Syntactic and Semantic Prominence in Pronoun Resolution

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Introduction

Subjects are preferred antecedents for pronominal reference (Mathews and Chodorow, 1988). Many models of discourse coherence (e.g., Centering Theory: Grosz et al., 1995) account for this by assuming a hierarchy of syntactic prominence for antecedents as below. The upper part of this hierarchy has been validated in numerous studies (e.g., Hudson-D'Zmura and Tanenhaus, 1997). However, for many verbs in English, syntactic role is conflated with semantic role: That is, syntactic SUBJECTS are often semantic AGENTS and so on. So it could be that what appears to be the result of the prominence of syntactic SUBJECTS is actually the result of the prominence of semantic AGENTS with respect to a hierarchy of semantic roles as below. This paper presents the results of a series of on-line and off-line experiments which compare the influence of syntactic prominence and semantic prominence on the salience of antecedents for subsequent pronominal reference.

Background

Syntactic Prominence (SYNPROM)

Entities realized in syntactic positions higher on the syntactic hierarchy below are more syntactically prominent: they appear higher in the syntactic tree and appear to be more salient as antecedents (Hudson-D'Zmura and Tanenhaus, 1997; Mathews and Chodorow, 1988).

Syntactic Hierarchy
SUBJECT > OBJECT > OBLIQUE

Semantic Prominence (SEMPROM)

Entities realized with higher roles on the semantic hierarchy below are more semantically prominent: they inherit more proto-AGENT entailments (Dowty, 1991) and are typically mapped onto higher syntactic positions.

Semantic Hierarchy
AGENT > THEME > OTHERS

Question How can the effects of syntactic and semantic prominence be distinguished?

Answer By using argument-reordering constructions.

Tough-constructions
1 Nancy$_i$$^{\star\bullet}$ easily beat Susan$_j$.
2 Susan$_j$* was easy for Nancy$_i$$^{\bullet}$ to beat $\emptyset_j$.

Spray/Load-constructions
1 John sprayed some paint$_i$$^{\star\bullet}$ on a wall$_j$.
2 John sprayed a wall$_j$* with some paint$_i$$^{\bullet}$.

$\star$ = syntactically prominent
$\bullet$ = semantically prominent

Experiments

Predictions

		SYNPROM only	SEMPROM only
Tough-constructions	Nancy$_i$$^{\star\bullet}$ easily beat Susan$_j$. She...	Nancy > Susan	Nancy > Susan
	Susan$_j$* was easy for Nancy$_i$$^{\bullet}$ to beat $\emptyset_j$. She...	Susan > Nancy	Nancy > Susan
Spray/*Load*-constructions	John sprayed some paint$_i$$^{\star\bullet}$ on a wall$_j$. It...	paint > wall	paint > wall
	John sprayed a wall$_j$* with some paint$_i$$^{\bullet}$. It...	wall > paint	paint > wall

Off-line Questionnaire

***Tough*-constructions (n=36)**

CONTROL	
Nancy$_i$$^{\star\bullet}$ easily beat Susan$_j$ in the 100-meter race.	
a. She$_i$ became the state champ for the second year.	75%
b. She$_j$ was frustrated and dejected after the race.	25%

[by subjects ($t = 5.13, p < 0.001$); by items ($t = 5.73, p < 0.001$)]

SPLIT	
Susan$_j$* was easy for Nancy$_i$$^{\bullet}$ to beat $\emptyset_j$ in the 100-meter race.	
a. She$_i$ became the state champ for the second year.	49%
b. She$_j$ was frustrated and dejected after the race.	51%

[n.s. by subjects or by items]

***Spray*/*Load*-constructions (n=24)**

CONTROL	
John sprayed some paint$_i$$^{\star\bullet}$ on a wall$_j$.	
a. It$_i$ dribbled down and made a mess.	70%
b. It$_j$ was big and needed two coats.	30%

[by subjects ($t = 5.47, p < 0.001$); by items ($t = 6.83, p < 0.001$)]

SPLIT	
John sprayed a wall$_j$* with some paint$_i$$^{\bullet}$.	
a. It$_i$ dribbled down and made a mess.	48%
b. It$_j$ was big and needed two coats.	52%

[n.s. by subjects or by items]

On-line Self-paced Reading Task

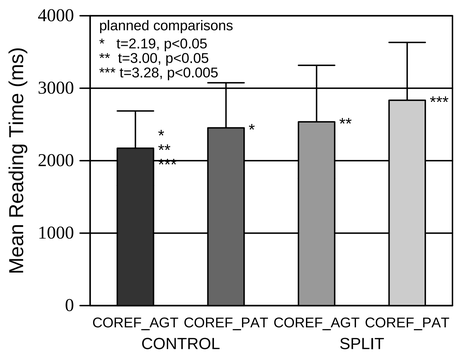
***Tough*-constructions (n=24)**

2 × 2 design: CONTEXT (CONTROL, SPLIT) × SEMPROM (COREF$_{agt}$, COREF$_{pat}$)

a. Nancy$_i$$^{\star\bullet}$ easily beat Susan$_j$ in the 100-meter race.	CONTROL
a'. Susan$_j$* was easy for Nancy$_i$$^{\bullet}$ to beat $\emptyset_j$ in the 100-meter race.	SPLIT
b. She$_i$ became the state champ for the second year.	COREF$_{agt}$
b'. She$_j$ was frustrated and dejected after the race.	COREF$_{pat}$

Effects	by subjects	by items
CONTEXT	$F = 5.22$ $p < 0.05$	$F = 7.03$ $p < 0.01$
SEMPROM	$F = 2.94$ $p = 0.09$	$F = 4.26$ $p < 0.05$
CONTEXT * SEMPROM	$F = 0.0$ $n.s.$	$F = 0.0$ $n.s.$

Mean reading times for continuation sentences



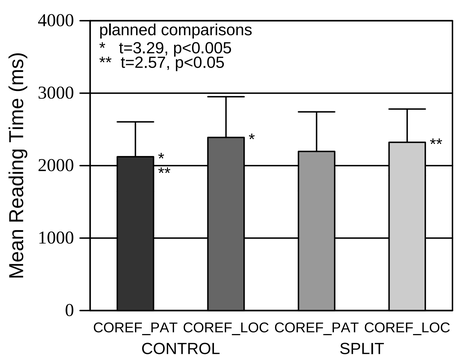
***Spray*/*Load* Constructions (n=28)**

2 × 2 design: CONTEXT (CONTROL, SPLIT) × SEMPROM (COREF$_{pat}$, COREF$_{loc}$)

a. John sprayed some paint$_i$$^{\star\bullet}$ on a wall$_j$.	CONTROL
a'. John sprayed a wall$_j$* with some paint$_i$$^{\bullet}$.	SPLIT
b. It$_i$ dribbled down and made a mess.	COREF$_{pat}$
b'. It$_j$ was big and needed two coats.	COREF$_{loc}$

Effects	by subjects	by items
CONTEXT	$F = 0.0$ $n.s.$	$F = 0.0$ $n.s.$
SEMPROM	$F = 4.08$ $p < 0.05$	$F = 5.33$ $p < 0.05$
CONTEXT * SEMPROM	$F = 0.52$ $n.s.$	$F = 0.69$ $n.s.$

Mean reading times for continuation sentences



Discussion

- The experimental evidence suggests that *both* syntactic and semantic prominence contribute to the discourse salience of entities
  - In the SPLIT condition of the off-line questionnaire, neither factor alone explains the results.
  - The planned comparisons in the on-line results with *tough*-constructions show a significant effect of both factors
    - SYNPROM - CONTROL-COREF$_{agt}$/SPLIT-COREF$_{agt}$
    - SEMPROM - CONTROL-COREF$_{agt}$/SPLIT-COREF$_{pat}$
- SEMANTIC PROMINENCE appears to be a more significant factor than SYNTACTIC PROMINENCE - difference is greater and more significant for the semprom comparison above.
- On-line and off-line results show clear evidence of validity of both higher and lower parts of semantic hierarchy; however, less clear evidence of validity of syntactic hierarchy

Further Work

Further work on the concept of semantic prominence includes:

- Further psycholinguistic investigation with other argument-reordering constructions (e.g., psych-verbs) and other experimental manipulations (e.g., repeated-name penalty Gordon et al., 1993).
- Corpus investigation to test whether semantic prominence has widespread relevance

Current models of discourse salience and pronoun resolution may be adapted with a concept of semantic prominence. Some possibilities include:

discrete semantic roles entities realized in an utterance are assigned some semantic prominence with respect to the thematic role assigned to it by the verb.

semantic entailments entities are promoted or demoted with respect to the specific semantic entailments imposed on them by the verb

References

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