Subject Selection in Raising and Control: Psycholinguistic Evidence

Misha Becker
University of North Carolina at Chapel Hill
mbecker@email.unc.edu

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Identifying Silent Subjects

How do you identify a silent subject?
Identifying Silent Subjects

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- \( pro \) → PRO
- \( wh \)-trace → NP-trace

Syntactic Bootstrapping (Gleitman 1990, Gleitman et al. 2005, i.a.)

(a) Subj is verbing → self-directed action/self-contained state
(b) Subj is verbing Obj → causal action
(c) Subj is verbing Obj to IndObj → transfer
(d) Subj verbs that Sentence → mental state/communication

What does \( gorp \) mean?

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Subject Selection in Raising & Control
How do you identify a silent subject?  

(1) John *gorps* [PRO/t to like cheese]

a. *gorp* = claim (→ control → PRO)

b. *gorp* = seem (→ raising → NP-trace)
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\[ \text{pro} \]

\[ \text{wh}-\text{trace} \]

\[ \text{NP}-\text{trace} \]

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Subject Selection in Raising & Control
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Previous work: subject animacy is one probabilistic but important cue learners can use.
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  - cross-linguistically restricted
  - compatible with raising verbs because no selection
Today’s Talk

- I’ll explain why animacy of the matrix subject *should* be a good cue to the identity of the null subject

Outline:

1. Assumptions about the syntax of raising and control
2. Cross-linguistic evidence on animacy in raising and control
3. Psycholinguistic evidence that subject animacy supports learning the identity of the silent subject
4. Additional influences on identity of infinitive subject

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I’ll present some evidence that animacy *is* a good cue for speakers/learners.
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In (2) $\text{John}_i$ is selected only by $\text{like}$
In (3) $\text{John}_i$ is selected only by $\text{claim}$, and PRO is selected by $\text{like}$
(2) John$_i$ seems $[IP\ t_i\ to\ like\ cheese]$
(3) John$_i$ claims $[IP\ PRO_i\ to\ like\ cheese]$

In (2) John is selected only by *like*
In (3) John is selected only by *claim*, and PRO is selected by *like*

<table>
<thead>
<tr>
<th>predicate</th>
<th>external argument</th>
<th>internal argument</th>
<th>infinitive subject</th>
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<tbody>
<tr>
<td>seem</td>
<td></td>
<td>IP</td>
<td>NP-trace</td>
</tr>
<tr>
<td>claim</td>
<td>NP$_{anim}$</td>
<td>IP</td>
<td>PRO</td>
</tr>
<tr>
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<td>NP$_{anim}$</td>
<td>NP(/IP)</td>
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</table>
(4) There seems to be a mess on the table.
(5) * There claims to be a mess on the table.
(4) There seems to be a mess on the table.
(5) * There claims to be a mess on the table.

John gorgs to like cheese.
External arguments are canonically animate
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... in LANGUAGE, not just English
Animate Subjects

External arguments are canonically animate

... in LANGUAGE, not just English

Some exceptions...

(6) The sound frightened Mary.
External arguments are canonically animate

... in LANGUAGE, not just English

Some exceptions...

(6) The sound frightened Mary.
(7) The rock smashed the window.
Inanimate subjects are restricted and rare:

- Many languages require the subject to be “more animate” than the object:
  - Navajo (Athapaskan)
  - Chamorro (Austronesian)
  - Japanese (Altaic)
  - Jacaltec (Mayan)
  - Blackfoot (Algonquian)
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  - Lakhota (Siouan)
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2. Dahl (2000) found that in spoken Swedish 89% of objects are inanimate and 93% of subjects are animate
Animacy across Languages

Crosslinguistically...

\[
\left\{
\begin{array}{l}
\text{more animate} \\
\text{more likely subject} \\
\text{less likely object}
\end{array}
\right\} \leftrightarrow \left\{
\begin{array}{l}
\text{less animate} \\
\text{less likely subject} \\
\text{more likely object}
\end{array}
\right\}
\]

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Parallels in behavior of raising and control vis-à-vis animacy:

- German
- Italian
- Maori
(8) Der Kuchen scheint gut zu schmecken
the cake seem-3s good to taste-INF
“The cake seems to taste good”
(8) Der Kuchen scheint gut zu schmecken
    the cake seem-3s good to taste-INF
    “The cake seems to taste good”

(9) * Der Kuchen versucht gut zu schmecken
    the cake try-3s good to taste-INF
    (“The cake is trying to taste good”)
Italian

(10) Questo libro sembra troppo lungo
   this book-M seem-3s too long-M
   “This book seems (to be) too long”
ITALIAN

(10) Questo libro sembra troppo lungo
this book-M seem-3s too long-M
“This book seems (to be) too long”

(11) * Questo libro provava essere troppo lungo
this book try-IMPF/3s be-INF too long
(“This book tried to be too long”)
Cross-linguistic Animacy Patterns in Raising and Control

Maori, Tongan (Polynesian), Chamorro (Austronesian)
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**Maori** (VSO; raising verb: ‘not/don’t’) (Chung 1978)

(12) a. Kīhai i haere\textsubscript{V} a Tamahae\textsubscript{S}
    not PST go DET T.
    “Tamahae didn’t go” (unraised)

b. Kīhai a Tamahae\textsubscript{S} i haere\textsubscript{V}
    not DET T. PST go
    “Tamahae didn’t go” (raised)
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“Tamahae didn’t go”

(13)  

a. Kāore anō kia whiti\textsubscript{V} [te rā]\textsubscript{S}  
not yet SUBJ shine the sun  

“The sun hasn’t risen yet”  

(b. Kāore anō [te rā]\textsubscript{S} kia whiti\textsubscript{V}  
not yet the sun SUBJ shine  

“The sun hasn’t risen yet”
Maori (control verb: ‘want’)

(14)  a. Ka hiahia/V / whakaarotV auS ki te haere
     TAM want / think I COMP go
     “I want/decided to go”

b. *I hiahia/V koesS ki te riro i te wahine
   PST want you COMP taken CAUS the woman
   (“You wanted to be taken away by the woman”)
Ambiguous Verbs

English *begin*:

- a. It began to rain.
- b. The carpenter began [PRO to saw through the wood]
English *begin*:

(15)  
  a. It began to rain.  
  b. The carpenter began [PRO to saw through the wood]
With verbs that are ambiguous in permitting either raising or control readings, an inanimate subject typically forces a raising interpretation:

(16)  a. The ball began to roll down the hill. (→ by gravity)
    b. Charles began to roll down the hill. (→ by gravity or own volition)
Wurmbrand (2001): two types of “restructuring”
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Only lexical restructuring verbs permit extraposition of the infinitive.
Only **lexical restructuring** verbs permit **extraposition** of the infinitive.

(17) a. ... dass Hans t versuchte [den Kuchen zu essen]  
    that John t try-PST the cake to eat-INF  
    “that John tried to eat the cake”

b.  *... dass Hans t schien [den Kuchen gegessen zu hab en]  
    that John t seem-PST the cake eat-PART to have-INF  
    (“that John seemed to have eaten the cake”)
Because they threatened to lock me in an insane asylum

"because the game threatens to get off track"
Drohen ‘threaten’: ambiguous verb

(18) ... weil man mir t gedroht hat, [mich in because one me/Dat t threaten-PART have-3s me/Acc in ein Irrenhaus zu sperren] a insane asylum to lock-INF

“Because they threatened to lock me in an insane asylum”
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“Because they threatened to lock me in an insane asylum”

(19) *... weil das Spiel t droht, [aus den Fugen zu because the game t threaten-3s out the track geraten] to fall-INF

(“because the game threatens to get off track”)

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(19)   *... weil das Spiel t droht, [aus den Fugen zu because the game t threaten-3s out the track geraten] to fall-INF

(“because the game threatens to get off track”)

(20)   Das Spiel droht aus den Fugen zu geraten
the game threaten-3s out the track to fall-INF

“The game threatens to get off track”
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“The game threatens to get off track”

⇒ lexical restructuring in (18); functional restructuring in (19).
So far:

- control predicates select an external argument (canonically animate) which controls the subject (PRO) of the embedded clause.
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Interim Summary

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- Raising predicates do not select an external argument, allow embedded subject to raise $\rightarrow$ embedded subject is NP-trace.
- Cross-linguistic data: Control predicates prefer an animate subject, raising predicates don’t care (no selection) $\rightarrow$ inanimate subjects OK.
So far:

- control predicates select an external argument (canonically animate) which controls the subject (PRO) of the embedded clause
- raising predicates do not select an external argument, allow embedded subject to raise $\rightarrow$ embedded subject is NP-trace
- cross-linguistic data: control predicates prefer an animate subject, raising predicates don’t care (no selection) $\rightarrow$ inanimate subjects OK
- ambiguous predicates: inanimate subject often forces a raising interpretation
How do children learn to distinguish raising from control structures → identify the silent subject as trace vs. PRO?

My claim: learners use assumptions about canonical argument structure relations

- external arguments are animate
- inanimate subjects are probably not selected locally

This involves a combination of Syntactic and Semantic Bootstrapping

 Speakers expect subjects to be animate, and animate subjects to be selected by their local predicate

Psycholinguistic studies of adults and children: animate subjects are interpreted as external arguments, inanimate subjects aren’t
Acquiring the Raising/Control Distinction

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- Children have expectations about semantic properties of syntactic categories
  - Nouns label people/objects
  - Verbs label events/states
  - Adjectives label attributes
  - etc.

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- Children have expectations about the semantic properties of grammatical roles
  - Agent $\rightarrow$ subject
  - Event $\rightarrow$ verb
  - Patient $\rightarrow$ object
  - etc.
[the] categorization of words can be inferred from their semantic properties, and their grammatical relations can be inferred from the semantic relations in the event witnessed.

(Pinker 1984, p.40)
## Semantic vs. Syntactic Bootstrapping

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<tr>
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<tbody>
<tr>
<td>Human</td>
<td></td>
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- More animate NPs → more likely subject
- Less animate NPs → mapped to lower positions
- Inanimate subject was probably raised

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- Syntactic Bootstrapping: can't learn abstract verbs by witnessing scenes
- Use syntax frame to narrow down verb meaning
- If subject was raised, verb means something about appearance/aspect/negation/modality (not desire, effort)
Semantic vs. Syntactic Bootstrapping

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- inanimate subject $\rightarrow$ unexpected!
- inanimate subject was probably raised
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   - Inanimate subject $\rightarrow$ unexpected!
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2. **Syntactic Bootstrapping**
Semantic vs. Syntactic Bootstrapping

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<thead>
<tr>
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<tbody>
<tr>
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<td></td>
<td>Subject</td>
</tr>
<tr>
<td>Non-human Animal</td>
<td></td>
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<tr>
<td>Inanimate</td>
<td></td>
<td>Theme</td>
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1. **Semantic Bootstrapping**
   - More animate NP → more likely subject
   - Less animate NPs → mapped to lower positions
   - inanimate subject → unexpected!
   - inanimate subject was probably raised

2. **Syntactic Bootstrapping**
   - can’t learn abstract verbs by witnessing scenes
   - use syntax frame to narrow down verb meaning
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1. Semantic Bootstrapping
   - More animate NP $\rightarrow$ more likely subject
   - Less animate NPs $\rightarrow$ mapped to lower positions
   - Inanimate subject $\rightarrow$ unexpected!
   - Inanimate subject was probably raised

2. Syntactic Bootstrapping
   - Can’t learn abstract verbs by witnessing scenes
   - Use syntax frame to narrow down verb meaning
   - If subject was raised, verb means something about appearance/aspect/negation/modality (not desire, effort)
Fill-in-the-blank

Test items

(21) NP _______ [IP to [VP]]

(22) Warren _______ to hate rutabagas, but his mom made him eat them anyway. (verb)
Fill-in-the-blank

Test items

(21) NP ______  [IP to [VP]]
(22) Warren ______  to hate rutabagas, but his mom made him eat them anyway. (verb)

Fillers

(23) On a ______  Saturday in April, Megan hauled the lumber over to the toolshed. (adjective)
(24) The **salesman** ____ to advertise an interesting new product.
⇒ animate
(24) The salesman _____ to advertise an interesting new product.  
⇒ animate

(25) The banner _____ to advertise an interesting new product.  
⇒ inanimate
(24) The salesman _____ to advertise an interesting new product.  
⇒ animate

(25) The banner _____ to advertise an interesting new product.  
⇒ inanimate

Responses in Subject Animacy Condition

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<tr>
<th>Sentence</th>
<th>Control (N)</th>
<th>Raising (N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The salesman ...</td>
<td>52.5% (42)</td>
<td>18.8% (15)</td>
</tr>
<tr>
<td>The banner ...</td>
<td>17.5% (14)</td>
<td>43.8% (35)</td>
</tr>
</tbody>
</table>
Novel verbs and their "meanings"

- joop to look a certain way
- rickle to really dislike being someplace
- meb to probably be a certain way
- sart to make a big effort to be some way
- trollick to be some way most of the time
- zid to really enjoy being someplace

Novel verbs were presented in sentences; we assessed whether people interpreted the novel verbs as raising or control verbs.
Novel Verbs and their “Meanings”

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<td>trollick</td>
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Novel verbs were presented in sentences; we assessed whether people interpreted the novel verbs as raising or control verbs.
Between-participants manipulations:

1. explicit definition provided or not
2. sentence “frame” informative/uninformative for categorization
Example: \textit{joop}

1. The old man \textit{joops} to be very tired. (uninformative)
Example: *joop*

1. The old man *joops* to be very tired. (uninformative)
2. The book *joops* to be very long. (informative: inanimate)
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(a) There *joops* to be a computer on the desk. (*there*-construction)
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2. The book joops to be very long. (informative: inanimate)
3. It joops to be sunny outside. (informative: expletive)

(a) There joops to be a computer on the desk. (**there**-construction)
(b) What the fairy joops is to be small. (**pseudocleft**)
Results: % Expected Responses (N = 185)
Animate subjects: Adults are biased to expect the main clause subject to be the external argument.
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This bias can be interrupted when a novel verb is presented with an inanimate subject.
Animate subjects: Adults are biased to expect the main clause subject to be the external argument.

This bias can be interrupted when a novel verb is presented with an inanimate subject.

An inanimate subject is unlikely to be selected by the main predicate $\Rightarrow$ silent subject is NP-trace, not PRO.
Psycholinguistic Studies with Children


. . . with animate subjects

Misha Becker, UNC Chapel Hill

Subject Selection in Raising & Control
Hirsch & Wexler (2007), Orfitelli (2012): children acquire raising late...
Hirsch & Wexler (2007), Orfitelli (2012): children acquire raising late...
...with *animate* subjects
<table>
<thead>
<tr>
<th>Item</th>
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<tbody>
<tr>
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<td>control</td>
</tr>
<tr>
<td>The flower wants to fly away</td>
<td>control</td>
</tr>
<tr>
<td>The hay seems to be on the ground</td>
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When subjects are animate, children give correct interpretations of control sentences:

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<td>The pig wanted to eat the doughnut</td>
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* sig. above chance, ** p ≤ 0.01, p ≤ 0.05

Previous work shows children age 4+ have accurate interpretations of object-control PRO (Cohen Sherman & Lust 1995).
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Previous work shows children age 4+ have accurate interpretations of object-control PRO (Cohen Sherman & Lust 1995).
When presented with a sentence of the form NP verb $[IP \text{ to } VP]$
When presented with a sentence of the form NP verb \([IP \rightarrow VP]\)

- adults and children project a control structure if the main clause subject is animate (infinitive subject is PRO)
When presented with a sentence of the form NP verb [\textit{IP} to \textit{VP}]

- adults and children project a control structure if the main clause subject is animate (infinitive subject is PRO)
- and a raising structure if the main clause subject is inanimate (infinitive subject is NP-trace)
Additional Complicating Factors... Eventivity

(26) a. The driver to hit the car on the passenger's side. ⇒ animate/eventive

(27) a. His campaign manager to remain a problem for the mayoral candidate. ⇒ animate/stative
(26)  a. The **driver** ______ to hit the car on the passenger’s side. ⇒ animate/eventive  
b. The **boulder** ______ to hit the car on the passenger’s side. ⇒ inanimate/eventive  

(27)  a. His **campaign manager** ______ to remain a problem for the mayoral candidate. ⇒ animate/stative  
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Recall: animate subject → control verbs, inanimate subject → raising verbs
### Responses Considering both Animacy and Eventivity (Becker 2005)

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<td>65% (26)</td>
<td>5% (2)</td>
</tr>
<tr>
<td>The boulder ... to hit</td>
<td>32.5% (13)</td>
<td>17.5% (7)</td>
</tr>
<tr>
<td>His manager ... to remain</td>
<td>40% (16)</td>
<td>32.5% (13)</td>
</tr>
<tr>
<td>The affair ... to remain</td>
<td>2.5% (1)</td>
<td>70% (28)</td>
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(28) John_{animate} tried [PRO to remain_{stative} calm.]

(29) The tomato_{inanimate} seemed [t to grow_{eventive} well in the sun.]
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(30)  Agent/Force verb [IP_{inf} to eventive-verb]
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(31) Theme verb \[ \text{IP}_{\text{inf}} \text{ to stative-verb } \]
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Conclusions

- Cues to the syntactic identity of an infinitive subject (PRO vs. trace) can be found in the animacy of the matrix subject.

We expect this based on behavior of raising and control structures with respect to animacy across languages such as German, Italian, and Maori. The expectation bears out in psycholinguistic studies with adults and children.

In addition, the eventivity of the embedded predicate influences speakers' assumption that the embedded subject is PRO vs. trace.

Future directions: explore the eventivity effect further.
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Thank you!

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Charles Yang
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Expressive Communication and Origins of Meaning Group
Institute for Arts and Humanities
Subject Selection in Raising & Control

Misha Becker, UNC Chapel Hill