How to sprout

Sluicing without deletion? Case matching provides a well-known argument that sluicing may involve deletion of silent syntactic structure (e.g., Merchant 2001):

(1) a. Someone$_{\text{NOM}}$ spoke to John, but I don't know who$_{\text{NOM}}$/*whom$_{\text{ACC}}$ ~~__ spoke to John~~.

b. John spoke to someone$_{\text{ACC}}$, but I don't know whom$_{\text{ACC}}$ ~~John spoke to __~~.

If the sluice gap contains a copy of the antecedent clause, the case of the WH-word is determined just as in any non-sluiced embedded question. Jäger (2001, 2005) explains how to guarantee case matching without resorting to silent syntactic structure. However, Jäger's (2005:228) analysis does not generalize to sprouting (Chung, Ladusaw & McCloskey 1995):

(2) John left ~~at some time~~, but I don't know when ~~he left __~~.

Jäger's analysis requires the antecedent clause to contain an indefinite, but the essence of sprouting is that there is no overt indefinite or any other overt sluicing trigger.

I will provide a primarily semantic, anaphoric analysis that generalizes smoothly to sprouting cases. Although I will share Jäger's starting point (type logical grammar), my solution will differ from his not only in its empirical coverage, but conceptually and technically as well.

Fragment. Let us reason about syntactic and semantic composition. If two constituents, A and Γ, can combine to form a complex expression in category B (i.e., if $A \cdot \Gamma \vdash B$, where '$\cdot$' indicates normal syntactic composition) and if we remove A, then what remains is an expression that clearly can combine with an A to its left to form a B: we conclude that $\Gamma \vdash A\backslash B$. This is simple categorial grammar. Likewise (but less familiarly), if $\Gamma[A]$ is a syntactic structure containing a specific occurrence of A inside of it, and this composite structure is in category B (i.e., if $\Gamma[A] \vdash B$), then removing A from Γ produces an expression containing an A gap: $\lambda x\Gamma[x] \vdash A\backslash\!\!\backslash B$, where '$A\backslash\!\!\backslash B$' is the category of a B missing an A somewhere inside of it. I will write $A \circ \lambda x\Gamma[x] \vdash B$, where '$\circ$' is the syntactic operation of plugging A into the gap left in Γ, and where "$\lambda x...x...$" keeps track of the syntactic position from which A has been removed.

For instance, if the syntactic structure *John* · ((*spoke* · (*to* · *someone*)) · *yesterday*) has category S, and *someone* has category DP$_{\text{ACC}}$, then by the reasoning given above we are able to infer that λx(*John* · ((*spoke* · (*to* · x)) · *yesterday*)) $\vdash$ DP$_{\text{ACC}}\backslash\!\!\backslash$S. Since this is the expression that the sluice gap is anaphoric to (and that supplies its semantic content), we correctly predict that the sluice gap will combine only with an accusative WH-word, and not with a nominative one.

We can implement the reasoning developed above in the form of a practical (i.e., decidable) fragment using Genzen sequent inference rules. Although the talk will not presuppose any previous familiarity with type logical grammar, the notation is as in Moortgat 1997:

$$\frac{\Gamma \vdash A \quad \Sigma[B] \vdash Z}{\Sigma[\Gamma \cdot A\backslash B] \vdash Z}\,\backslash L \qquad \frac{A \cdot \Gamma \vdash B}{\Gamma \vdash A\backslash B}\,\backslash R \qquad \frac{\Sigma[B] \vdash Z \quad \Gamma \vdash A}{\Sigma[B/A \cdot \Gamma] \vdash Z}\,/L \qquad \frac{\Gamma \cdot A \vdash B}{\Gamma \vdash B/A}\,/R$$

$$\frac{\Gamma \vdash A \quad \Sigma[B] \vdash Z}{\Sigma[\Gamma \circ A\backslash\!\!\backslash B] \vdash Z}\,\backslash\!\!\backslash L \qquad \frac{A \circ \Gamma \vdash B}{\Gamma \vdash A\backslash\!\!\backslash B}\,\backslash\!\!\backslash R \qquad \frac{\Sigma[B] \vdash Z \quad \Gamma \vdash A}{\Sigma[B/\!\!/A \circ \Gamma] \vdash Z}\,/\!\!/L \qquad \frac{\Gamma \circ A \vdash B}{\Gamma \vdash B/\!\!/A}\,/\!\!/R$$

The $\backslash R$ and $\backslash\!\!\backslash R$ rules have already been discussed; the other inferences can easily be justified.

We need one additional rule to allow for in-situ scope-taking:

$$\Gamma[A] \equiv A \circ \lambda x\Gamma[x]$$

This rule says that $A \circ \lambda x\Gamma[x]$ is an equivalent way of writing the result of plugging A into the gap in $\lambda x\Gamma[x]$, and that the two forms can be freely intersubstituted.

Example. Then we have the following derivation for a simple sluicing example, *Someone left, but I don't know who* (*bidk* is an amalgam representing *but-I-don't-know*):

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\dfrac{(\text{someone} \circ \mathrm{DP}\backslash\!\!\backslash \mathrm{s}) \cdot (\text{bidk} \cdot (\text{who} \cdot \mathrm{DP}\backslash\!\!\backslash \mathrm{s})) \vdash \mathrm{s}}
{\mathrm{DP}\backslash\!\!\backslash \mathrm{s} \circ \lambda y((\text{someone} \circ y) \cdot (\text{bidk} \cdot (\text{who} \cdot \mathrm{DP}\backslash\!\!\backslash \mathrm{s}))) \vdash \mathrm{s}} \equiv
}
{\lambda y((\text{someone} \circ y) \cdot (\text{bidk} \cdot (\text{who} \cdot \mathrm{DP}\backslash\!\!\backslash \mathrm{s}))) \vdash (\mathrm{DP}\backslash\!\!\backslash \mathrm{s})\backslash\!\!\backslash \mathrm{s}} \backslash\!\!\backslash R
}
{\mathrm{DP}\backslash\!\!\backslash \mathrm{s} \circ \lambda z \lambda y((\text{someone} \circ y) \cdot (\text{but} \cdot (\text{who} \cdot z))) \vdash (\mathrm{DP}\backslash\!\!\backslash \mathrm{s})\backslash\!\!\backslash \mathrm{s}} \equiv
}
{\lambda z \lambda y((\text{someone} \circ y) \cdot (\text{bidk} \cdot (\text{who} \cdot z))) \vdash (\mathrm{DP}\backslash\!\!\backslash \mathrm{s})\backslash\!\!\backslash((\mathrm{DP}\backslash\!\!\backslash \mathrm{s})\backslash\!\!\backslash \mathrm{s})} \backslash\!\!\backslash R
\quad
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\dfrac{
\dfrac{\mathrm{DP} \cdot \mathrm{DP}\backslash \mathrm{S} \vdash \mathrm{S}}
{\mathrm{DP} \circ \lambda x(x \cdot \text{left}) \vdash \mathrm{s}} \equiv
}
{\lambda x(x \cdot \text{left}) \vdash \mathrm{DP}\backslash\!\!\backslash \mathrm{s}} \backslash\!\!\backslash R
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{\lambda x(x \cdot \text{left}) \circ (\mathrm{DP}\backslash\!\!\backslash \mathrm{s})\backslash\!\!\backslash \mathrm{s} \vdash \mathrm{s}} \backslash\!\!\backslash L
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{\dfrac{\lambda x(x \cdot \text{left}) \circ (((\mathrm{DP}\backslash\!\!\backslash \mathrm{s})\backslash\!\!\backslash \mathrm{s})/\!\!/((\mathrm{DP}\backslash\!\!\backslash \mathrm{s})\backslash\!\!\backslash((\mathrm{DP}\backslash\!\!\backslash \mathrm{s})\backslash\!\!\backslash \mathrm{s})) \circ \lambda z \lambda y((\text{someone} \circ y) \cdot (\text{bidk} \cdot (\text{who} \cdot z)))) \vdash \mathrm{s}}
{\dfrac{\lambda x(x \cdot \text{left}) \circ \lambda y((\text{someone} \circ y) \cdot (\text{bidk} \cdot (\text{who} \cdot \mathrm{SLUICEGAP}))) \vdash \mathrm{s}}
{\dfrac{(\text{someone} \circ \lambda x(x \cdot \text{left})) \cdot (\text{bidk} \cdot (\text{who} \cdot \mathrm{SLUICEGAP})) \vdash \mathrm{s}}
{(\text{someone} \cdot \text{left}) \cdot (\text{bidk} \cdot (\text{who} \cdot \mathrm{SLUICEGAP})) \vdash \mathrm{s}} \equiv} \equiv} \equiv} /\!\!/L
$$

Starting from the bottom: *someone* "raises" to take scope over the antecedent clause; the remnant of *someone*, i.e., $\lambda x(x \cdot \textit{left})$ raises to take scope over the entire sluice; then the sluice gap raises and tucks in beneath the raised remnant. The final ingredient is to assign to the sluice gap the duplicator meaning $\lambda\kappa x.\kappa x x$. Then the standard (Curry-Howard) semantics for multi-modal type logical grammars (for now, see, e.g., Moortgat 1997 for details) delivers the denotation of the remnant as the content of the sluice gap.

Sprouting. The fragment already generates sprouting examples. In the derivation above, the WH-word *who* needs an S containing a DP gap in order to form an embedded question, and so has category $\mathrm{Q}/(\mathrm{DP}\backslash\!\!\backslash \mathrm{s})$. The WH-word *when* in (2), then, requires a clause with an adverbial gap, i.e., $\mathrm{Q}/(\mathrm{ADV}\backslash\!\!\backslash \mathrm{s})$, where $\mathrm{ADV} = (\mathrm{DP}\backslash \mathrm{s})\backslash(\mathrm{DP}\backslash \mathrm{s})$. But assuming that the empty structure is a right identity for '·', i.e., that $\Gamma \cdot () \equiv \Gamma$, we have this simple proof: $\dfrac{\mathrm{DP}\backslash \mathrm{s} \vdash \mathrm{DP}\backslash \mathrm{s}}{\vdash (\mathrm{DP}\backslash \mathrm{s})\backslash(\mathrm{DP}\backslash \mathrm{s})} \backslash R$. In other words, starting with the tautology $\mathrm{DP}\backslash \mathrm{s} \vdash \mathrm{DP}\backslash \mathrm{s}$, if we remove the leftmost constituent from the structure on the left of the turnstyle, the remaining (empty) structure must have category ADV (with the identity function as its Curry-Howard semantic value). This means that we can freely add a silent, identity-function denoting adverb to the antecedent clause. There is no need to posit silent lexical content such as *at some time*, since all the analysis requires is the ability to compute a suitable remnant.

Reassurances. There are many important details not given here but that are ready for the talk, including: how an adaptation of Merchant's mutual entailment condition explains AnderBois' inquisitiveness facts (and also, unlike AnderBois' account, generalizes to sprouting); how to sluice with implicit arguments; decidability results, including a working parser; and presenting in more detail the technical properties of the fragment.

Conclusion. A new explicit account of sluicing with no deletion of silent syntactic structure can handle case-matching facts, sprouting, and more.

Key references: • AnderBois, Scott 2010. Sluicing as anaphora to issues. SALT • Chung, Ladusaw & McCloskey 1995. Sluicing and LF. *NLS* • Jäger, Gerhard 2001. Indefinites and sluicing. AC • Jäger, Gerhard 2005. *Anaphora in TLG*. Springer • Merchant, Jason 2001. *The Syntax of Silence*. OUP • Moortgat, Michael 1997. Categorial Type Logics. *Handbook of Logic and Lg.*