A matter of ambiguity?
Using eye movements to examine collective vs. distributive interpretations of plural sets

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Outline

- How do listeners interpret plural subjects?
- Collectivity vs. Distributivity in formal semantics
- Previous work
- Current study
  - Visual World Paradigm
- Results
- Ambiguity vs. Vagueness
- Discussion & future studies
Plural Subjects

*John and Bill are carrying a box.*

(a) (b)
Plurality

• Link (1983): join-semilattice structures:

Sue, John and Bill
Distributivity: Heim et al. (1991)

- The distributive reading involves an implicit distributive operator, $D$

\[ [\text{J&B} \quad D]_{\text{carry-a-box}} \text{ entails:} \]

\[
\text{carry-a-box}(J) \& \text{carry-a-box}(B)
\]

- $D$ is like a covert “each”.
- Collective readings do not involve postulating $D$
Previous Psycholinguistics Work: Frazier et al. (1999)

- Readers initially prefer the collective?

\[
\text{John and Bill are carrying a box together across the street.}
\]

Easy.

\[
\text{John and Bill are carrying a box each across the street.}
\]

Difficult!

- Effect is relatively late
- Dependent measure (reading times) reflects processing cost, not representational commitments \textit{per se}
Visual World Paradigm
Our Experiment

• Subjects saw:

![Image of two children holding objects](image)

• and heard one of the following sentence types:

(i) John and Bill each are carrying a red ball.
(ii) John and Bill are carrying a red ball.
(iii) John and Bill are carrying a red box.
(iv) John and Bill together are carrying a red box.

*ambiguous region* are carrying a red *object* (counterbalanced for ball/box)

- ball. “each” condition
- ball. “null” – dist. condition
- box. “null” – coll. condition
- box. “together” condition
John and Bill each/together/ Ø are carrying a red b… (b)all/(b)ox
Collective Preference per Time Region

* Bonferroni-corrected significance level (α = 0.002)

Sentence Type:
- each
- null, Dist obj
- null, Coll obj
- together

Legend:
- Red: each
- Teal: null, Dist obj
- Green: null, Coll obj
- Purple: together

Graph labels:
- Collective Advantage
- A: before onset of predicate
- B: 1st half of ambiguous region
- C: 2nd half of ambiguous region
- ns: non-significant

Significance markers:
- *: significant
Summary

• Immediate preference for collective interpretation

• Compatible with the analyses in
  • Heim et al. (1991): D operator $\rightarrow$ more complex representation
  • Frazier et al. (1999): Distributive incurs processing costs
A matter of ambiguity, not vagueness

• Immediate collective preference, even in the $\emptyset$ condition, suggests the collective-vs.-distributive distinction is one of ambiguity as opposed to vagueness:
  • vagueness:
    • processor can remain agnostic about collective/distributive status of the NP until it reaches "ball" or "box"
    • looks to each scene would be equally frequent: in this case, the null hypothesis
  • ambiguity:
    • the processor must assign collectivity or distributivity even in the absence of information determining this (before "ball" or "box")
    • subject fixates the representation it has committed to: in this case, there is a preference for the collective
More work to be done

- In children, this is still an ambiguity (not vagueness), but the preference is for the *distributive*! (Syrett & Musolino, 2010)

- Preference for collective/distributive interacts with the type of predicate and its bias:
  - *John and Bill are lifting a piano.*  Collective bias
  - *John and Bill are wearing a hat.*  Distributive bias
More work to be done

- Our study used mainly neutral predicates, and included as many collective- as distributive-biased predicates, e.g.
  - *John and Bill are lifting a dresser.* Collective bias
  - *John and Bill are wearing a raincoat.* Distributive bias
More work to be done

- Our study used mainly neutral predicates, and included as many collective- as distributive-biased predicates, e.g.

- However, a regression analysis using individual predicates’ collective/distributive bias scores might provide evidence for a lexical bias effect.

- Also, manipulating the relative frequencies of distributive and collective interpretations in general would allow us to examine how an ambiguity decision might be sensitive to corpus distributions.
Thank you!