Semantic and Syntactic Effects on the Production of Ordering Errors

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INTRODUCTION

How do semantic (conceptual) and syntactic properties affect grammatical encoding?

Semantic/conceptual property

Semantic integration (Solomon & Pearlmutter, 2004)

- Degree of message-level relatedness between utterance elements to be planned
- Phrase- and word-exchange errors increase with integration (DiBattista & Pearlmutter, 2011).
- Integration affects *grammatical encoding* stage of Bock & Levelt's (1994) model of sentence production.

Syntactic properties

Grammatical role and grammatical class similarity (Garrett, 1975)

Exchanging phrases have same role; exchanging words have same class.

Evidence from corpus analysis, but not from experimental investigation

Syntactic similarity

Like role and class similarity, should influence grammatical encoding

Internal syntactic structure

the blue shelf above the green sink	the blue shelf above the sink
Homogeneous structures	**Heterogeneous** structures
Det + Adj + N	Det + Adj + N vs. Det + N

External syntactic context

the blue shelf above the green sink	the blue shelf above the sink
Homogeneous context	**Heterogeneous** context
Ns within Det + Adj + N constructions	Ns within Det + Adj + N vs. Det + N construction

Predictions

Integration and syntactic similarity will affect grammatical encoding.
Phrase and word exchanges will increase with integration and similarity.

EXPERIMENT 1

Method

32 pictures: A common object and attribute, or two common objects
Pictures varied in integration and color scheme.
Responses varied in integration, similarity, and description preference.

16 **integrated** pictures

Preferred response: the blue spot on the brown apple
Unpreferred response: the brown apple with the blue spot

16 **unintegrated** pictures

Preferred response: the green shelf above the blue sink
Unpreferred response: the blue sink below the green shelf

EXPERIMENT 1 (CONT'D)

Color applied to both, neither, or exactly one picture component.
Color application determined presence of/placement of adjective in responses.
Four color schemes were collapsed into two syntactic similarity conditions.

Color Scheme	Picture	Correct Description (Pref)	Response Structure
Two Color		the green shelf above the blue sink	Homogeneous
Grayscale		the shelf above the sink	Homogeneous
One Color		the green shelf above the sink	Heterogeneous
		the shelf above the blue sink	Heterogeneous

Ss introduced to stimuli and component labels in two familiarization phases.

Test phase

Picture in one of four color schemes
Preferred or unpreferred preposition appeared below (2000 ms SOA).
Ss described pictures using component labels, color words if appropriate, and preposition.

129 original participants; 18 excluded due to unusable trials.
Responses coded as correct responses vs. exchange errors:

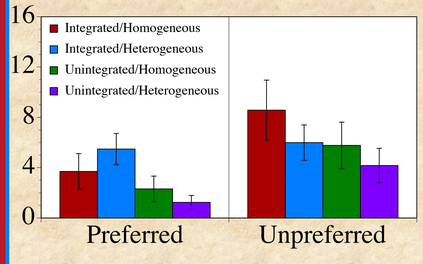
Response Type	Response
Correct Description	the green shelf above the blue sink
Phrase Exchange	the blue sink above the green shelf
Noun Exchange	the green sink above the blue shelf
Adjective Exchange	the blue shelf above the green sink

Results

Weighted linear regressions on empirical-logit transformed percentages
- Exchanges/(Exchanges + Correct Descriptions)

Analyses on all errors together, and on phrase and word errors separately
Fixed effects: Integration, similarity, preference, and their interactions
Random effect: Either participants or items

Untransformed Error Rates: Combined Phrase and Word Errors



- Integrated > Unintegrated
- Unpreferred > Preferred (marginal by items)
- Homogeneous > Heterogeneous
- No interactions
- Integration and similarity significant for phrase and word errors separately.

Confound: Syntactic and semantic content similarity vary together. Are the results attributable to syntactic or semantic similarity?

EXPERIMENT 2

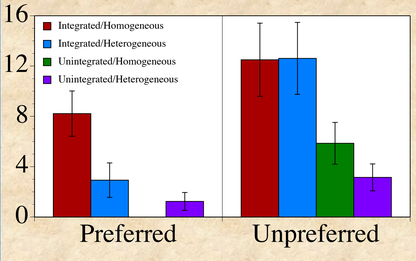
Modified color schemes: Solid colors and checkered colors
Responses varied in syntactic similarity, but not in semantic content.

Color Scheme	Picture	Correct Description (Pref)	Response Structure
Two Solid		the green shelf above the blue sink	Homogeneous
Two Checkered		the shelf that's green above the sink that's blue	Homogeneous
One Solid, One Checkered		the green shelf above the sink that's blue	Heterogeneous
		the shelf that's green above the blue sink	Heterogeneous

Same procedure as in Experiment 1
171 Ss run; 74 of these were analyzable.
- Some Ss did not remember instructions for different response types.
- Some experimenters did not re-instruct appropriately as needed.

Results

Untransformed Error Rates: Combined Phrase and Word Errors



- Integrated > Unintegrated
- Unpreferred > Preferred
- 3-way interaction
  In preferred condition only
  - Hom > Het for Integ cases
  - Het > Hom for Unint cases
- Same general pattern in phrase errors analyzed separately

GENERAL DISCUSSION

Integration and preference affect grammatical encoding.

Similarity effect: Experimental evidence that constituent similarity influences grammatical encoding.
- Role of similarity previously seen only in corpus analysis.
- Production system attends to this similarity during utterance planning.
- Effect most reliable when syntactic and semantic content similarity vary together.

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We would like to thank Jason Bran, Shreya Divatia, Arielle Edelheit, Kaytee Flick, Jennifer Foxwell, Ranya Gebara, Maureen Gillespie, Keith Levin, Lauren Mangold, Ian More, Carolyn Schulz, Devin St. John, and Mariah Warren for their help in collecting data and transcribing and coding responses.