Interpreting Plural Predication in Visual Contexts: Cover-Based Resolution of NP Structures

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Introduction

- Plurals allow for different interpretations (Scha, 1984):

(1) The boxes weigh 15 lbs. LF: $\forall x(x \in \text{cover} \rightarrow x \text{ weigh 15 lbs})$

a. cover$_a$: $\{\{a\},\{b\},\{c\},\{d\}\}$ a, b, c and d each weighs 15 lbs

b. cover$_b$: $\{\{a,b,c,d\}\}$ a, b, c and d together weigh 15 lbs

c. cover$_c$: $\{\{a,b\},\{c,d\}\}$ a and b together weigh 15 lbs, c and d together weigh 15 lbs

- Some interpretations are more prominent than the others.
  Dotlačil and Brasoveanu (2021) and Frazier et al. (1999): collective readings are easier to access compared to distributive readings. For (1), cover$_b$ > cover$_a$
  Buccola et al. (2021): the readings are influenced by the syntactic forms of the plural entities predicated over.
  Scontras and Goodman (2017): the prominence of readings is influenced by visual cues.

- Understudied domain: **the intermediate readings**.
  Previous studies have largely focused on the distributive–collective distinction. In contrast, we turn to the less-discussed question of the availability and preferences associated with intermediate readings (e.g., cover$_c$ in (1)).

- **Significance** of the Topic
  Intermediate readings are not only commonly attested but also highly diverse. Examining their availability and preference is crucial for capturing and modeling the full range of plural interpretation. Moreover, it is central to the study of structured plurals, or the mereology of higher-order plurality.

- **Research questions**

  – Are different intermediate readings equally available for definite plurals and nominal conjunctions?

  – Are there semantic or pragmatic factors influencing the availability of intermediate readings?

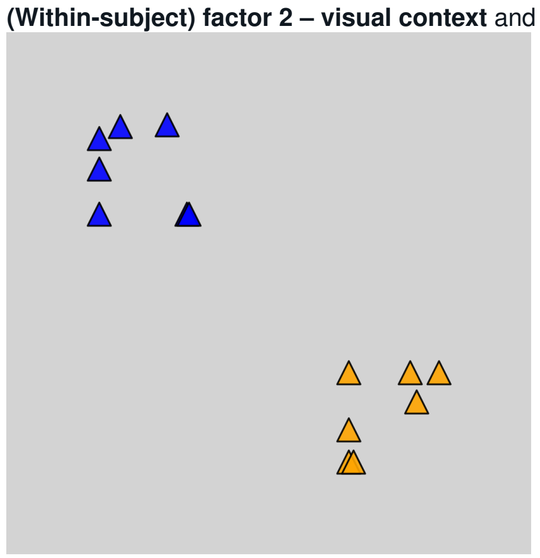
Experiment

A web-based slider-rating experiment with a 2 x 3 x 2 factorial design (N = 40)
(Between-subject) factor 1 – NP form:

(2) Definite plural (DP): *The shapes* are grouped.

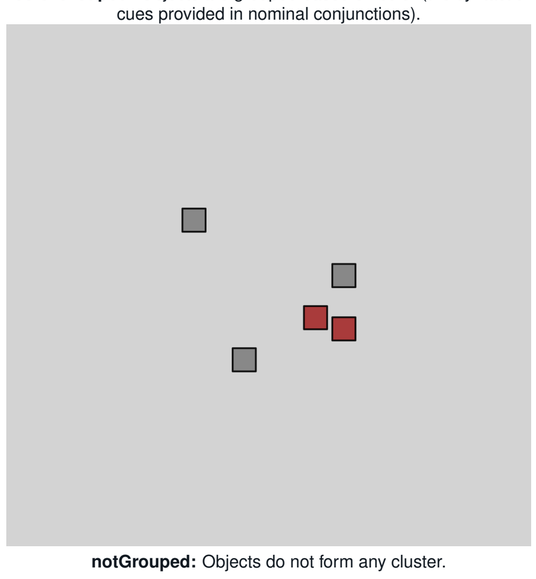
(3) Nominal conjunction (CONJ): *The yellow triangles and the blue triangles* are grouped.

(Within-subject) factor 2 – visual context and **factor 3 – comparison *(yes or no)*:**

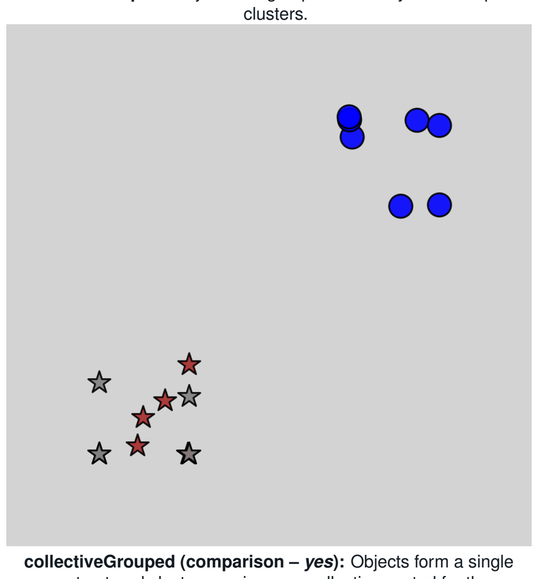


colorGrouped: Objects are grouped based on color (the syntactic cues provided in nominal conjunctions).

randomGrouped: Objects are grouped randomly into two spatial clusters.



notGrouped: Objects do not form any cluster.



collectiveGrouped (comparison – *yes*): Objects form a single unstructured cluster, serving as a collective control for the intermediate readings.

References

Buccola, B., Kuhn, J., & Nicolas, D. (2021). *Natural Language Semantics*, *29*(4), 509–525. Dotlačil, J., & Brasoveanu, A. (2021). *Glossa: a journal of general linguistics*, *6*(1), 1–22. Frazier, L., Pacht, J. M., & Rayner, K. (1999). *Cognition*, *70*(1), 87–104. Goodman, N. D., & Frank, M. C. (2016). *Trends in cognitive sciences*, *20*(11), 818–829. Landman, F. (1989a). Landman, F. (1989b). *Linguistics and Philosophy*, *12*(5), 559–605. Scha, R. J. (1984). Distributive, collective and cumulative quantification. In J. Groenendijk, T. M. V. Janssen, & M. Stokhof (Eds.), *Selected papers from the third amsterdam colloquium* (pp. 131–158). De Gruyter Mouton. Scontras, G., & Goodman, N. D. (2017). *Cognition*, *168*, 294–311.

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Predictions

Condition	Hypothesis	Predicted Pattern
DEFINITE PLURAL	H_0	Different covers are equally available. *colorGrouped* ≈ *randomGrouped* > *notGrouped*
	H_1	Some covers are preferred over others. *colorGrouped* ≉ *randomGrouped* > *notGrouped*
CONJUNCTION	H_0	Different covers are equally available. *collectiveGrouped* > *colorGrouped* ≈ *randomGrouped* > *notGrouped*
	H_1	Some covers are preferred over others. For instance, covers with syntactic cues are more accessible: *collectiveGrouped* > *colorGrouped* > *randomGrouped* > *notGrouped*

Results

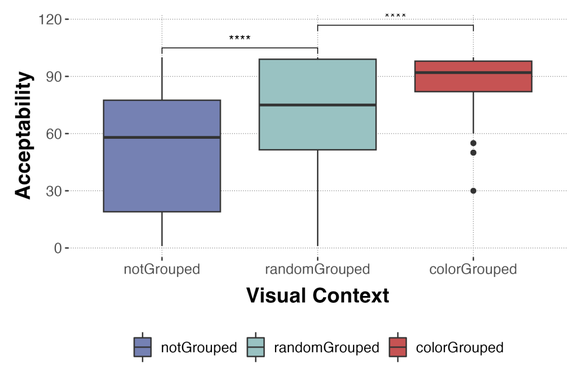

Figure 1: Definite plural: exemplified by *The circles*.

Definite Plural Condition

- Significant effect of **Visual Context**: $\chi^2(2) = 52.58$, $p < .001$.
- Post-hoc tests: all contrasts significant.
- Pattern supports **H1**:
  notGrouped served as the semantically false baseline and showed low acceptability.
  Both *randomGrouped* and *colorGrouped* were rated significantly higher than this baseline. Among them, *colorGrouped* was preferred over *randomGrouped* and showed less variability.
- For definite plurals, intermediate covers based on random or color grouping were both judged acceptable relative to the false control. Participants found color grouping easier to access than random grouping.

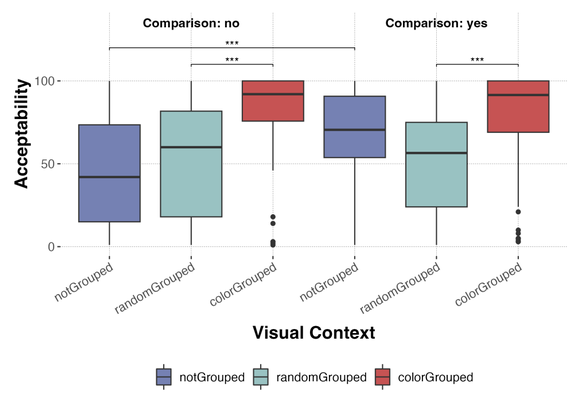

Figure 2: Conjunction condition: exemplified by *The red circles and the blue circles*.

Conjunction Condition

- Significant **Interaction** between **Visual Context** and **Comparison**: $\chi^2(2) = 15.14$, $p < .001$.
- Driven by **notGrouped**: higher ratings with comparison, much lower without ($\beta = 20.3$, $SE = 5$, $t = 4.06$, $p = .001$).
- Significant main effect of **colorGrouped**: higher than randomGrouped in both comparison conditions:
  - no comparison: $\beta = 30.76$, $SE = 5$, $t = 6.18$, $p < .001$
  - with comparison: $\beta = 26.24$, $SE = 5$, $t = 5.27$, $p < .001$
- No significant differences between **notGrouped** and **randomGrouped**.

Discussions

- Are different intermediate readings equally available for definite plurals and nominal conjunctions? **NO**
  For **definite plurals**, intermediate readings with or without random grouping are **both accessible** to participants. People find color grouping significantly more acceptable than random grouping. For **conjunctions**, covers supported by **syntactic cues** are **strongly preferred** over other covers. Intermediate readings with random grouping are **not accessible**, as judgments do not differ significantly from the false baseline.

- Are there semantic or pragmatic factors influencing the availability of intermediate readings? **YES**
  The results show that the syntactic forms of the plural entities put a **categorial restrictions** on the possible covers (Landman, 1989a, 1989b).
  The results also show a general preference for covers that are ‘simpler’, i.e., with clear grouping criterion. Further investigations are needed on how far this generalization goes. For instance, for covers with random groupings, would different **complexities** lead to different acceptabilities.
  Is randomGrouped impossible, or merely too complex for conjunctions? Echoing Scontras and Goodman (2017), participants’ inaccessibility of a reading arises from contextual uncertainty rather than lexical restriction.

Conclusion and next steps

- Definite plurals are sensitive to structured covers with low variation and can license intermediate readings given contextual cues. Conjunctions allow only a restricted, prototype cover; unsupported covers are rated no better than false ones, even with pragmatic cues.

- Next Step: formal modeling of cover selection as a inference problem within the RSA framework(Goodman & Frank, 2016): compare *randomGrouped* vs complex *colorGrouped* which is complex in that the size varies randomly.