Sluicing as anaphora to a scope remnant

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Synopsis: I argue that sluicing is anaphora to a continuation, that is, to a constituent missing a piece. When a DP takes scope over a clause, it creates the right kind of antecedent. The prediction is that sluicing is sensitive to scope islands, but not to overt-movement islands.

Quantifier Raising: a logical inference?

• Montague 1973: Quantifying In: (2661 citations)

• May 1978, 1985: Quantifier Raising (QR): (2866 citations)

Montague ↓ everyone(\(\lambda x.\text{Ann saw } x\)) \(\vdash\) \(S\) Ann saw everyone \(\vdash\) \(S\) ↑ May

Today’s question: How to incorporate QR into a genuine logic?

Lambek’s substructural logic NL for natural language

Without Exchange, ‘→’ splits into ‘\(\setminus\)’ and ‘\(/\)’

• Formulas: \(\mathcal{F} = \text{DP} \mid S \mid \mathcal{F}\setminus\mathcal{F} \mid \mathcal{F}\slash\mathcal{F}\)

• Structures: \(\mathcal{I} = \mathcal{F} \mid \mathcal{I}\cdot\mathcal{I}\)

• Sequents: \(\mathcal{I} \vdash \mathcal{I}\)

• Logical rules:

\[
\begin{align*}
\Gamma \vdash A & \quad \Sigma[B] \vdash C \\
\Sigma[\Gamma \cdot A \setminus B] \vdash C & \quad A \cdot \Gamma \vdash B \\
\Gamma \vdash A \setminus B \quad B \setminus A & \quad \Gamma \vdash B / A
\end{align*}
\]

Structural rules: none! (Cut baked in)
How context notation works in inference rules

- Capital Greek letters (Δ, Γ, Σ) stand for complete structures
- 'Σ[Δ]' ≡ Σ containing a distinguished instance of Δ
- 'Σ[Γ·A\B]' matches the structure below in two ways:
  - [Ann · DP\S] · (and ((the · man) · cried))
  - (Ann · left) · (and · [(the · man) · DP\S])

An example derivation of Ann saw Bill

1. \[
\begin{align*}
\text{DP} & \rightarrow \text{DP} \\
\text{S} & \rightarrow \text{S} \\
\text{Ann} & \rightarrow \text{Ann}
\end{align*}
\]

2. \[
\begin{align*}
\text{DP} & \rightarrow \text{DP} \\
\text{S} & \rightarrow \text{S} \\
\text{Ann} & \rightarrow \text{Ann}
\end{align*}
\]

3. a. Curry-Howard: L rules correspond to function application
   b. saw(bill)(ann)

Adding a structural rule for QR

- Associativity: \[ p \cdot (q \cdot r) \equiv (p \cdot q) \cdot r \]

- Quantifier Raising: \[ Σ[Δ] ≡ Δ \cdot λx Σ[x] \]
**NLQR: NL with Quantifier Raising**

- **Variables:** \( \mathcal{V} = x \mid y \mid z \mid \ldots \)
- **Formulas:** \( \mathcal{F} = DP \mid S \mid \mathcal{F} \backslash \mathcal{F} \mid \mathcal{F} / \mathcal{F} \)
- **Structures:** \( \mathcal{S} = \mathcal{F} \mid \mathcal{F} \cdot \mathcal{F} \mid \mathcal{V} \mid \lambda \mathcal{V} \mathcal{S} \)
- **Sequents:** \( \mathcal{S} \vdash \mathcal{F} \)
- **Logical rules:**
  \[
  \begin{align*}
  & \frac{\Gamma \vdash A \quad \Sigma[B] \vdash C}{\Sigma[\Gamma \cdot A \backslash B] \vdash C} \quad L \quad & \frac{A \cdot \Gamma \vdash B}{\Gamma \vdash A \backslash B} \quad R \\
  & \frac{\Gamma \vdash A \quad \Sigma[B] \vdash C}{\Sigma[B / \mathcal{A} / \Gamma] \vdash C} \quad L \quad & \frac{\Gamma \cdot A \vdash B}{\Gamma \vdash B / \mathcal{A}} \quad R
  \end{align*}
  \]

- **Structural rule:** \( \Sigma[\Delta] \equiv_{QR} \Delta \cdot \lambda x \Sigma[x] \)

Linear: 1 var per lambda; \( x \) chosen fresh

**Works great!**

\[
\begin{align*}
\text{Ann} \cdot (\text{saw} \cdot \text{DP}) & \vdash S \\
\text{DP} \cdot \lambda x (\text{Ann} \cdot (\text{saw} \cdot x)) & \vdash S \quad \text{QR} \\
\lambda x (\text{Ann} \cdot (\text{saw} \cdot x)) & \vdash \text{DP} \backslash S \quad \text{R} \\
S / (\text{DP} \backslash S) & \vdash \lambda x (\text{Ann} \cdot (\text{saw} \cdot x)) \quad \text{LEX} \\
\text{everyone} \cdot \lambda x (\text{Ann} \cdot (\text{saw} \cdot x)) & \vdash S \quad \text{QR} \\
\text{Ann} \cdot (\text{saw} \cdot \text{everyone}) & \vdash S
\end{align*}
\]

...including the Curry-Howard labeling for the semantics:

\[
\begin{align*}
\text{ann} \cdot (\text{saw} \cdot y) & \vdash \text{saw} \cdot \text{ann} \\
\gamma \circ \lambda x (\text{ann} \cdot (\text{saw} \cdot x)) & \vdash \text{saw} \cdot \text{ann} \quad \text{QR} \\
\lambda x (\text{ann} \cdot (\text{saw} \cdot x)) & \vdash \lambda y \cdot \text{saw} \cdot \text{ann} \quad \text{R} \\
\lambda x (\text{ann} \cdot (\text{saw} \cdot x)) & \vdash \lambda y \cdot \text{saw} \cdot \text{ann} \quad \text{LEX} \\
\text{everyone} \circ \lambda x (\text{ann} \cdot (\text{saw} \cdot x)) & \vdash \text{everyone} (\lambda y \cdot \text{saw} \cdot \text{ann}) \\
\text{ann} \cdot (\text{saw} \cdot \text{everyone}) & \vdash \text{everyone} (\lambda y \cdot \text{saw} \cdot \text{ann}) \quad \text{QR}
\end{align*}
\]

**Scope-taking as a syntactic mode of combination**

- (4) \( \rightarrow \)
  \[
  \begin{array}{ccc}
  \text{A} & \cdot & \text{A} \backslash B \\
  \text{B} \end{array}
  \]

- (5) \( \leftarrow \)
  \[
  \begin{array}{ccc}
  \text{B} / \text{A} & \cdot & \text{A} \\
  \text{B} \end{array}
  \]

- (6) \( \uparrow \)
  \[
  \begin{array}{ccc}
  \text{A} & \circ & \text{A} \backslash B \\
  \text{B} \end{array}
  \]

- (7) \( \downarrow \)
  \[
  \begin{array}{ccc}
  \text{B} / \text{A} & \circ & \text{B} \\
  \text{B} \end{array}
  \]

**Two modes of syntactic combination**

Compare with tangram diagrams in Moortgat 1996b
Parasitic scope: sentence-internal same

(8)  
\[ \begin{align*}
& \text{} \\
& \text{a. The same waiter served everyone. [Stump, Heim]} \\
& \text{b. There is a (unique) waiter } x \text{ such that } x \text{ served everyone.} \\
\end{align*} \]

\[
\frac{(\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served DP}) \vdash S}{\vdash S \lambda x((\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served } x))} \vdash S \lambda R \\
\frac{\lambda x((\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served } x)) \vdash DP \vdash S \lambda L}{\vdash DP \vdash S \lambda L} \\
\frac{(\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served DP}) \vdash S}{\vdash S \lambda x((\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served } x))} \vdash DP \vdash S \lambda L \\
\frac{\text{everyone } o (\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served } x) \vdash S}{\vdash S \lambda L} \\
\frac{(\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served DP}) \vdash S}{\vdash S \lambda x((\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served } x))} \vdash DP \vdash S \lambda L \\
\frac{\text{everyone } o (\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served } x) \vdash S}{\vdash S \lambda L} \\
\frac{(\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served DP}) \vdash S}{\vdash S \lambda x((\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served } x))} \vdash DP \vdash S \lambda L \\
\frac{\text{everyone } o (\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served } x) \vdash S}{\vdash S \lambda L} \\
\frac{(\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served DP}) \vdash S}{\vdash S \lambda x((\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served } x))} \vdash DP \vdash S \lambda L \\
\frac{\text{everyone } o (\text{the } (\lambda \cdot \text{waiter})) \cdot (\text{served } x) \vdash S}{\vdash S \lambda L} \end{align*} \]

Details in Barker 2007; not derivable in MM96.

Parasitic scope in schematic format

\[ \begin{align*}
& \text{Grey constituent } \sim \text{ string with two points of discontinuity} \\
\end{align*} \]

Other phenomena with a parasitic scope analysis

(10)  
\[ \begin{align*}
& \text{a. Anaphora: Morrill, Fadda & Valentín 2011} \\
& \text{b. he: (DP)/(DP/(DPS))} \\
& \text{c. Everyone thinks he is smart.} \\
& \text{d. everyone } o (\text{he } o (\lambda y x (y \text{ thinks } (f \text{ is } \text{smart})))) \vdash S \\
\end{align*} \]

(11)  
\[ \begin{align*}
& \text{a. Average: Kennedy and Stanley 2009} \\
& \text{b. The average American has 2.3 kids.} \\
& \text{c. 2.3 } o (\text{avg } (\lambda y (n \text{ kids}))) \\
\end{align*} \]

(12)  
\[ \begin{align*}
& \text{a. Fancy coordination: Kubota & Levine (various papers)} \\
& \text{b. I said the same thing to Terry on Mon and to Kim on Tue.} \\
& \text{c. I said the same thing to Kim on Monday and I said the same thing to Kim on Tuesday.} \\
\end{align*} \]

(13)  
\[ \begin{align*}
& \text{a. Remnant comparatives: Pollard and Smith 2013} \\
& \text{b. Ann owes Bill more than Clara.} \\
\end{align*} \]

Kubota and Levine’s workshop in week 2!
Recursive scope

(14) a. Solomon 2009
b. Ann and Bill know [some of the same people].
c. There is a set of people \(X\) such that Ann knows some of \(X\) and Bill knows some of \(X\).
d. No guarantee that Ann and Bill know anyone in common!
e. Solomon: \(\text{same} : (\text{DP} \wedge S) \vee (\text{DP} \wedge (\text{DP} \wedge S)) \vee (\lambda \wedge \text{DP})\)

\[
\begin{align*}
\text{same} : & ((\text{DP} \wedge S) \vee (\text{DP} \wedge (\text{DP} \wedge S)) \vee (\lambda \wedge \text{DP})) \\
\text{they} & \circ ((\text{same} \circ \lambda x (\text{of} \circ (\text{the} \circ (\text{x} \cdot \text{people})))) \circ \lambda y (y \cdot (\text{know} \circ z))) \vdash S \\
\text{they} & \circ \lambda y (y \cdot (\text{know} \circ (\text{same} \circ \lambda x (\text{of} \circ (\text{the} \circ (\text{x} \cdot \text{people})))))) \vdash S \\
\text{they} & \circ (\text{know} \circ (\text{same} \circ \lambda x (\text{of} \circ (\text{the} \circ (\text{x} \cdot \text{people}))))) \vdash S
\end{align*}
\]

They need to be silenced

\[
\begin{align*}
\text{same} : & (\text{DP} \wedge S) \vee (\text{DP} \wedge (\text{DP} \wedge S)) \vee (\lambda \wedge \text{DP}) \\
\text{they} & \circ ((\text{same} \circ \lambda x (\text{of} \circ (\text{the} \circ (\text{x} \cdot \text{people})))) \circ \lambda y (y \cdot (\text{know} \circ z))) \vdash S \\
\text{they} & \circ \lambda y (y \cdot (\text{know} \circ (\text{same} \circ \lambda x (\text{of} \circ (\text{the} \circ (\text{x} \cdot \text{people})))))) \vdash S \\
\text{they} & \circ (\text{know} \circ (\text{same} \circ \lambda x (\text{of} \circ (\text{the} \circ (\text{x} \cdot \text{people}))))) \vdash S
\end{align*}
\]

(15) lancet liver fluke (Dicrocoelium dendriticum)

Three comparison analyses: structured silence?

Some analyses of sluicing assume that the sluice ellipsis site contains a silent object that has internal structure:

- **LF copying**: Chung, Ladusaw and McCloskey 1995
  - Re-use (“recycle”) the Logical Form of the antecedent
  - Builds silent structure inside sluicegap

- **PF Deletion**: Merchant 2001
  - Build any IP you want to. Move the WH out; delete the remainder if there is a certain kind of semantic equivalence with the antecedent

Other analyses propose that sluicing is a kind of anaphora:

- **Anaphora**: Jäger 2005
  - Antecedent: clause containing an indefinite
  - No internal structure to silence

Three puzzles to use for comparing analyses

**Case matching**: the case of the WH element in the sluice must match the case of the inner antecedent.

(4) Er will jemandem schmeicheln, aber sie wissen nicht, \{*wen / wem\}.
  he wants someone.dat flatter but they know not \{who.acc / who.dat\}
  ‘He wants to flatter someone, but they don’t know who.’

(5) Er will jemanden loben, aber sie wissen nicht, \{wen / *wem\}.
  he wants someone.acc praise but they know not \{who.acc / who.dat\}
  ‘He wants to praise someone, but they don’t know who.’

**Island insensitivity**: the inner antecedent can be embedded within an island for WH-movement.

(6) He wants a detailed list, but I don’t know how detailed \[he wants a ___ list\] (* if pronounced)

(7) Bo talked to the people who discovered something, but we don’t know what \[Bo talked to the people who discovered ___\].

**Sprouting**: sometimes there is no overt inner antecedent

(10) John left, but I don’t know when.
Claims about silent structure: LF recycling

Chung, Ladusaw and McCloskey 1995:240–6:

IP recycling can be thought of as copying the LF of some discourse-available IP into the empty IP position. ... In some cases, the recycled IP does not come supplied with a syntactic position for the displaced [WH] constituent to bind. When such a position does not already exist, it must be created, by an additional part of the recycling process we call sprouting.

- Case matching: OK: The WH is base-generated, and must bind (be coindexed with) some DP inside the reconstructed sluice. This kind of binding must be sensitive to case.
- Island insensitivity: ✨ Being bound is not island-sensitive.
- Sprouting: Well... As long as the reconstructed LF obeys all of the selectional and other syntactic constraints of antecedent, sprouting is ok (see quotation above).

Claims about silent structure: PF Deletion

Merchant 2001 (PF Deletion): Sluicing involves movement of a wh-phrase out of a sentential [IP or FocP] constituent... followed by deletion of that node.

Mutual entailment restriction: clause can be deleted iff the antecedent and the deletion target mutually entail each other, modulo existential focus-closure.

- Case matching: ✨ Since the WH originated in-situ, then moved, it will show all of the case matching properties of ordinary wh-movement.
- Island insensitivity: Well... Must decide that remaining unpronounced rescues island violations
- Sprouting: ✨ There is no such thing as sprouting distinct from other types of sluicing. Generate any sluice you want; as long as it mutually entails the existential focus closure of the antecedent, no problem.

Voice alterations...

Jäger’s 2001, 2005 anaphoric approach

\[
\begin{align*}
X & \Rightarrow M : A \\
Y, x : A, Z, y : B, W & \Rightarrow N : C \\
Y, X, Z, w : B | A, W & \Rightarrow N[M/x][wM/y] : C \\
& \text{[[L]]}
\end{align*}
\]

\[
\begin{align*}
X, x : A, Y & \Rightarrow M : B \\
X, y : A | C, Y & \Rightarrow \lambda z. M[yz/x] : B | C \\
& \text{[[R]]}
\end{align*}
\]

\[
\begin{align*}
X, x : A, Y & \Rightarrow M : B \\
X, y : C \rhd A, Y & \Rightarrow \lambda z. M[yz/x] : C \rhd B \\
& \text{[~]}
\end{align*}
\]

\[
\begin{align*}
\text{a. } & \text{A cup moved} \\
\text{b. } & \text{a} - \lambda P x p_x x : (np \rhd np)/n \\
\text{c. } & \text{y} : (np \rhd np)/n, z : n, w : np \backslash s \Rightarrow \lambda u.w(yzu) : np \rhd s
\end{align*}
\]

- a. which cup moved
- b. which - q/(s \rhd np)/n
- which - q|(np \rhd s)/n : \lambda P Q ? x.P x \land Q^+ x

Jäger’s 2001, 2005 anaphoric approach, cont’d

- Indefinites contribute an unbound variable.
- Presence of unbound variables must be registered on category of containing clause (e.g., ‘SDP’).
- WH words (e.g., who) ambiguous between normal version and a sluice version anaphoric to SDP.

Status with respect to the three puzzles:

- Case matching: OK: Some anaphora must be sensitive to case (SDP$_{acc}$).
- Island insensitivity: ✨ unbound variables insensitive to islands.
- Sprouting: Oops! Analysis requires overt indefinite inner antecedent.

(8) Even overt inner antecedents need not be indefinite: [John or Mary] left, but I don’t know which one. (AnderBois)
Preview of the account here

- Inner antecedent must take scope over the antecedent clause.
- Sluicegap silent proform anaphoric to scope remnant
- Case matching: OK: Some anaphora must be sensitive to case.
- Island insensitivity: $\circ$ scopability independent of syntactic islands
- Sprouting: $\circ$ Reasonable assumptions explain sprouting

Summary of theoretical landscape:

<table>
<thead>
<tr>
<th>Case matching sensitivity</th>
<th>Island insensitivity</th>
<th>Sprouting</th>
</tr>
</thead>
<tbody>
<tr>
<td>LF Copying</td>
<td>OK</td>
<td>$\circ$</td>
</tr>
<tr>
<td>PF Deletion</td>
<td>$\circ$</td>
<td>$\circ$</td>
</tr>
<tr>
<td>Indef. Anaphora</td>
<td>OK</td>
<td>$\circ$</td>
</tr>
<tr>
<td>Anaphora to continuation</td>
<td>OK</td>
<td>$\circ$</td>
</tr>
</tbody>
</table>

Quantificational binding as parasitic scope

An analysis inspired by a parallel proposal in Morrill, Fadda & Valentí 2007:52: he $= \lambda x.\lambda y.\lambda z.(DP\backslash S)/(DP\backslash (DP\backslash S)).$

Verb phrase ellipsis (VPE) as parasitic scope

DPhe: $\lambda x.\lambda y.\lambda z.(DP\backslash S)/(DP\backslash ((DP\backslash S)\backslash ((DP\backslash S)\backslash S)))$

VPE: $\lambda x.\lambda y.\lambda z.(DP\backslash S)/(DP\backslash S)/(DP\backslash S)$

(13) a. John left or Bill did. **Basic VPE**

$$\lambda \text{left} \circ \text{VPE} \circ \lambda (\text{John} \cdot x) \cdot (\text{or} \cdot (\text{Bill} \cdot y))) \vdash S$$

b. $\lambda \text{left} \circ \lambda (\text{John} \cdot x) \cdot (\text{or} \cdot (\text{Bill} \cdot y))) \vdash S$

(14) a. John said he left or Bill did. **Sloppy coreference**

$$\lambda \text{said} \circ \lambda (\text{he} \cdot (\text{said} \cdot (\text{he} \cdot (\text{left} \cdot y)))) \vdash S$$

b. $\lambda \text{said} \circ \lambda (\text{he} \cdot (\text{said} \cdot (\text{he} \cdot (\text{left} \cdot y)))) \vdash S$

c. Use this VP in place of left in (13); semantic value $\lambda x.\text{said}(\text{left} \cdot x)$

(15) a. John said he left or Bill did. **Strict coreference**

$$\lambda \text{said} \circ \lambda (\text{he} \cdot (\text{said} \cdot (\text{he} \cdot (\text{left} \cdot y)))) \vdash S$$

b. $\lambda \text{said} \circ \lambda (\text{he} \cdot (\text{said} \cdot (\text{he} \cdot (\text{left} \cdot y)))) \vdash S$

c. Continue the proof by using the VP $\text{said y left}$ to bind VPE.

Basic sludging

SLUICEGAP: $\lambda P.\lambda x.\lambda y.\lambda z.(DP\backslash S)/(DP\backslash (DP\backslash S)/(DP\backslash S)/(DP\backslash S))$

(16) Someone left, but I don’t know who SLUICEGAP.

The continuation of someone relative to the clause someone left (i.e., $\lambda x(\cdot \text{left})$) provides the semantic value for the sluice gap:

\[
\begin{align*}
\lambda x(\text{left}) \circ \lambda (\text{said} \cdot (\text{left} \cdot y)) & \vdash S \\
\lambda x(\text{left}) \circ \lambda (\text{left} \cdot y) & \vdash S \\
\lambda x(\text{left}) & \vdash S \\
\lambda x(\text{left}) & \vdash S \\
\lambda x(\text{left}) & \vdash S \\
\lambda x(\text{left}) & \vdash S \\
\end{align*}
\]

$bidx = \text{but-I-don’t-know}$
Good prediction: scope of inner antecedent

CLM p. 255 [my paraphrase]: Inner antecedents must take scope over the rest of the antecedent.

(17) Each student wrote a paper on a Mayan language, but I don’t remember which one. [CLM]
(18) Someone saw everyone, but I don’t know who.

(16) Ann photographed a woman and/*or a building yesterday, but I don’t know who.
(17) *No one spoke to a neighbor of his, but I don’t know who.
(18) Every teacher called more than two students. [*more-than-two > every]

Good prediction: no syntactic island sensitivity

• The relationship between the inner antecedent and the antecedent clause is scopability, not wh-extractability.
• Indefinites in particular can scope out of syntactic islands.

Case matching

(19) who: Q/(DP_{ACC} \S)
Q/(DP_{DAT} \S)

(20) a. SLUICEGAP: ((DP_{ACC} \S) \S)/(\S\S)
((DP_{ACC} \S) \S)/(\S\S)
((DP_{ACC} \S) \S)/(\S\S)

As in Jäger 2001, given an anaphoric type-logical treatment, “Sluicing is correctly predicted to be insensitive to syntactic islands, but sensitive to morphological features of the antecedent.”

Full accounting principle of category formation: As in Jacobson (e.g., 1999), the category of a larger expression registers information about its missing pieces: there is no hiding of information in the derivational history.

Sprouting: a simple case

Suggested independently to me by Lucas Champollion and Dylan Bumford: If (some) WH phrases were S modifiers (rather than VP modifiers), the analysis would extend to sprouting immediately.

(21) a. I want to know why John left.
   b. I want to know why Mary said John left. (unambiguous)
   c. why: S/\S; WHYSLUICEGAP: (S\S)/(S\S)
   d. Target: Mary said John left, but I don’t know why.

\[ \begin{align*}
   (\text{John} \cdot \text{left}) \circ (\text{WHYSLUICEGAP} \circ \lambda y \lambda x (\text{Mary} \cdot (\text{said} \cdot x)) \cdot (\text{bidk} \cdot (\text{why} \cdot y))) & \vdash S \\
   (\text{John} \cdot \text{left}) \circ \lambda x (\text{Mary} \cdot (\text{said} \cdot x)) \circ (\text{bidk} \cdot (\text{why} \cdot \text{WHYSLUICEGAP}))) & \vdash S \\
   (\text{Mary} \cdot (\text{said} \cdot (\text{John} \cdot \text{left}))) \circ (\text{bidk} \cdot (\text{why} \cdot \text{WHYSLUICEGAP})))) & \vdash S \\
\end{align*} \]

For the other reading, take Mary said John left as the antecedent.

Perfectly straightforward anaphora to a clause.
Sprouting: less simple

(22) a. I want to know when Mary said John left. (ambiguous!)
b. when: \( S \upharpoonright (\text{ADV} \upharpoonright S) \), where \( \text{ADV} = (\text{DP} \upharpoonright S) \upharpoonright (\text{DP} \upharpoonright S) \)
c. WHENSLGAP: \( (\text{ADV} \upharpoonright S) \upharpoonright S \upharpoonright ((\text{ADV} \upharpoonright S) \upharpoonright (\text{ADV} \upharpoonright S) \upharpoonright S) \)
d. Target: Mary said John left, but I don’t know when [she said he (left-)].
e. Need to find an ADV position inside of John left.

• Strategy: allow empty antecedents
• Empty antecedents usually avoided in TLG (*very man)
• Silent lexical entries avoided in general
• Strategies for eliminating silence, as in Jäger, could be tried;
  ...if so, however, unsure about interaction with swiping.
• In any case, already using silent lexical entry for SLUICEGAP.

Sprouting with silence

when: \( Q/(\text{ADV} \upharpoonright S) \), WHENSLGAP = \( ((\text{ADV} \upharpoonright S) \upharpoonright S) \upharpoonright ((\text{ADV} \upharpoonright S) \upharpoonright (\text{ADV} \upharpoonright S) \upharpoonright S) \)
\( \text{ADV} = (\text{DP} \upharpoonright S) \upharpoonright (\text{DP} \upharpoonright S) \)

(24) a. Everyone ate, but I don’t know what. b. ?No one ate, but I don’t know what.

Implicit arguments

(23) a. John ate, but I don’t know what.

b. New category: given A, B formulas, \( A \otimes B \)
c. Residuation laws: \( A \vdash C/B \) iff \( A \otimes B \vdash C \) iff \( B \vdash A \setminus C \)
d. \( \text{ate}_{\text{INSTR}} : \langle \text{eat}_i, \lambda \exists x \cdot \text{Px} \rangle : ((\text{DP} \upharpoonright S) \vdash (\text{DP} \upharpoonright S) \upharpoonright S) \\
\sum A \cdot B \vdash C \\
\sum A \otimes B \vdash C \\
\Gamma \vdash A \\
\Delta \vdash B \\
\Gamma \cdot \Delta \vdash A \otimes B \\
(\text{John} \cdot ((\text{DP} \upharpoonright S) \upharpoonright S) \vdash (\text{DP} \upharpoonright S)) \cdot (\text{bidk} \cdot (\text{what} \cdot \text{SLUICEGAP})) \vdash S \)

Available to Jäger; how to guarantee narrowest scope of IA?
Problems for mutual entailment

Romero, Merchant: the focus closure of the antecedent clause and the sluice must entail each other.

Counterexamples:

(20) *Kelly was murdered, but we don’t know who.
(21) *Someone paid Mary, but we don’t know by whom.
(22) Some numbers between 2 and 20 are even or odd, but I’m not going to tell you which numbers are prime or not prime.

The wh-correlate does NOT need to be indefinite

(23) I know that John left, but I don’t know who else.
(24) Mary has dined at Masa, and I don’t know where else.
(25) John liked the collards, but I don’t know which other dishes.
(26) Mary tasted each hot dish, and I don’t know what else.

The answer ban

- The antecedent clause must not resolve (or partly resolve) the issue raised by the sluiced interrogative.

(27) *John left, but I don’t know who.
(28) John left, but I don’t know who else.
(29) *John or Mary left, but I don’t know who.
(30) John met a woman, but I don’t know who.
(31) Mary knows that John left, but Bill doesn’t know who.

Andrews Amalgams: ellipsis to a containing continuation

(33) Johnson 2013:
   a. Sally will eat something today, but I don’t know what ...
   b. Sally will eat [I don’t know what ...] today.

\[
\begin{align*}
\text{idk} \cdot (\text{what} \cdot \text{DP} \backslash S) & \vdash S \\
\text{DP} \backslash S \circ \lambda x (\text{idk} \cdot (\text{what} \cdot x)) & \vdash S \equiv \\
\lambda x (\text{idk} \cdot (\text{what} \cdot x)) & \vdash (\text{DP} \backslash S) \backslash S \quad G \vdash G \\
G \vdash ((\text{DP} \backslash S) \backslash S) \circ \lambda x (\text{idk} \cdot (\text{what} \cdot x)) & \vdash G \\
\text{AMALGAM} \circ \lambda x (\text{idk} \cdot (\text{what} \cdot x)) & \vdash G \equiv \\
\text{idk} \cdot (\text{what} \cdot \text{AMALGAM}) & \vdash G \\
\lambda y (\text{idk} \cdot (\text{what} \cdot y)) & \vdash (\text{DP} \backslash S) \backslash S \\
G \circ \lambda x (\text{Sally} \cdot (\text{ate} \cdot x)) & \vdash S \\
(G \vdash ((\text{DP} \backslash S) \backslash S) \circ \lambda y (\text{idk} \cdot (\text{what} \cdot y))) \circ \lambda x (\text{Sally} \cdot (\text{ate} \cdot x)) & \vdash S \\
\text{LEX} & \equiv \\
(idk \cdot (\text{what} \cdot \text{AMALGAM})) \circ \lambda x (\text{Sally} \cdot (\text{ate} \cdot x)) & \vdash S \\
\text{Sally} \cdot (\text{ate} \cdot (idk \cdot (\text{what} \cdot \text{AMALGAM}))) & \vdash S & \equiv \\
G & \equiv S \backslash (\text{DP} \backslash S) \quad (\text{i.e., scope-taking DP, a generalized quantifier})
\end{align*}
\]
Mismatching examples

Chung 2006: The syntactic objects which are copied or re-used will have to be abstract enough to permit certain 'mismatches' between the antecedent and the apparent requirements of the ellipsis-site.

(25) a. John remembers meeting someone,
    but he doesn’t remember who [he-met].
b. ((DP\S-ing)\S)\S/((DP\S)\S/((DP\S-ing)\S))

• Syntax is no problem.
• Semantically, no need to build a tensed clause: only necessary to turn an \-ing clause meaning into a tensed clause meaning.
• In this case, we need a function from a “remembering” event type to an open proposition concerning a specific event within that event type

Claims

• The ellipsis site contains a silent proform, e.g., SLICEGAP
• So silent elements are ok— but don’t have internal structure
• The syntactic category of the inner antecedent is transparently available to the sluicegap, case matching is easy
• The inner antecedent must scope over the antecedent clause
• Because the only constraint on the relationship between the inner antecedent and the antecedent clause is scopability, sluicing is insensitive to syntactic islands.
• When implemented by a suitable type logical grammar that allows reasoning about scope, sprouting follows from independently motivated assumptions about empty antecedents

Sluicing is anaphora to an anti-constituent, that is, anaphora to a continuation.