DO COMPREHENDERS VIOLATE BINDING THEORY?

Depends on your point of view

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May 31, 2016

UMass Linguistics
Two Questions:

- How can evidence from processing inform linguistic theory?
- What’s the role of general memory mechanisms in on-line linguistic dependency formation?
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- What’s the role of general memory mechanisms in on-line linguistic dependency formation?

Case Study: Principle A

- Can investigations of reflexive processing inform our understanding of Binding Theory?
- How do Reflexives fit into existing models of dependency formation in sentence comprehension?
**Principle A:**

A reflexive must be co-indexed with a c-commanding referent within the minimal XP containing the reflexive, and a subject\(^1\).

(1) \([\text{Louise}_i \text{ stole the picture of herself}_i]_{\text{TP}}\)

(2) \(\text{Louise}_i \text{ stole } [\text{Linda}_j \text{’s picture of herself}_{i/j}]_{\text{DP}}\)

(3) \(\text{Bob}_i \text{ said that } [[\text{Gene}_j \text{’s friend}]_k \text{ embarrassed himself}_{i/j/k}]_{\text{TP}}\)

Standard Binding Theory treats the interpretation of reflexive anaphors as a function of locality and c-command.

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\(^1\)Chomsky (1986); Charnavel and Sportiche (2016)
Investigations of Principle A in sentence comprehension make substantial use of the mismatch paradigm\(^2\).

**Mismatch paradigm:**

- **TARGETS:** Principle A compatible referents
- **TARGET MATCH:** does the reflexive match the features of the target?

\[
\text{(4) Jonathan saw that } \left\{ \begin{array}{l}
\text{Steven} \\
\text{Amanda}
\end{array} \right\} \text{ had hurt } \text{himself} \ldots
\]

\(^2\text{Sturt (2003)}\)
Investigations of Principle A in sentence comprehension make substantial use of the mismatch paradigm\(^3\).

**Mismatch paradigm:**

- **LURES**: Principle A incompatible referents
- **LURE MATCH**: does the reflexive match the features of a lure?

\(\text{\textbf{LURE}}\)
\[
\{\begin{array}{c}
\text{Jonathan} \\
\text{Jennifer}
\end{array}\}
\]

saw that Steven had hurt **himself**...

\(^3\text{Sturt (2003)}\)
Investigations of Principle A in sentence comprehension make substantial use of the mismatch paradigm\(^4\).

**Mismatch paradigm:**

- **Target match** effects represent adherence to Principle A.
- **Lure match** effects represent Principle A fallibility.

\(^4\)Sturt (2003)
Many studies find that Principle A acts as a strong, early constraint on antecedent identification. For example, Sturt (2003) used eye-tracking while reading to investigate sentences like (5):

\[(5) \quad \{\text{Jonathan, Jennifer}\} \text{ saw that } \{\text{Steven had hurt } \{\text{himself, herself}\}\}

\[\text{LURE} \quad \text{TARGET}\]

\[\text{5Dillon et al. (2013); Nicol and Swinney (1989); Xiang et al. (2009)}\]
Many studies find that Principle A acts as a strong, early constraint on antecedent identification. For example, Sturt (2003) used eye-tracking while reading to investigate sentences like (5):

\[
\text{LURE} \begin{cases} 
\text{Jonathan} \\
\text{Jennifer} 
\end{cases} \quad \text{saw that} \quad \text{TAR\text{GET}} \begin{cases} 
\text{Steven} \\
\text{herself} 
\end{cases} \quad \text{had hurt} \begin{cases} 
\text{himself} 
\end{cases}
\]

In early measures of reading difficulty, Sturt (and others\(^5\)) found:

\begin{itemize}
  \item A \textit{target mismatch penalty}: reflexives were read slower when they mismatched the target antecedent.
  \item No effect of lure match on early reading times!
\end{itemize}

\textbf{Hypothesis:} The parser uses Principle A to find antecedents

\(^5\text{Dillon et al. (2013); Nicol and Swinney (1989); Xiang et al. (2009)}\)
However, recent work calls this finding into question\textsuperscript{6}. Parker (2014) used eye-tracking while reading to investigate sentences like (6):

\begin{equation}
(6) \begin{cases}
\text{LURE} \\
\text{Susan} \\
\text{Steven}
\end{cases}
\text{said that the}
\begin{cases}
\text{TARGET} \\
\text{girls} \\
\text{girl} \\
\text{boy}
\end{cases}
\text{embarrassed himself...}
\end{equation}

\textsuperscript{6}Chen et al. (2012); King et al. (2012); Parker (2014); Patil et al. (2016)
However, recent work calls this finding into question\textsuperscript{6}. Parker (2014) used eye-tracking while reading to investigate sentences like (6):

\[
(6) \begin{cases}
\text{LURE} \\
\{\text{Steven} \\
\text{Susan}\}
\end{cases}
\text{said that the} \begin{cases}
\text{TARGET} \\
\{\text{boy} \\
\text{girl} \\
\text{girls}\}
\end{cases}
\text{embarrassed} \text{himself...}
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\textbf{Parker found:}

A target mismatch penalty: reflexives were read slower when they mismatch the target antecedent.

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However, recent work calls this finding into question. Parker (2014) used eye-tracking while reading to investigate sentences like (6):

\[
(6) \begin{align*}
& \text{LURE} \quad \{ \text{Steven} \quad \text{Susan} \} \\
& \text{TARGET} \quad \{ \text{boy} \quad \text{girl} \quad \text{girls} \}
\end{align*}
\]

said that the \text{target} \{ \text{boy} \quad \text{girl} \quad \text{girls} \} embarrassed \text{himself}...

Parker found:

Lure match facilitation: reflexives which matched the lure referent were read faster.

But...
However, recent work calls this finding into question\textsuperscript{8}. Parker (2014) used eye-tracking while reading to investigate sentences like (6):

(6) \{\textbf{LURE} Steven Susan\} said that the \{\textbf{TARGET} boy girl girls\} embarrassed himself...

\textbf{Parker found:}

\textbf{Lure match facilitation} was only observed when the reflexive mismatched the target antecedent in \textbf{two} features!

\textsuperscript{8}Chen et al. (2012); King et al. (2012); Parker (2014); Patil et al. (2016)
However, recent work calls this finding into question\(^9\). Parker (2014) used eye-tracking while reading to investigate sentences like (6):

\[
(6) \left\{ \begin{array}{l}
\text{LURE} \\
\{ \text{Steven} \\
\text{Susan} \}
\end{array} \right\} \text{ said that the } \left\{ \begin{array}{l}
\text{TARG} \\
\{ \text{boy} \\
\text{girl} \\
\text{girls} \}
\end{array} \right\} \text{ embarrassed } \text{himself}...
\]

Parker found:
Reflexive processing violates Principle A when a \textit{lure match} is available, and the \textit{target mismatch} penalty is very strong.

\(^9\)Chen et al. (2012); King et al. (2012); Parker (2014); Patil et al. (2016)
Principle A Fallibility

In sentence processing:

- Reflexive comprehension typically hews to Principle A
- Comprehenders occasionally leverage morphosyntactic features to access lure referents
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- Reflexive comprehension typically hews to Principle A
- Comprehenders occasionally leverage morphosyntactic features to access lure referents

**In theory:**

Offline judgments also show apparent Principle A violations:

(7)  \textit{John}$_i$’s intentionally misleading testimony was enough to ensure that [the newspaper would print pictures of \textit{himself};

the next morning]$_{TP}$.

The antecedent of \textit{himself} is neither local, nor c-commanding!
Complications:

A straightforward account of reflexive binding is complicated by behavior which seems to violate Principle A:

- Comprehenders don’t *just* use Principle A to find antecedents
- Not all reflexives are locally bound
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- Comprehenders don’t just use Principle A to find antecedents
- Not all reflexives are locally bound

Understanding fallibility:
Descriptively, the standard version of Principle A seems to be fallible, indicating that either:

- The locality and c-command description of Principle A is wrong
- We don’t yet understand something about the on-line implementation of Principle A
Modifying Binding Theory:

One response to (7) has been to reformulate Binding Theory.

(7) John$_i$’s intentionally misleading testimony was enough to ensure that [the newspaper would print pictures of himself$_i$ the next morning]$_{TP}$. 

$^{10}$Pollard and Sag (1992); see also Reinhart and Reuland (1993)
Modifying Binding Theory:

One response to (7) has been to reformulate Binding Theory.

(7) John’s intentionally misleading testimony was enough to ensure that [the newspaper would print pictures of himself the next morning]$_{TP}$.

Predicate-based Binding Theory:

- **Principle A**: A reflexive anaphor must be bound by a coargument of its predicate *if one exists*\(^{10}\).
- In (7), the reflexive is the only argument of *pictures of*, and is thus **Principle A exempt**.

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\(^{10}\)Pollard and Sag (1992); see also Reinhart and Reuland (1993)
**Principle A in Theory and Processing**

**Linguistic Theory:** What’s the right descriptive form of Principle A?

- Is Binding Theory based on locality and c-command\(^{11}\)?
- Or is it predicate-based\(^{12}\)?

---

\(^{11}\) Chomsky (1986); Charnavel and Sportiche (2016)

\(^{12}\) Pollard and Sag (1992); Reinhart and Reuland (1993)

\(^{13}\) Dillon et al. (2013); Nicol and Swinney (1989); Sturt (2003); Xiang et al. (2009)

\(^{14}\) King et al. (2012); Parker (2014); Patil et al. (2016)
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**Linguistic Theory:** What’s the right descriptive form of Principle A?

- Is Binding Theory based on locality and c-command\(^\text{11}\)?
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**Sentence Processing:** How does Principle A impact processing?

- How does Principle A constrain antecedent search\(^\text{13}\)?
- Why do comprehenders consider lure referents\(^\text{14}\)?

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- How does Principle A constrain antecedent search\(^{13}\)?
- Why do comprehenders consider lure referents\(^{14}\)?

Both lines of investigation ask variations on the same question:
*When, and why, does Principle A not apply?*

\(^{11}\)Chomsky (1986); Charnavel and Sportiche (2016)
\(^{12}\)Pollard and Sag (1992); Reinhart and Reuland (1993)
\(^{13}\)Dillon et al. (2013); Nicol and Swinney (1989); Sturt (2003); Xiang et al. (2009)
\(^{14}\)King et al. (2012); Parker (2014); Patil et al. (2016)
In general, Principle A:

- Should be understood in terms of locality and c-command
- Strongly constrains reflexive comprehension

Principle A fallibility:

- Arises when a logophoric interpretation of the reflexive form is made available to the parser
- This interpretation is more readily available in some positions than in others
Cue-based parsing

- Modeling linguistic dependencies
- Explaining Principle A fallibility

Principle A fallibility is conditioned on a logophoric interpretation:

- Expt 1: the effect of attitude verbs on reflexive processing
- Expt 2: demonstrating person blocking in reflexive processing

Wrapping up:

- Evaluating the role of general memory mechanisms
- Reconnecting with theories of reflexive binding
Cue-based parsing models:

- A cue-based retrieval mechanism subserves parsing operations\(^{15}\) by bringing already-processed material back into attention.

\(^{15}\)E.g. structure building, attachment decisions, reference resolution; (Lewis and Vasishth, 2005; McElree et al., 2003; Van Dyke, 2007)

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Cue-based parsing models:

- A cue-based retrieval mechanism subserves parsing operations by bringing already-processed material back into attention.
  - Probe memory in parallel with a set of search cues
  - Probabilistically retrieve representations as a function of activation
    - Activation fluctuates as a function of retrieval probe match
    - Activation decays as a function of recency

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- Partial matches can result in accidental retrieval!

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- Partial matches can result in accidental retrieval!

- **Error-prone retrieval** might explain Principle A fallibility in reflexive comprehension

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16 Chen et al. (2012); Parker (2014); Patil et al. (2016)
(8) Steven said that the girl embarrassed himself ...
(8) Steven said that the girl embarrassed himself ...
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\[
\begin{array}{|c|c|}
\hline
\text{GENDER:} & fem \\
\text{NUMBER:} & sg \\
\text{PERSON:} & 3rd \\
\text{ANIMACY:} & anim \\
\text{RELATION:} & c-com. \\
\text{LOCALITY:} & +\text{local} \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|}
\hline
\text{GENDER:} & masc \\
\text{NUMBER:} & sg \\
\text{PERSON:} & 3rd \\
\text{ANIMACY:} & anim \\
\text{RELATION:} & c-com. \\
\text{LOCALITY:} & +\text{local} \\
\hline
\end{array}
\]

\[
\begin{array}{|c|c|}
\hline
\text{GENDER:} & fem \\
\text{NUMBER:} & sg \\
\text{PERSON:} & 3rd \\
\text{ANIMACY:} & anim \\
\text{RELATION:} & c-com. \\
\text{LOCALITY:} & +\text{local} \\
\hline
\end{array}
\]
Steven said that the girl embarrassed himself ...

Steven

- Gender: masc
- Number: sg
- Person: 3rd
- Animacy: anim
- Relation: c-com.
- Locality: -local

The girl

- Gender: fem
- Number: sg
- Person: 3rd
- Animacy: anim
- Relation: c-com.
- Locality: +local
(9) Steven said that the girls embarrassed himself ...
(9) Steven said that the girls embarrassed himself ...
(9) Steven said that the girls embarrassed himself ...

<table>
<thead>
<tr>
<th>Steven</th>
<th></th>
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<tbody>
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<td></td>
<td></td>
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<tr>
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<tr>
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<table>
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<tr>
<th>the girls</th>
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<tr>
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<tr>
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<tr>
<td>ANIMACY:</td>
<td>anim</td>
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<tr>
<td>RELATION:</td>
<td>c-com.</td>
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The appeal of cue-based models:

- These models are dependency (and domain) general
- Motivated by a lot of work outside linguistics

Explaining grammatical fallibility:

- Cue-based retrieval tidily explains grammatical fallibility
- Retrieval is a probabilistic function of similarity, and likely to produce errors

For cue-based models, grammatical fallibility is the result of a noisy, imperfect implementation of linguistic knowledge.
Cue-based parsing models give a singular characterization of grammatical fallibility:

- The parser is trying to faithfully implement grammatical knowledge in the form of retrieval cues
- But retrieval is an imperfect, probabilistic operation, and sometimes returns unintended objects

17 Pollard and Sag (1992); Reinhart and Reuland (1993)
Cue-based parsing models give a singular characterization of grammatical fallibility:

- The parser is trying to faithfully implement grammatical knowledge in the form of retrieval cues
- But retrieval is an imperfect, probabilistic operation, and sometimes returns unintended objects

Does this characterization hold true of Principle A fallibility?

- We know that some reflexives are not constrained by Principle A\(^\text{17}\)
- Is Principle A fallibility in comprehension the result of parsing errors, or is it driven by a Principle A exempt interpretation?

\(^\text{17}\)Pollard and Sag (1992); Reinhart and Reuland (1993)
Studies vary in the types of verbs they used to embed reflexives, possibly indicating a grammatical basis for Principle A fallibility.

(10) Jonathan \{ \begin{align*} \text{said} & \quad \text{thought} \quad \text{heard} \end{align*}\} that the girls embarrassed himself...

<table>
<thead>
<tr>
<th>Matrix Embedding Verb</th>
<th>Paper</th>
<th>speech</th>
<th>belief</th>
<th>perception</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sturt (2003)</td>
<td>30%</td>
<td>54%</td>
<td>16%</td>
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<td></td>
<td>Cunnings and Sturt (2014)</td>
<td>—</td>
<td>88%(86%)</td>
<td>12%(14%)</td>
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<td></td>
<td>Parker (2014)</td>
<td>86%(72%)</td>
<td>14%(28%)</td>
<td>—</td>
</tr>
</tbody>
</table>

Studies which report Principle A adherence used relatively few speech verbs compared to those which find Principle A fallibility!
Logophoricity

Logophoric pronouns:
Logophors are pronouns which necessarily refer to the person whose speech, thoughts, or feelings are reported in an utterance\(^\text{18}\).

\(^{18}\)Clements (1975)

\(^{19}\)Culy (1997); Huang and Liu (2001)
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\begin{itemize}
  \item Some logophors are morphologically distinct (e.g. in Ewe) others are homophonous with reflexive forms (e.g. Mandarin)\(^\text{19}\).
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Logophoricity

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- Some logophors are morphologically distinct (e.g. in Ewe) others are homophonomous with reflexive forms (e.g. Mandarin)\(^\text{19}\).
- There is crosslinguistic variation in which attitude predicates can embed logophoric reference:

\[(11) \text{speech} \ll \text{thought} \ll \text{knowledge} \ll \text{perception} \text{ (Culy, 1994)}\]

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- There is crosslinguistic variation in which attitude predicates can embed logophoric reference:

\[(11) \quad \text{speech} \ll \text{thought} \ll \text{knowledge} \ll \text{perception} \quad (\text{Culy, 1994})\]

Given the similarity of the variation in reflexive processing studies to (11), can Principle A fallibility be tied to logophoricity?

\(^{18}\text{Clements (1975)}\)

\(^{19}\text{Culy (1997); Huang and Liu (2001)}\)
**Question:** Does the kind of attitude verb affect lure sensitivity?
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(12) The \{nanny, butler\} said that the girl lied about herself...
**Experiment 1: Attitude Verb Manipulation**

**Question:** Does the kind of attitude verb affect lure sensitivity?

(12) The \{\text{LURE}\} \{\text{Verbs}\} \{\text{butler, nanny}\} \{\text{said, heard}\} that the girl lied about herself...
**Experiment 1: Attitude Verb Manipulation**

**Question:** Does the kind of attitude verb affect lure sensitivity?

(12) The \{LURE\} 
\{nanny, butler\} \{VERB\} 
\{said, heard\} that the \{TARGET\} 
\{girl, boys\} lied about herself...
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**Question:** Does the kind of attitude verb affect lure sensitivity?

(12) The \{nanny, butler\} \{said, heard\} that the \{girl, boys\} lied about herself...

**Lure match effects:**

Differences between LURE conditions (match—mismatch) represent Principle A fallibility.

- **Judgment Scores:** positive values indicate increased acceptability
- **Reading times:** negative values represent facilitation
Experiment 1: Attitude Verb Manipulation

Question: Does the kind of attitude verb affect lure sensitivity?

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Predictions:

- Logophoric Reflexives: larger lure-match effect in \textit{speech} verb conditions, relative to \textit{perception} verb conditions
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**Question:** Does the kind of attitude verb affect lure sensitivity?

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**Predictions:**

- **Logophoric Reflexives:** larger lure-match effect in *speech* verb conditions, relative to *perception* verb conditions

**Methods:**

- An off-line acceptability judgment task (n=64) and eye-tracking while reading study (n=36)
Experiment 1: Acceptability Judgments

The lure \{nanny, butler\} \{said, heard\} that the target \{girl, boys\} lied about herself...

<table>
<thead>
<tr>
<th>TARGET</th>
<th>LURE</th>
<th>VERB</th>
<th>speech</th>
<th>perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>+match</td>
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<td></td>
<td>4.99 (.12)</td>
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</tr>
<tr>
<td>-match</td>
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<td>5.20 (.10)</td>
</tr>
<tr>
<td>-match</td>
<td>+match</td>
<td></td>
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<td>3.68 (.16)</td>
</tr>
<tr>
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<td>-match</td>
<td></td>
<td>3.56 (.17)</td>
<td>3.60 (.16)</td>
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Target mismatch penalty: sentences in which the target matched the reflexive were rated much better overall.
Experiment 1: Acceptability Judgments

(12) The {nanny, butler} said heard that the {girl, boys} lied about herself...

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Lure match facilitation: When the lure matched the reflexive, acceptability very slightly improved...
EXPERIMENT 1: ACCEPTABILITY JUDGMENTS

(12) The {nanny butler} {said heard} that the {girl boys} lied about herself...

### Lure Match Facilitation

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</table>

**Lure match facilitation:** When the lure matched the reflexive, acceptability very slightly improved...

**But only for target-mismatch, speech verb reflexives**
(12) The nanny said that the boys lied about herself yesterday.

Fixation duration measures:
The nanny said that the boys lied about herself yesterday.

**Fixation duration measures:**

- **First Pass:** Sum of fixations before exiting a region (1+2)
(12) The nanny said that the boys lied about herself yesterday.

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Eye-tracking while reading

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Fixation duration measures:

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- **Total Time**: Sum of all fixations on a region (1+2+6)
The nanny said that the boys lied about herself yesterday.

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**Experiment 1: Reading Measures**

### Lure Match Effect [match–mismatch]

**First Pass**

<table>
<thead>
<tr>
<th>Time (ms)</th>
<th>speech perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>−300</td>
<td>*</td>
</tr>
</tbody>
</table>

**Go–Past**

<table>
<thead>
<tr>
<th>Time (ms)</th>
<th>speech perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>−200</td>
<td>*</td>
</tr>
</tbody>
</table>

**Total Time**

<table>
<thead>
<tr>
<th>Time (ms)</th>
<th>speech perception</th>
</tr>
</thead>
<tbody>
<tr>
<td>−100</td>
<td>*</td>
</tr>
</tbody>
</table>

**Target Antecedent**

- **+match**
- **−match**
**Experiment 1: Summary**

**Acceptability judgments:**

- **Strong effects of Principle A:** sentences in which the reflexive and target antecedent mismatched were rated significantly worse.
- **Weak sensitivity to lures:** feature-matched lures barely improved the acceptability of target-mismatch, speech verb sentences.
**Experiment 1: Summary**

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**Eye-movement data:**

- **Strong effects of Principle A:** In perception verb conditions, target-mismatch reflexives were ready more slowly.
- **Strong sensitivity to lures:** feature-matched lures facilitated reading of, and progression past, target-mismatch reflexives...
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- **Strong effects of Principle A:** In perception verb conditions, target-mismatch reflexives were ready more slowly.
- **Strong sensitivity to lures:** feature-matched lures facilitated reading of, and progression past, target-mismatch reflexives... but only in speech-verb conditions!
Experiment 1: Discussion

The effect of attitude verbs:

- Principle A fallibility is conditioned on the kind of attitude verb used to embed the reflexive
- This finding suggests that competition from a logophoric interpretation is responsible for Principle A fallibility.
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The effect of attitude verbs:

- Principle A fallibility is conditioned on the kind of attitude verb used to embed the reflexive.
- This finding suggests that competition from a logophoric interpretation is responsible for Principle A fallibility.

Other predictions from logophoricity:

- In addition to preferences in attitude verbs, logophors prefer to take perspective centers as antecedents.
- Lures should be more attractive referents when they represent the perspective from which a proposition is reported.
- Experiment 2 tested this using a person blocking paradigm.
Mandarin Person Blocking:

Non-local interpretations of reflexives are blocked by indexicals.

(13) Zhangsan\textsubscript{i} renwei Lisi\textsubscript{j} hen ziji\textsubscript{i/j}.
Zhangsan thinks Lisi hates self.

(14) Zhangsan\textsubscript{i} renwei wo\textsubscript{j}/ni\textsubscript{j} hen ziji*\textsubscript{i/j}.
Zhangsan thinks I/you hate self.

Blocking and logophoricity:

- Long-distance ziji is a logophor, and needs to refer to a source.
- Blocking occurs when a sentence-internal source (Zhangsan) would conflict with an external source (I/you)\textsuperscript{20}.
- Indexicals prevent other referents from anteceding logophors.

\textsuperscript{20}Huang and Liu (2001); Kuno (1972)
Question: do indexicals attenuate sensitivity to lures?

(15) The \{ \underline{LURE} \\ actress \\ actor \} said that Lucy lied about \underline{herself}...
Question: do indexicals attenuate sensitivity to lures?

(15) The \( \left\{ \text{actress} \right\} \) said that \( \left\{ \text{Lucy} \right\} \) lied about herself...
Experiment 2: Testing for person blocking

**Question:** do indexicals attenuate sensitivity to lures?

(15) The \{ \text{LURE} \begin{cases} \text{actress} \\ \text{actor} \end{cases} \} said that \{ \text{TARGET} \begin{cases} \text{Lucy} \\ \text{it} \\ \text{l} \end{cases} \} lied about herself...

**Predictions:**

- Logophoric Reflexives: the effect of lure-match should be smaller in I conditions relative to it conditions.
Experiment 2: Testing for Person Blocking

**Question:** do indexicals attenuate sensitivity to lures?

(15) The \( \text{LURE} \) \{ actress, actor \} said that \( \text{TARGET} \) \{ Lucy, it, I \} lied about herself...

**Predictions:**

- **Logophoric Reflexives:** the effect of lure-match should be smaller in *I* conditions relative to *it* conditions.

**Methods:**

Two off-line acceptability judgment tasks (n=54 each) and an eye-tracking while reading study (n=36)
Experiment 2: Acceptability Judgments

(15) The \{'actress\,\,\,actor\} said that \{'Lucy\,\,\,it\,\,\,I/you\} lied about herself...

<table>
<thead>
<tr>
<th>LURE</th>
<th>Target</th>
<th>First Person Blocking</th>
<th>Second Person Blocking</th>
</tr>
</thead>
<tbody>
<tr>
<td>actress</td>
<td>Lucy</td>
<td>+Match 5.23(.15)</td>
<td>+Match 5.45(.13)</td>
</tr>
<tr>
<td>actor</td>
<td>it</td>
<td>-Match 5.26(.15)</td>
<td>-Match 5.54(.12)</td>
</tr>
<tr>
<td></td>
<td>I/you</td>
<td>+Match 3.81(.19)</td>
<td>+Match 4.03(.20)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>-Match 3.04(.18)</td>
<td>-Match 3.16(.19)</td>
</tr>
<tr>
<td></td>
<td></td>
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<td>+Match 3.35(.20)</td>
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<tr>
<td></td>
<td></td>
<td>-Match 2.77(.18)</td>
<td>-Match 3.02(.19)</td>
</tr>
</tbody>
</table>

Target mismatch penalty: Reflexives which matched the target antecedent (Name conditions) were rated better overall.
**Experiment 2: Acceptability Judgments**

(15) The \{ \text{actress} \} \text{ said that } \{ \text{Lucy} \} \text{ lied about herself...} \\

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</tr>
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<td>\text{Name} 5.23(.15)</td>
<td>5.26(.15)</td>
</tr>
<tr>
<td>\text{it} 3.81(.19)</td>
<td>3.04(.18)</td>
</tr>
<tr>
<td>\text{I/you} 3.23(.19)</td>
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</tr>
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**Lure match facilitation:** Target-mismatched reflexives (\text{it}/\text{I} conditions) were rated better when they matched the lure.
Experiment 2: Acceptability Judgments

(15) The \{ actress, actor \} said that \{ Lucy, it, I/you \} lied about herself...

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**Person Blocking:** The lure match effect was substantially smaller when the target was I or you!
Experiment 2: Acceptability Judgments

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<td>0.78(.12)</td>
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Person Blocking: The lure match effect was substantially smaller when the target was I or you!

Indexical pronouns reduced sensitivity to lure referents.
**Experiment 2: Reading Measures**

Lure Match Effect [match–mismatch]

- **First Pass**
  - Target Antecedent
  - Name
  - "it"
  - "I"

- **Go–Past**
  - Target Antecedent
  - Name
  - "it"
  - "I"

- **Total Time**
  - Target Antecedent
  - Name
  - "it"
  - "I"
Acceptability Judgments:

- Strong effects of Principle A: target-mismatched reflexives were rated substantially worse.
- Differential sensitivity to lures: feature-matched lures improved acceptability more for *it* sentences than for *I* or *you* sentences.
**Experiment 2: Summary**

**Acceptability Judgments:**

- **Strong effects of Principle A:** target-mismatched reflexives were rated substantially worse.
- **Differential sensitivity to lures:** feature-matched lures improved acceptability more for *it* sentences than for *I* or *you* sentences.

**Eye-movement data:**

- **Strong effects of Principle A:** Reflexives in target mismatch sentences were read much slower overall.
- **Differential sensitivity to lures:**
  - When the lure matched, reflexives in *it* sentences were read on-par with reflexives which matched the target antecedent.
  - This effect was delayed for reflexives in *I* sentences, which were still read slowly overall.
Experiment 1:

- Showed that comprehenders selectively violate Principle A depending on the attitude verb used to embed the reflexive.
- This aligns neatly with Culy (1997)’s logophoric verbal hierarchy.
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- Showed that comprehenders take longer/are less likely to attend to lure referents in the presence of indexical pronouns.
- This closely mirrors person blocking effects in Mandarin, which have been attributed to logophoricity.
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These experiments provide strong evidence of logophoricity in English reflexive comprehension.
Does the parser reliably implement Principle A?

In a sense, no.
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In a sense, no. But in another, truer sense, yes...
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Why do comprehenders violate Principle A?

- **Cue-based parsing:** Principle A fallibility is the result of the noisy retrieval process which implements grammatical constraints.
Principle A fallibility in comprehension

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- **Expts 1 and 2** suggest that this approach may be misguided:
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  - Lure referents are selectively accessed on the basis of their suitability as logophoric antecedents.
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  - Principle A fallibility isn’t just an artifact of noisy search.
  - Lure referents are selectively accessed on the basis of their suitability as logophoric antecedents.

Principle A fallibility is not the result of *errors* in memory retrieval, but rather countervailing grammatical principles.
How can these effects inform our theories?

We had two different versions of the Binding Theory:

- Standard Binding Theory (locality and c-command)
- Predicate-based Binding (coargumenthood)

The primary evidence in favor of predicate-based theories is the explanation they afford sentences like (16).

(16) John$_i$’s intentionally misleading testimony was enough to ensure that [the newspaper would print pictures of himself$_i$ the next morning]$_{TP}$.

**Prediction:** Only nonargument reflexives should be sensitive to lures.
Is coargumenthood sufficient to explain Principle A fallibility?

The answer from a wide variety of studies seems to be no.

The role of coarguments

Is coargumenthood sufficient to explain Principle A fallibility?
The answer from a wide variety of studies seems to be no.

- Runner et al. (2003, 2006): Reflexives in possessed picture NPs don’t always refer to their possessor.

(17) Tom liked Jerry’s picture of himself.
Is coargumenthood sufficient to explain Principle A fallibility?

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- Runner et al. (2003, 2006): Reflexives in possessed picture NPs don’t always refer to their possessor.
- Cunnings and Sturt (2014): Picture NP reflexives aren’t always sensitive to lures.

(18) \[
\begin{array}{c}
\text{Mary} \\
\text{Steve}
\end{array}
\] noticed that John posted a picture of herself...
Is coargumenthood sufficient to explain Principle A fallibility?

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(19) The \{actress, actor\} said that the schoolboys embarrassed herself.
Is coargumenthood sufficient to explain Principle A fallibility?

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The present work augments this picture by showing that argument reflexives sometimes behave logophorically.
Predicate-based Binding:

There seems to be good reason to abandon predicate-based theories of binding:

- Not all non-argument reflexives are locally free\(^{21}\)
- Not all argument reflexives are locally bound\(^{22}\)

---

\(^{21}\)Charnavel and Sportiche (2016); Cunnings and Sturt (2014)

\(^{22}\)Parker (2014); Runner et al. (2003, 2006), the present work.
An argument for locality and c-command

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There seems to be good reason to abandon predicate-based theories of binding:

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- Not all argument reflexives are locally bound\textsuperscript{22}

An alternative:
Speakers have sub-grammatical knowledge of logophoricity.

- This knowledge rises to the surface more readily in some situations than in others.
- Nonargument positions happen to be particularly likely to give rise to logophoric interpretations.

\textsuperscript{21}Charnavel and Sportiche (2016); Cunnings and Sturt (2014)
\textsuperscript{22}Parker (2014); Runner et al. (2003, 2006), the present work.
Wrapping up: the case of Principle A

**Linguistic Theory:** What’s the right descriptive form of Principle A?

- Coargumenthood plays a role, but doesn’t seem to be the single factor conditioning non-local interpretations
- Principle A is a function of locality and c-command

**Sentence Processing:** How does Principle A impact processing?

- Comprehenders preferentially access Principle A compatible referents, except when:
  - The Principle A parse is degraded *and*
  - A logophoric interpretation can be computed

**What’s missing:** A theory of how the parser arbitrates between Principle A and logophoric analyses of reflexive forms.
What’s the role of general memory mechanisms in on-line linguistic dependency formation?

It depends on the analysis of the linguistic representation of the dependency. Cue-based parsing models have the ability to explain apparent grammatical fallibility, but they may overlook explanations from linguistic theory.

How can evidence from processing inform linguistic theory?

Investigations of the on-line implementation of linguistic structure can help arbitrate between competing representational theories, but we need a way of distinguishing implementational error from grammatical alternatives.
Logophors in the wild...

Arrested Development, Season 1 Episode 13: ”Beef Consomme”:

- Michael is in love with his brother GOB’s girlfriend, Marta.
Arrested Development, Season 1 Episode 13: ”Beef Consomme”:

- Michael is in love with his brother GOB’s girlfriend, Marta.
- GOB, worried about his relationship, tells Michael that he overheard Marta say she was in love with ”some hermano guy”.

Narrator: Unfortunately, Michael discovered too late that hermano in Spanish meant brother, and the person Marta was infatuated with was, in fact, himself.
Arrested Development, Season 1 Episode 13: "Beef Consomme":

- Michael is in love with his brother GOB’s girlfriend, Marta.
- GOB, worried about his relationship, tells Michael that he overheard Marta say she was in love with "some hermano guy".
- Neither brother remembers the meaning of the word "hermano".
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- Neither brother remembers the meaning of the word "hermano".

(20) **Narrator:** Unfortunately, Michael discovered too late that hermano in Spanish meant brother, and the person Marta was infatuated with was, in fact, himself.
Thank you!

Brian Dillon  Lyn Frazier  Kyle Johnson

Thanks also: Amanda Rysling, Anthony Yacovone, Caroline Andrews, Amanda Doucette, and the UMass psycholing workshop.


The boxer told the skier that the doctor would blame him...

Cross-modal lexical decision:

- **Him**: Semantic priming for associates of *boxer* and *skier*
The boxer told the skier that the doctor would blame himself...

Cross-modal lexical decision:

- **Him**: Semantic priming for associates of *boxer* and *skier*
- **Himself**: Semantic priming only for words related to *doctor*
EXPERIMENT 1: CUMULATIVE PROGRESSION

Lure Match Effect [match–mismatch]

Speech
Perception

Character Progression

Time (ms)

Target Antecedent

+match
−match
(15) **Context:** \{ Some movie critics \} \{ A salacious tabloid \} said some very unflattering things about several Hollywood icons.

**Test:** The \{ actress \} said that \{ it \} lied about herself...
EXPERIMENT 2: CUMULATIVE PROGRESSION

Lure Match Effect [match–mismatch]

Character Progression

Time (ms)

Target Antecedent

Name
It
I
The coargument contrast:

It seems to be the case that non-argument reflexives take long-distance construals more easily than argument reflexives:

(21)  ? John said that the newspaper published an embarrassing picture of himself.

(22)  * John said that the newspaper embarrassed himself by publishing a rude picture.

If logophoric interpretations are available for argument reflexives, why should this contrast hold?
Coargumenthood as coactivation

King, Andrews, & Wagers (2012):

King et al. (2012) proposed that insensitivity to lures is due to the fact that many reflexives are post verbal, and so co-active with other arguments retrieved by the verb.

(23) The mailman who met Susan sent \{ herself a letter \\ a letter to herself \}...

King et al. found:

Lure match facilitation when the reflexive was not immediately post verbal, suggesting that co-activation of referents with the reflexive may be integral to the strong influence of Principle A.
Understanding coargumenthood:

We have observed facts about adherence to Principle A in reflexive interpretation:

- There seems to be a contrast between argument, and non-argument reflexives
- The co-activation of referents seems to play a role in online reflexive comprehension

Given that non-argument reflexives are going to be verb non-adjacent, it seems plausible that they will also not be co-active with other arguments in the sentence. Thus, it may be possible to derive the coargumenthood contrast by appealing to processing facts like co-activation.
Logophoricity in comprehension:

Comprehenders seem to have access to logophoric representations for the purposes of parsing, but is this just a processing strategy?
Sub-grammatical logophoricity

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Logophoricity in production:
Speakers of standard English at least occasionally produce long-distance reflexives compatible with a logophoric interpretation.
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(20) Unfortunately, he discovered too late that hermano in Spanish meant brother, and the person Marta was infatuated with was, in fact, himself.
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Logophoricity in Iron Range English:
IRE has grammatical long-distance reflexives which show person blocking effects analogous to Experiment 2 (Loss, 2014).
Evidence of logophoricity:

- Comprehenders behave in a typologically constrained manner
- Speakers (occasionally) produce logophoric reflexives
- Extant dialects have grammaticized these effects

It seems that English has access to logophoric representations, but perhaps hasn’t fully grammaticized them. This may be analogous to the emergence of the unmarked in Phonology.