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

Christine Boylan
Dimka Atanassov
Florian Schwarz
John Trueswell

Penn
University of Pennsylvania

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

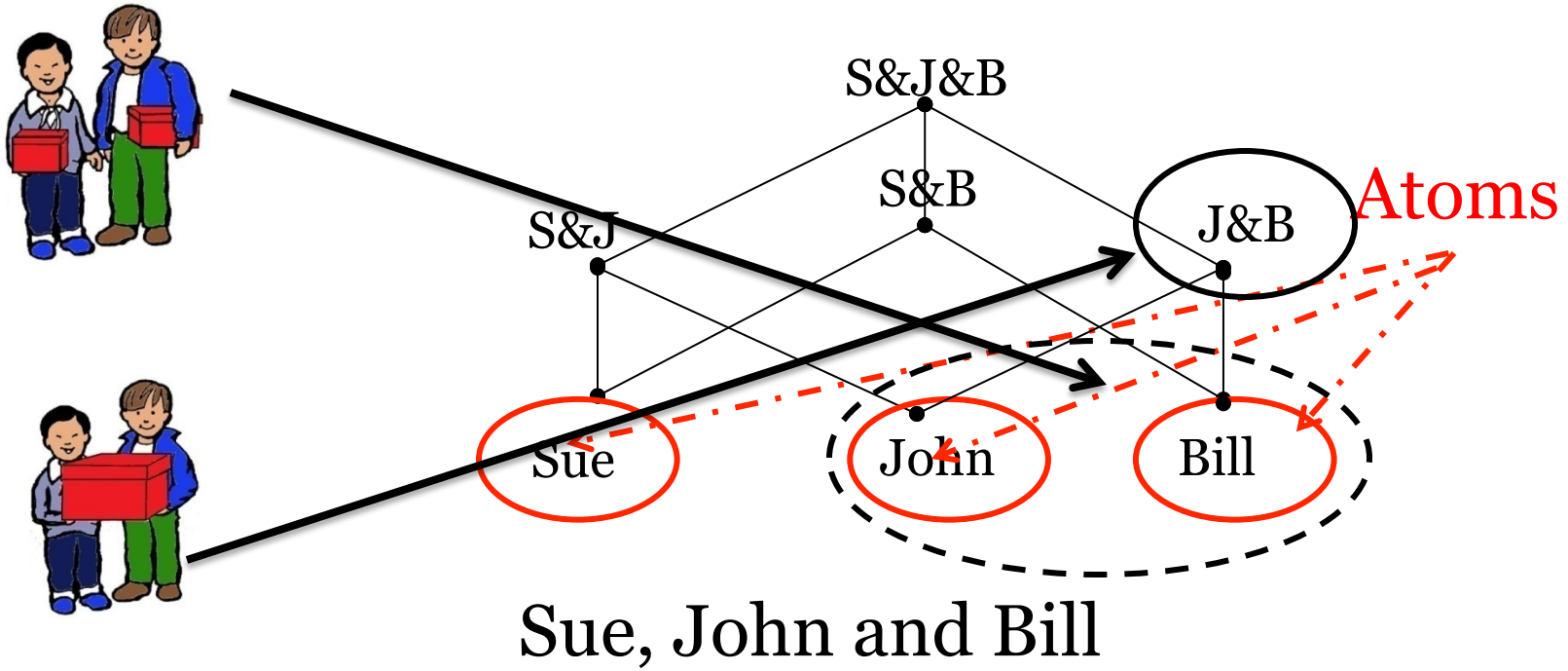
John and Bill are carrying a box.

(a)

(b)

Plurality

- Link (1983): join-semilattice structures:

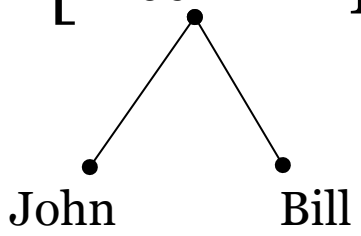


Distributivity: Heim et al.(1991)

- The distributive reading involves an implicit distributive operator, D

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

carry-a-box(J) & carry-a-box(B)



- D is like a covert “each”.
- Collective readings do not involve postulating D
- See also: Choe, Jae-Woong (1987), Link (1998, 1983), Fred Landman (2000)

Previous Psycholinguistics Work:
Frazier et al. (1999)

- Readers initially prefer the collective?

John and Bill *are carrying a box together* *across the street.*

Easy.

John and Bill *are carrying a box each* *across the street.*

Difficult!

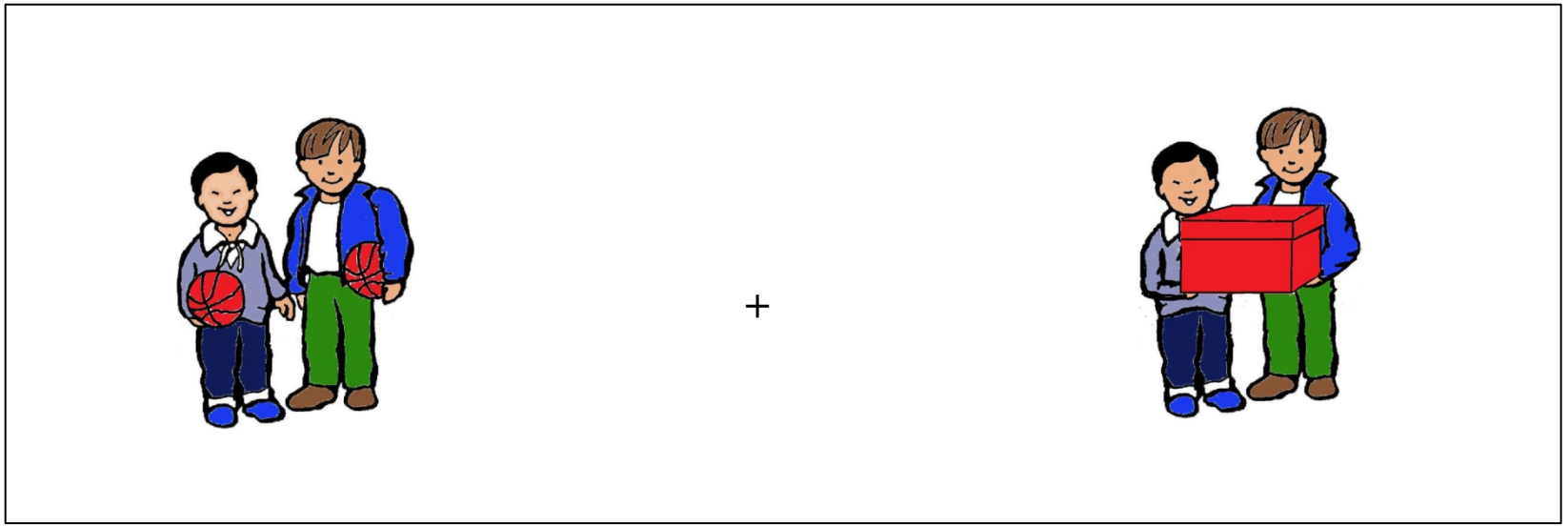
No differences

- Effect is relatively late
- Dependent measure (reading times) reflects processing cost, not representational commitments *per se*

Visual World Paradigm

Our Experiment

- Subjects saw:



- and heard one of the following sentence types:

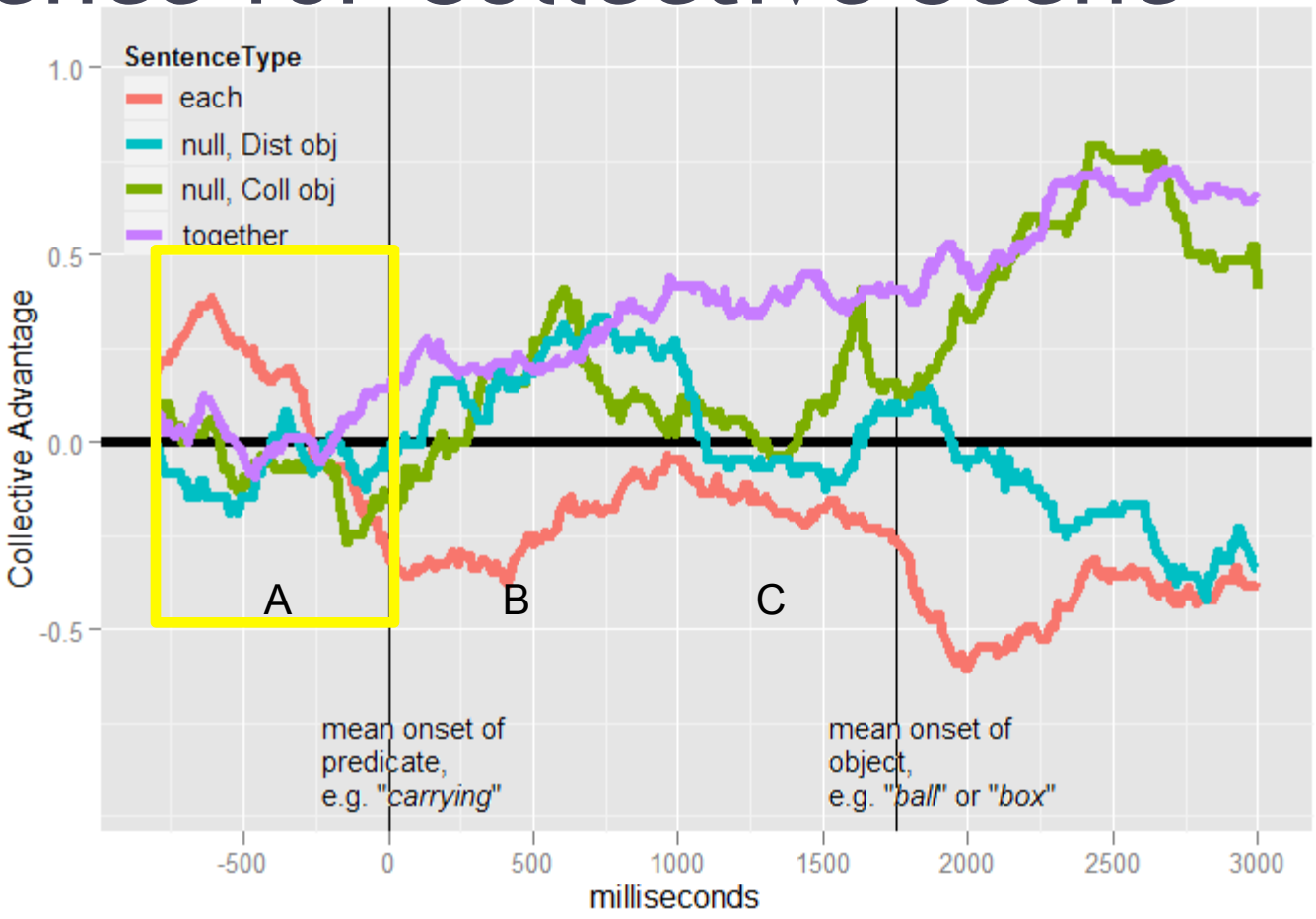
	ambiguous region	*object* (counterbalanced for ball/box)	
(i) John and Bill each	are carrying a red	**ball.**	"each" condition
(ii) John and Bill	are carrying a red	**ball.**	"null" – dist. condition
(iii) John and Bill	are carrying a red	**box.**	"null" – coll. condition
(iv) John and Bill together	are carrying a red	**box.**	"together" condition

Eye Movement Results: Preference for Collective Scene

Collective

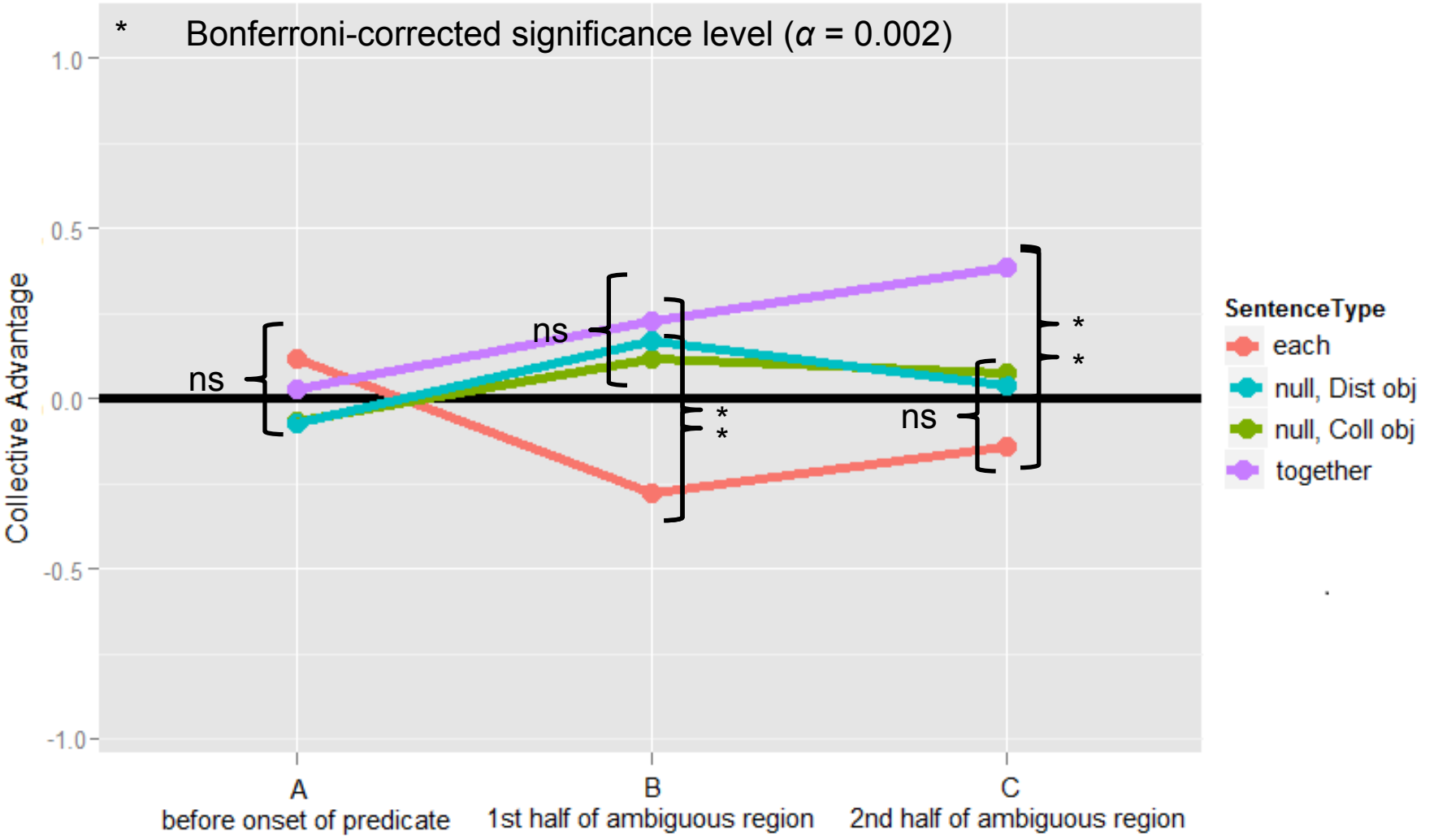
Distributive

Collective Advantage



John and Bill each/together/ Ø are carrying a red b… (b)all/(b)ox

Collective Preference per Time Region



Summary

- Immediate preference for collective interpretation

- Compatible with the analyses in
  - Heim et al. (1991): D operator → more complex representation
  - Frazier et al. (1999): Distributive incurs processing costs

A matter of ambiguity, not vagueness

- Immediate collective preference, even in the Ø 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

vs.

  - *John and Bill are wearing a raincoat.* Distributive bias

vs.

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!