Inanimacy in the Input
How a very infrequent cue can still be very powerful

Misha Becker
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Introduction

How do children figure out the structure of sentences in which

the true grammatical relations which hold among the words in a sentence are not expressed directly in its surface structure. (C. Chomsky 1969, p.6)
(1)  

a. The climber; seemed \([t_i \text{ to be stuck}.]\) (raising verb)
b. Max; is easy \([(\text{Op}) \text{PRO}_{arb} \text{ to see } t_i.]\) (tough-adjective)
c. The relatives; arrived \(t_i\) at the wedding. (unaccusative)
(2) a. The climber; pretended [PRO; to be stuck.] (control verb)
b. Max; is eager [PRO; to see e.] (control adjective)
c. The relatives danced at the wedding. (unergative)
Learning Problem

(3) a. The climber gorped to be stuck.
b. Max is daxy to see.
c. The relatives flimmed at the wedding.
Inanimate Subjects

(4) a. The rock seemed to be stuck.
   b. # The rock pretended to be stuck.

(5) a. The house is easy to see.
   b. # The house is eager to see.

(6) a. The gifts arrived at the wedding.
   b. # The gifts danced at the wedding.
(7)  
    a. The rock gorped to be stuck.
    b. The house is daxy to see.
    c. The gifts flimmed at the wedding.
1. Naturalistic input (child-directed speech)
2. Simulated learning tasks (children and adults)
1. Naturalistic input (child-directed speech)
2. Simulated learning tasks (children and adults)

Inanimate subject $\rightarrow$ infrequent, but...
$\rightarrow$ unlikely to be external argument
$\rightarrow$ noncanonical underlying structure
Do children hear inanimate subjects in the input?
1. Do children hear inanimate subjects in the input?

2. Do they hear inanimate subjects disproportionately with displacing predicates?
1. Do children hear inanimate subjects in the input? (kind of)
2. Do they hear inanimate subjects *disproportionately* with displacing predicates? YES!
### Mothers’ Use of Animate/Inanimate Subjects with Raising and Control Verbs

<table>
<thead>
<tr>
<th>Raising Verbs</th>
<th>Animate Subjects</th>
<th>Inanimate Subjects</th>
<th>% Inanimate Subj.</th>
</tr>
</thead>
<tbody>
<tr>
<td>seem</td>
<td>4</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>used (to)</td>
<td>45</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>going (to)</td>
<td>1197</td>
<td>58</td>
<td>5.2%</td>
</tr>
<tr>
<td>total</td>
<td>1246</td>
<td>69</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Control Verbs</th>
<th>Animate Subjects</th>
<th>Inanimate Subjects</th>
<th>% Inanimate Subj.</th>
</tr>
</thead>
<tbody>
<tr>
<td>want</td>
<td>405</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>like</td>
<td>210</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>try</td>
<td>86</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>love</td>
<td>10</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>hate</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>712</td>
<td>2</td>
<td>0.3%</td>
</tr>
</tbody>
</table>

$$\chi^2 = 33.8, \ df = 1, p \leq 0.001; \quad \text{(Adapted Mitchener & Becker 2011, pp.175–176)}$$
Mothers’ Use of Animate and Inanimate Subjects with *Tough*/Control Adjectives

<table>
<thead>
<tr>
<th>Tough-Adjectives*</th>
<th>Animate Subj.</th>
<th>Inanimate Subj.</th>
<th>% Inanimate Subj.</th>
</tr>
</thead>
<tbody>
<tr>
<td>hard</td>
<td>0</td>
<td>41</td>
<td></td>
</tr>
<tr>
<td>difficult</td>
<td>0</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>easy</td>
<td>0</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>0</td>
<td>48</td>
<td>100%</td>
</tr>
</tbody>
</table>

Control Adjectives**

<table>
<thead>
<tr>
<th></th>
<th>Animate Subj.</th>
<th>Inanimate Subj.</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>happy</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>afraid</td>
<td>2</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>glad</td>
<td>4</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>10</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

\[\chi^2 = 58.0, \ df = 1, \ p = 0.00\]

*tough was not used; **anxious, willing and eager were not used.
Mothers’ Use of Animate and Inanimate Subjects with Unaccusatives and Unergatives

<table>
<thead>
<tr>
<th>Unaccusatives</th>
<th>Animate Subject</th>
<th>Inanimate Subject</th>
<th>% Inanimate Subj.</th>
</tr>
</thead>
<tbody>
<tr>
<td>close</td>
<td>0</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>come</td>
<td>375</td>
<td>169</td>
<td></td>
</tr>
<tr>
<td>fall</td>
<td>176</td>
<td>139</td>
<td></td>
</tr>
<tr>
<td>open</td>
<td>1</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>552</td>
<td>335</td>
<td>38.8%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Unergatives</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>cry</td>
<td>122</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>dance</td>
<td>60</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>laugh</td>
<td>25</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>207</td>
<td>12</td>
<td>5.5%</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 85.0, \ df = 1, \ p \leq 0.001 \]
Unaccusative and Unergative Verbs and Subject Animacy

(8)  a. The sunshine is laughing. (Adam 12)
    b. What kind of egg dances around? (Adam 21)
    c. The teapot’s crying? (Nina 18)
Mothers’ Use of Animate and Inanimate Subjects with Unaccusatives and Unergatives

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<td>122</td>
<td>5</td>
<td></td>
</tr>
<tr>
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<td>60</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>laugh</td>
<td>25</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>total</td>
<td>207</td>
<td>12 (8)</td>
<td>5.5% (3.7%)</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 85.0, \ df = 1, \ p \leq 0.001 \]
<table>
<thead>
<tr>
<th>Predicate</th>
<th>Inanimate Subj</th>
<th>Predicate</th>
<th>Inanimate Subj</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raising V</td>
<td>5.2%</td>
<td>Control V</td>
<td>0.3%</td>
</tr>
<tr>
<td>Tough-Adj</td>
<td>100%</td>
<td>Control Adj</td>
<td>0%</td>
</tr>
<tr>
<td>Unaccusative</td>
<td>37.8%</td>
<td>Unergative</td>
<td>5.5%</td>
</tr>
</tbody>
</table>
In CDS parents use non-displacing predicates (control, unergatives) with inanimate subjects approx. 0%
1. In CDS parents use non-displacing predicates (control, unergatives) with inanimate subjects approx. 0%
2. They use displacing predicates (raising, *tough*, unaccusatives) with inanimate subjects > 0% (much variation)
1. In CDS parents use non-displacing predicates (control, unergatives) with inanimate subjects approx. 0%.
2. They use displacing predicates (raising, *tough*, unaccusatives) with inanimate subjects > 0% (much variation).
3. Can learners use this cue to categorize novel predicates?
In CDS parents use non-displacing predicates (control, unergatives) with inanimate subjects approx. 0%.

They use displacing predicates (raising, tough, unaccusatives) with inanimate subjects > 0% (much variation).

Can learners use this cue to categorize novel predicates?

Two word-learning experiments:

- adults: novel raising/control verbs
- children: novel tough/control adjectives
Word-Learning Experiments: Adult Studies
# Word-Learning Experiments: Adult Studies

## Table: Novel Verbs and their Meanings (Becker & Estigarribia 2011)

<table>
<thead>
<tr>
<th>Raising</th>
<th>Definition</th>
<th>Control</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>joop</td>
<td>to look a certain way</td>
<td>rickle</td>
<td>to really dislike being someplace</td>
</tr>
<tr>
<td>meb</td>
<td>to probably be a certain way</td>
<td>sart</td>
<td>to make a big effort to be some way</td>
</tr>
<tr>
<td>trollick</td>
<td>to be some way most of the time</td>
<td>zid</td>
<td>to really enjoy being someplace</td>
</tr>
</tbody>
</table>
Word-Learning Experiments: Adult Studies

Between-participants manipulations:

1. how many exemplars (1, 3 or 5)
2. explicit definition provided or not
3. sentence “frame” informative for categorization or not
The lifeguard trollicks to have a tan

wants/likes

seems/tends
The lifeguard trollicks to have a tan
wants/likes
seems/tends

The kitchen sink trollicks to be full of dirty dishes vs. Cats zid the sunshine
seems/*likes

likes/*seems

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Inanimacy in the Input
Linguistic cues

Frame

informative uninformative

Definition

definition no definition

Inform. frame + definition

Uninform. frame + definition

Inform. frame + no def.

*Uninform. frame + no def.
Example: **joop**
1. The old man joops to be very tired.
2. The book joops to be very long.
3. It joops to be sunny outside.

   (a) There joops to be a computer on the desk. (*there*-construction)
(b) What the fairy joops is to be small. (pseudocleft)
Results: % Correct

185 adult participants
Word-Learning Experiments: Child Studies
Word-Learning Experiments: Child Studies

Becker, Estigarribia & Gylfadottir (2011)
- 40 children ages 4–7 years
- Novel adjective task

(10) The NP is Adjective to VP
    Adj = easy, eager
# Word-Learning Experiments: Child Studies

## Table: Novel Adjectives in Child Study

<table>
<thead>
<tr>
<th>Tough Adj</th>
<th>Contextual Meaning</th>
<th>Control Adj</th>
<th>Contextual Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>daxy</td>
<td>easy</td>
<td>greppy</td>
<td>happy/willing</td>
</tr>
<tr>
<td>stroppy</td>
<td>easy</td>
<td>narpy</td>
<td>happy/excited</td>
</tr>
</tbody>
</table>

The table shows the adjectives used in the child study along with their contextual meanings.
<table>
<thead>
<tr>
<th>Adjective</th>
<th>Example sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>daxy</td>
<td>An apple is very daxy to draw</td>
</tr>
<tr>
<td>stroppy</td>
<td>The motorcycle is not at all stroppy to hide</td>
</tr>
<tr>
<td>greppy</td>
<td>I’m sure Mr. Farmer would be greppy to help</td>
</tr>
<tr>
<td>narpy</td>
<td>My teacher was narpy to teach—she gave us fun projects</td>
</tr>
</tbody>
</table>

**Group 2:**

<table>
<thead>
<tr>
<th>Adjective</th>
<th>Example sentence</th>
</tr>
</thead>
<tbody>
<tr>
<td>daxy</td>
<td>The policeman is not daxy to draw (his uniform is complicated)</td>
</tr>
<tr>
<td>stroppy</td>
<td>I bet the nurse is stroppy to hide (she’s quiet)</td>
</tr>
<tr>
<td>greppy</td>
<td>(same as Group 1)</td>
</tr>
<tr>
<td>narpy</td>
<td>(same as Group 1)</td>
</tr>
</tbody>
</table>
Methodology: RT in response to Yes/No questions (after Naigles, Fowler & Helm 1995)

- Longer RT for ungrammatical questions
- Shorter RT for grammatical questions

![Graph showing RT comparison between grammatical and ungrammatical questions.](image-url)
(11) a. Is it Adjective to VP?  
Is it hard to talk to the nurse?  
*Is it afraid to fight the dinosaur?

b. Is NP Adjective?  
*Is the nurse hard?  
Is the nurse afraid?
Inanimacy in the Input

![Graph showing the comparison between grammatical and ungrammatical inputs for 'hard' and 'afraid'.]
Results: Group 1 (animacy cue)

![Graph showing the results for Group 1 with lines representing inan/TC and ctrl. The x-axis represents G and UG, and the y-axis represents values ranging from 2.5 to 3.3. The graph indicates a significant difference between the two groups.]
Results: Group 2 (no animacy cue)

![Graph showing the results of Group 2 with no animacy cue. The graph compares the performance of two conditions: anim/TC and ctrl, with G and UG on the x-axis and values ranging from 2.8 to 3.4 on the y-axis. The graph indicates a linear increase in performance for both conditions.]
Misha Becker UNC Chapel Hill

Inanimacy in the Input

Learning Problem
Naturalistic Input
Experimental Input
Conclusions

- Inanimacy in the Input
Our 4-year-olds behaved the same as our 7-year-olds
No Age Effects

- Our 4-year-olds behaved the same as our 7-year-olds
- But conventional wisdom: *tough* constructions are hard for children until age 6–10 years
No Age Effects

- Our 4-year-olds behaved the same as our 7-year-olds
- But conventional wisdom: *tough* constructions are hard for children until age 6–10 years
- Why did our kids do better?
No Age Effects

- Our 4-year-olds behaved the same as our 7-year-olds
- But conventional wisdom: *tough* constructions are hard for children until age 6–10 years
- Why did our kids do better?
- Inanimacy is helpful!
Results: Group 1 vs. Group 2

![Graph showing comparison between Group 1 and Group 2](image-url)
Inanimate subjects indicate a displaced subject
Summary

- Inanimate subjects indicate a displaced subject
- In CDS inanimate subjects are rare but occur disproportionately with displacing predicates
Inanimate subjects indicate a displaced subject

In CDS inanimate subjects are rare but occur disproportionately with displacing predicates

Adults and children use inanimate subjects to categorize novel predicates as displacing predicates
Summary

- Inanimate subjects indicate a displaced subject
- In CDS inanimate subjects are rare but occur disproportionately with displacing predicates
- Adults and children use inanimate subjects to categorize novel predicates as displacing predicates

Why is animacy a good cue to (noncanonical) sentence structure?
Summary

- Inanimate subjects indicate a displaced subject
- In CDS inanimate subjects are rare but occur disproportionately with displacing predicates
- Adults and children use inanimate subjects to categorize novel predicates as displacing predicates

1. Why is animacy a good cue to (noncanonical) sentence structure?
2. Where do the (displacing/nondisplacing) predicate categories come from?
Why is Animacy a Good Cue?
Why is Animacy a Good Cue?

Before age 3 months babies distinguish people vs. objects in attention, cooing, reaching
Why is Animacy a Good Cue?

Before age 3 months babies distinguish people vs. objects in attention, cooing, reaching

Distinguish on basis of . . .
- features (face vs. no face)
Why is Animacy a Good Cue?

Before age 3 months babies distinguish people vs. objects in attention, cooing, reaching

Distinguish on basis of...

- features (face vs. no face)
  - prefer drawings of faces vs. non-faces
  - prefer faces w/ normal configuration over scrambled configuration
Why is Animacy a Good Cue?

Before age 3 months babies distinguish people vs. objects in attention, cooing, reaching

Distinguish on basis of...
- features (face vs. no face)
  - prefer drawings of faces vs. non-faces
  - prefer faces w/ normal configuration over scrambled configuration
- self-propelled motion (7 months)
Why is Animacy a Good Cue?

Crosslinguistically...

{ more animate
  more likely subject
  less likely object } ←→ { less animate
  less likely subject
  more likely object }

Animacy Hierarchy  \sim  Thematic Hierarchy

<table>
<thead>
<tr>
<th>Human</th>
<th>Agent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-human Animate</td>
<td>Goal/Source</td>
</tr>
<tr>
<td>Inanimate</td>
<td>Theme</td>
</tr>
</tbody>
</table>
Where do the Categories Come From?

Does subject animacy help fit novel predicates into categories already known?
Where do the Categories Come From?

1. Does subject animacy help fit novel predicates into categories already known?
2. Or does it help construct the categories themselves?
Where do the Categories Come From?

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- inanimate subjects used disproportionately with displacing predicates
Where do the Categories Come From?

1. Does subject animacy help fit novel predicates into categories already known?
2. Or does it help construct the categories themselves?

- inanimate subjects used disproportionately with displacing predicates
- but proportions not uniform across types of predicates
<table>
<thead>
<tr>
<th>Predicate</th>
<th>Inanimate Subj</th>
<th>Predicate</th>
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</tr>
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<tbody>
<tr>
<td>Raising V</td>
<td>5.2%</td>
<td>Control V</td>
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<td>Unaccusative</td>
<td>37.8%</td>
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</tr>
<tr>
<td><em>Tough</em>-Adj</td>
<td>100%</td>
<td>Control Adj</td>
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<td>100%</td>
<td>Control Adj</td>
<td>0%</td>
</tr>
</tbody>
</table>

⇒ Subject inanimacy is useful for categorizing predicates into known categories but not useful for creating categories
Acknowledgements

Thank you to...

Bruno Estigarribia
Duna Gylfadottir
Brian Cansler
Marguerite Cameron
W. Garrett Mitchener
Chris Wiesen
UNC Humanities Division support grant
Lisa Pearl, Jon Sprouse and NSF
Inanimacy in the Input
Results: Group 1 vs. Group 2

![Graph showing the comparison between Group 1 and Group 2.](image)
What about Expletives?

Expletives are important and should be used as a learning cue!
What about Expletives?

Expletives are important and should be used as a learning cue!
But...

- they are not found in all languages, while inanimate NPs are
What about Expletives?

Expletives are important and should be used as a learning cue!
But...

- they are not found in all languages, while inanimate NPs are
- they are very rare in input to children (13% for raising verbs (Hirsch & Wexler 2007))
What about Expletives?

Expletives are important and should be used as a learning cue!
But...

- they are not found in all languages, while inanimate NPs are
- they are very rare in input to children (13% for raising verbs (Hirsch & Wexler 2007))
- they are not necessarily an unequivocal cue since there can be “ambiguous” displacing/nondisplacing predicates (begin, Perlmutter 1970)
Passives also have derived subjects and allow those subjects to be inanimate. . .

(12) The cookie was eat-en (by the girl).
(13) The girl ate the cookie.
What about Passives?

But...

- passives are morphosyntactically different from their active counterparts
What about Passives?

But...

- passives are morphosyntactically different from their active counterparts
- the only candidate for a parallel nondisplacing counterpart is adjectival passives which also allow inanimate subjects
What about Passives?

But...

- passives are morphosyntactically different from their active counterparts.
- the only candidate for a parallel nondisplacing counterpart is adjectival passives which also allow inanimate subjects.
- the core lexical meaning of *eat* is not different between the two voices (cf. *easy* vs. *eager*).
What about Passives?

But...

- passives are morphosyntactically different from their active counterparts
- the only candidate for a parallel nondisplacing counterpart is adjectival passives which also allow inanimate subjects
- the core lexical meaning of eat is not different between the two voices (cf. easy vs. eager)
- Lempert (1989): children trained on animate patients produce more passives than children trained on inanimate patients (latter produce more actives)