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gillespie.m@neu.edu

# Scope of Planning as an Alternative to Hierarchical Feature Passing in Language Production

**Maureen Gillespie & Neal J. Pearlmutter**
**Northeastern University**

## INTRODUCTION

**How are number agreement features tracked during language production?**

**Mismatch Effect:** More subject-verb agreement errors occur when the head noun of the subject NP is singular and local nouns, in PP modifiers, are plural than when local nouns are singular (Bock & Miller, 1991).

**Hierarchical Distance:** Number features of the head noun of the subject NP are passed to the verb; plural features of local nouns occasionally pass incorrectly to the verb, causing agreement errors.

Franck, Vigliocco, & Nicol (2002):

The helicopter for the flight(s) over the canyon(s)

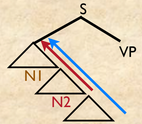


Figure 1. Descending structure

- N2 mismatch effect was larger than N3 mismatch effect.

- Suggests plural local nouns situated hierarchically closer to the verb have a greater chance of interfering with agreement computation than plural local nouns situated deeper in the syntactic tree.

**Semantic Integration:** Elements within a phrase that are conceptually linked are planned with more overlap, which allows their features to interfere with each other.

Solomon & Pearlmutter (2004):

The pizza with the yummy topping(s) (Integrated) N1 N2

The pizza with the tasty beverage(s) (Unintegrated) N1 N2

- Integrated mismatch effect was larger than Unintegrated mismatch effect.
- Suggests plural local nouns planned closer in time to the head noun have a greater chance of interfering with agreement computation than nouns planned later.

- Confound: In Franck et al. (2002), N1 and N2 were more integrated than N1 and N3; thus, semantic integration is an alternative explanation for Franck et al.'s (2002) results.

**Linear Distance to Head:** Local nouns appearing closer to the head noun may interfere with agreement computation more than local nouns appearing farther from the head noun.

- Not previously tested, but could be an alternative explanation for Franck et al. (2002)'s results.

## EXPERIMENT 1

**Are there effects of semantic integration or linear distance to the head (controlling hierarchical distance)?**

### Method

Early-Integrated
The book with the torn page(s) by the red pen(s)
Late-Integrated
The book by the red pen(s) with the torn page(s)

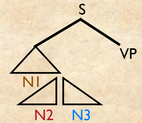


Figure 2. Flat structure

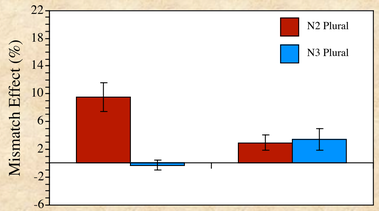
- Preambles equated hierarchical distance of N2 and N3 (see Norming)
- Singular vs. plural local nouns; head noun always singular

- 99 participants
- 40 critical items, 80 fillers (32 NP PP PP plural head)

- Preambles presented visually and were read aloud and completed as full sentences.

- Error rate = Errors / (Errors + Corrects)
- N# Mismatch Effect: (Error rate when *only* N# is plural) - (Error rate of purely singular)

### Results




- Early-Integrated: N2 > N3; rules out Hierarchical Distance only.

- Late-Integrated: N2 = N3; rules out Linear Distance to Head only.

- Early-Integrated N2 > Late-Integrated N3; rules out Semantic Integration only.

### Summary

- Linear distance to the head initially determines the order in which elements of the phrase are planned, and semantic integration shifts the relative timing of planning.

Early-Integrated N1 N2 N3

Late-Integrated N1 N2 N3

## EXPERIMENT 2

**Is there any effect of hierarchical distance (controlling semantic integration)?**

### Method

Flat (see Figure 2)
The highway to the western suburb(s) with the steel guardrail(s)
Descending (see Figure 1)
The backpack with the plastic buckle(s) on the leather strap(s)

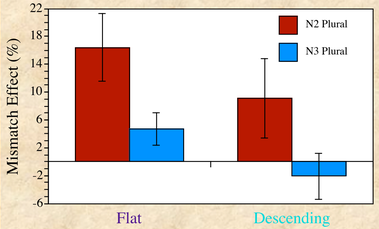
- Preambles equated semantic integration of N1-N2 and N1-N3 (see Norming)
- Singular vs. plural local nouns; head noun always singular
- No preambles where N2 and N3 were both plural

- 32 participants
- 24 critical items (half Flat, half Descending), 88 fillers (8 singular head with N2 and N3 plural, 32 NP PP PP plural head)

- All other details of method are as in Experiment 1.

- If Hierarchical Distance has an effect, difference between N2 and N3 mismatch effects should be smaller for Flat than Descending preambles.

### Results




- Flat = Descending

- N2 > N3; suggests Linear Distance to Head is a factor.

- No interaction of plural position and preamble type; rules out Hierarchical Distance.

### Summary

- Controlling semantic integration, only linear distance to the head affected mismatch effects.

- Hierarchical distance does not affect agreement computation.

## CONCLUSIONS

**Scope of planning affects agreement computation.**

No individual factor alone can explain the mismatch effects observed within these experiments.

Combination of linear distance to the head and semantic integration can explain Experiment 1, Experiment 2, and Franck et al.'s (2002) results.

**Scope of Planning** : Local nouns planned closer in time to the head noun are more likely to interfere with agreement computation.
- More semantically integrated local nouns are planned closer to the head noun.
- Order of production determines order of planning.

Local nouns planned relatively long after the head noun may be outside the head noun's scope of planning and may never have the chance to interfere with agreement computation.

## REFERENCES & ACKNOWLEDGMENTS

Bock, K. & Miller, C.A. (1991). Broken agreement. *Cognitive Psychology, 23*, 45-93.
Franck, J., Vigliocco, G., & Nicol, J. (2002). Subject-verb agreement errors in French and English: The role of syntactic hierarchy. *Language and Cognitive Processes, 17*, 371-404.
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## NORMING

| | Semantic Integration Rating | | | %N1 Attachment |
|---|---|---|---|---|
| | N1-N2 | N1-N3 | N2-N3 | |
| Early-Integrated | 5.70 | 2.18 | 2.01 | 97.7 |
| Late-Integrated | 2.17 | 5.68 | 2.08 | 98.8 |
| Mean | 3.94 | 3.93 | 2.05 | 98.1 |
| Flat | 4.09 | 5.06 | 2.73 | 92.1 |
| Descending | 4.12 | 5.10 | 4.26 | 5.6 |
| Mean | 4.11 | 5.08 | 3.50 | 48.9 |

*Note*. Semantic integration scale was 1-7, with 7 = highly integrated. %N1 attachment is the % attachment of the second PP to N1 (vs. N2).