

anaphora

QuDs [matrix] + [embedded]

= Equally accessible
= No distance-sensitivity

While it’s not clear *[with what money Ø]*, Jack believes *[the rumor]*.

Cataphora

FORWARD SPROUTING

BACKWARD SPROUTING
A Sketch

**ANAPHORA ACCOUNT TO SPROUTING**

- Why does only backward sprouting show sensitivity to DISTANCE?
  because it forms **CATAPHORA** with the upcoming QuD

(FORWARD) SPROUTING

Jack believes [the rumor that Jill bought a Ferrari ___] while it’s not clear [with what money \( \Theta_{TP} \)].

QuDs [matrix] + [embedded]

Why does he believe that?
How much does he believe that?

With what money did she buy it?

= EQUALLY ACCESSIBLE
= NO DISTANCE-SENSITIVITY

BACKWARD SPROUTING

While it’s not clear [with what money \( \Theta_{TH} \)], Jack believes [the rumor]

QuDs [matrix]

Why does he believe that?
How much does he believe that?
A Sketch

**ANAPHORA ACCOUNT TO SPROUTING**

- Why does only backward sprouting show sensitivity to DISTANCE?
  
  because it forms **CATAPHORA** with the upcoming **QuD**

(FORWARD) SPROUTING

Jack believes [the rumor that Jill bought a Ferrari ___] while it’s not clear [with what money ΘTP].

QuDs [matrix] + [embedded]

Why does he believe that?  
How much does he believe that?  
...  
With what money did she buy it?

= EQUALLY ACCESSIBLE  
= NO DISTANCE-SENSITIVITY

BACKWARD SPROUTING

While it’s not clear [with what money ΘTH], Jack believes [the rumor]

QuDs [matrix]

Why does he believe that?  
How much does he believe that?

Cataphora

...
A Sketch

**ANAPHORA ACCOUNT TO SPROUTING**

- Why does only backward sprouting show **sensitivity to DISTANCE**?
  - because it forms **CATAPHORA** with the upcoming QuD

(FORWARD) SPROUTING

Jack believes [*the rumor* that Jill bought a Ferrari ___] while it’s not clear [*with what money Ø*].

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(BACKWARD) SPROUTING

While it’s not clear [*with what money Ø*], Jack believes [*the rumor* that Jill bought a Ferrari ___].

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**EQUALLY ACCESSIBLE**

**NO DISTANCE-SENSITIVITY**

**X**
A Sketch

**Anaphora Account to Sprouting**

- Why does only backward sprouting show **sensitivity to Distance**?

  Because it forms **Cataphora** with the upcoming QuD

(Forward) Sprouting

Jack believes [the rumor that Jill bought a Ferrari ___] while it’s not clear [with what money $\Theta_{TP}$].

QuDs [matrix] + [embedded]

Why does he believe that?
How much does he believe that?
With what money did she buy it?

= Equally Accessible
= No Distance-Sensitivity

Anaphora

Backward Sprouting

While it’s not clear [with what money $\Theta_{TH}$], Jack believes [the rumor] that Jill bought a Ferrari ___.

QuDs [matrix]

Why does he believe that?
How much does he believe that?

Cataphora

$X$
A Sketch

**Anaphora Account to Sprouting**

- Why does only backward sprouting show sensitivity to Distance?
  - because it forms **cataphora** with the upcoming QuD

**Sprouting & Wh-Movement**

(Forward) Sprouting

Jack believes [the rumor that Jill bought a Ferrari __] while it’s not clear [with what money $\Theta_{TP}$].

While it’s not clear [with what money $\Theta_{TH}$], Jack believes [the rumor] that Jill bought a Ferrari __.

**Backward Sprouting**

QuDs [matrix] + [embedded]

Why does he believe that?  How much does he believe that?  With what money did she buy it?

= Equally Accessible  
= No Distance-Sensitivity

Anaphora

QuDs [matrix]

Why does he believe that?  How much does he believe that?

Cataphora

With what money did she buy it?

QuDs [embedded]

...
A Sketch

**Anaphora Account to Sprouting**

- Why does only backward sprouting show sensitivity to distance?
  
  because it forms **Cataphora** with the upcoming QuD

  
  Jack believes *the rumor that Jill bought a Ferrari* while it’s not clear *with what money*.

  
  While it’s not clear *with what money*, Jack believes *the rumor that Jill bought a Ferrari*.

  
  *QuDs [matrix] + [embedded]*

  
  Why does he believe that?  
  How much does he believe that?  
  With what money did she buy it?

  
  = Equally accessible  
  = No distance-sensitivity

  
  Anaphora

  
  Cataphora

  
  *QuDs [matrix]*

  
  Why does he believe that?  
  How much does he believe that?  

  
  With what money did she buy it?

  
  *QuDs [embedded]*

  
  = Distance-sensitive

  
  Stepwise, Active Search
Summary

I. Sprouting is not island-sensitive.
   - Naturally follows Anaphora (no-source) account — there is no wh-movement or islands in E-site
   - Also accountable by **FULL-SOURCE + REPAIR BY PF-DELETION** — island-repair occurs in sprouting, too
     **SHORT-SOURCE** — short-source is available for sprouting, too

II. Only **backward sprouting** is Distance-sensitive.
   - Naturally follows Anaphora (no-source) account — unlike anaphora, Cataphora is distance-sensitive
   - Challenging to **FULL-SOURCE + REPAIR BY PF-DELETION** — PF-deleted wh-movement loses distance-sensitivity.
     The distance-sensitivity in backward sprouting is due to extra factors.
     **SHORT-SOURCE** — short source is available for forward sprouting, but not for backward sprouting
     **what factors & why?** | **why?**

III. At this moment, Anaphora account may best capture the experimental findings.
     i.e., there is no wh-movement in sprouting
Thank you!
References

Barros, Matthew, Patrick Elliott & Gary Thoms. 2014. There is no island repair. Ms., Rutgers University, University College London, and University of Edinburgh.
References


