Lexical alternatives and the acquisition of subordinate nouns

June Choe and Anna Papafragou

University of Pennsylvania
Specificity of word meanings

Word learning is challenging because words don’t just label objects - they invoke **specific meanings** that the speaker **intends to convey**.

It’s hard to disambiguate word meanings that enter into a **subset-superset relationship** (e.g., ‘dog’ vs. ‘dalmatian’) even under referential certainty.

*Quine (1960); Clark (1987, 1990); Markman (1984, 1990)*
“This is a fep”
“Basic”-level bias

animal > dog > dalmatian

“superordinate” "subordinate"
The challenge of subordinate nouns

animal

“fep”

dog

dalmatian
Linguistic cues to subordination

“Anchoring” to known basic-level category can scaffold subordinate-level distinctions (e.g., “This is a dog. It is a terrier”. Callanan 1985; Waxman et al. 1991, 1997)

Conventions in linguistic form can serve as evidence for subordination (e.g., compound vs. single nouns. Clark 1987; Gelman et al. 1989)

Perhaps assumes richness of input & experienced language learner?
Evidence from cross-situational learning
Evidence from cross-situational learning

- Style of exemplar presentation (simultaneous presentation of exemplars highlights shared details; Spencer et al. 2011 among others)
Bottom-up perceptual account

Sequential

DOG-features
4-legged, has tail and snout, ...

Simultaneous

DALMATIAN-features
Spotted, lean, has long tail, ...

Spencer et al. (2011); Jenkins et al. (2015, 2021)
Evidence from cross-situational learning

- **Style of exemplar presentation** (simultaneous presentation of exemplars highlights shared details; Spencer et al. 2011 among others)

- **Sampling of exemplars** (“suspicious coincidence” of subordinate-level exemplars given basic-level meaning; Xu & Tenenbaum 2007 among others)
“Suspicious Coincidence” account

Observed

“dalmatian”  “dalmatian”  “dalmatian”

Un-observed

“dalmatian”

Xu and Tenenbaum (2007); Lewis and Frank (2018)
Evidence from cross-situational learning

- **Style of exemplar presentation** (simultaneous presentation of exemplars highlights shared details; Spencer et al. 2011 among others)

- **Sampling of exemplars** ("suspicious coincidence" of subordinate-level exemplars given basic-level meaning; Xu & Tenenbaum 2007 among others)

Effect can disappear under other circumstances of task (e.g., learning other categories within/across the basic-level; Wang & Trueswell 2019, 2022)
Subordinate nouns as a pragmatic puzzle

**Prior framing:** The learner tracks label-referent pairings as fundamental unit of evidence and discovers the “subordinate-ness” of the word.

**Current study:** When do learners expect to hear a word with a narrower (subordinate-level) meaning?

- Driven by inferences about the level of informativity intended by the speaker in the use of a word.
Informativity and the conceptual hierarchy

Informativity maps onto the **vertical scale** in the conceptual hierarchy

- ‘Dalmatian’ is not only a smaller conceptual category than ‘dog’; also a **more informative description** than ‘dog’ (“generic addressee” informativity).
Hypothesis

An explicit alternative at the subordinate-level should make the narrower subordinate-level meanings relevant for the target word.
Research questions

2 online experiments with adults:

Experiment 1: Do basic-level generalizations decrease if the target label is accompanied by a **semantic alternative at the subordinate-level**?

Experiment 2: Is the contribution of semantic contrast specifically about the **labelling of the alternative**, or does presenting a merely conceptual (i.e., unlabelled) contrast suffice?
Method: Immediate Generalization Paradigm

Training

“... kapsin ...”

Testing

“... Click on all the kapsins!”
Experiment 1 - Training conditions

No Contrast

“Look, this is a kapsin. Do you see the kapsin?”

Contrast

“... kapsin ...”  “... tantol ...”
Experiment 1 - Test grid

2 target subordinate
2 alternative subordinate
3 other basic
3 superordinate
8 other domains
Experiment 1 - Coding

Subordinate-level generalization
Experiment 1 - Coding

Basic-level generalization
Experiment 1 - Results

53 participants; 388 responses
Experiment 1 - Results

Significant* decrease in the proportion of Basic responses (& increase in Subordinate responses) when the semantic alternative is present.

Note:
1) Large % of Other responses
2) Low overall % of Basic responses

53 participants; 388 responses

P<0.0001; Chi-squared test of independence
Aside) “Incomplete Basic” responses
Experiment 2 - Learning conditions

Unlabelled Contrast

“... kapsin ...”

“... tantol ...”

Labelled Contrast

“And look here!

Do you see this?”
Experiment 2 - Learning conditions

Unlabelled Contrast

“Look here!
Do you see this?”

“... kapsin ...”

Labelled Contrast

“... tantol ...”

“... kapsin ...”
Experiment 2 - Results

90 participants; 669 responses

<table>
<thead>
<tr>
<th></th>
<th>$\beta$ (SE)</th>
<th>$t$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Intercept)</td>
<td>-7.6 (1.7)</td>
<td>-4.5</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Label</td>
<td>-2.7 (0.5)</td>
<td>-5.3</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Order</td>
<td>2.5 (0.9)</td>
<td>2.9</td>
<td>0.0033</td>
</tr>
</tbody>
</table>
Discussion: alternative accounts

Findings are unexpected under accounts where **information outside of referent introduction** is not considered evidence for word meaning.

- The semantic alternative does not contribute to the perceptual or distributional profile of the target label itself.

Consistent with hypothesis testing models tracking conjectures (e.g., Trueswell et al. 2013; Stevens et al. 2017), and Bayesian models reasoning over cues beyond the choice of labelled exemplar (e.g., Frank & Goodman 2012; 2014)
Discussion: pragmatic connections

Young children (~5 y.o.) interpret “some” in only the logical sense:

“Some giraffes have long necks”

- **Logical:** ✓ There exists giraffes with long necks.
- **Pragmatic:** ? Not just some but *all* do!

Conceptual difficulty? Processing difficulty?
Discussion: pragmatic connections

Young children (~5 y.o.) interpret “some” in only the logical sense:

“Some giraffes have long necks”

- **Logical:** ✓ There exists giraffes with long necks.
- **Pragmatic:** ? Not just some but *all* do!

Conceptual difficulty? Processing difficulty?

- Also been claimed for subordinate nouns! (Ross & Murphy, 1996; Sloutsky et al., 2007)
Discussion: pragmatic connections

"Some of the blickets have a crayon"
Discussion: pragmatic connections

“None of the blickets have a crayon”

“Some of the blickets have a crayon”

Skordos & Papafragou (2016)
Discussion: pragmatic connections

“None of the blickets have a crayon”

“Some of the blickets have a crayon”

Establishing the **relevant alternatives** constrains search for word meaning

Skordos & Papafragou (2016)
Conclusion

Learners use linguistically marked (vs. merely conceptual) contrast to infer the degree of informativity expressed in the use of a novel label.

- Semantic alternatives facilitate subordinate-level conjectures (Expt. 1)
- Alternatives must be labelled, not simply present (Expt. 2)

Informativity helps highlight the subordinate-level meaning as the relevant alternative to the basic-level meaning.

- Future plans: children participants, other communicative acts, etc.
## Appendix A: Magnitude of the Basic-level bias

<table>
<thead>
<tr>
<th>Study</th>
<th>Age</th>
<th>%Basic (%Sub) response</th>
<th>basic-level matches</th>
<th>Learned exemplar present at test</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ours (expt. 1)</td>
<td>adults</td>
<td>22% (44%)</td>
<td>5 (of 18)</td>
<td>Absent</td>
</tr>
<tr>
<td>X &amp; T 2007a</td>
<td>adults</td>
<td>76% (20%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>4 y.o.</td>
<td>31% (54%), 40% (56%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S,P,S,&amp;S 2011</td>
<td>adults</td>
<td>30%~50% (?%)</td>
<td>2 (of 12~24)</td>
<td>Present</td>
</tr>
<tr>
<td>J,S,S,&amp;S 2015</td>
<td>3-4 y.o.</td>
<td>26% (?%), 25% (?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L &amp; F 2018</td>
<td>adults</td>
<td>50~65% (?)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>W &amp; T 2022</td>
<td>adults</td>
<td>64% (35%)</td>
<td></td>
<td>Absent</td>
</tr>
</tbody>
</table>
## Appendix B: Distribution of “Other” responses

<table>
<thead>
<tr>
<th>Expt.</th>
<th>No Contrast</th>
<th>% of total</th>
<th>Distribution of “Other” responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Contrast</td>
<td>30%</td>
<td>Incomplete basic (23%), Incomplete subordinate (5%), ...</td>
<td></td>
</tr>
<tr>
<td>Contrast</td>
<td>19%</td>
<td>Mutually exclusive (13%), Incomplete subordinate (3%), ...</td>
<td></td>
</tr>
<tr>
<td>Labelled Alternative</td>
<td>18%</td>
<td>Mutually exclusive (10%), Incomplete subordinate (3%) ...</td>
<td></td>
</tr>
<tr>
<td>Unlabelled Alternative</td>
<td>24%</td>
<td>Incomplete basic (10%), Incomplete superordinate (7%), ...</td>
<td></td>
</tr>
</tbody>
</table>
Appendix C: “Experiment 3”