

Introduction:

Grammatical principles and probabilistic information

- The sensitivity of comprehenders to thematic preferences at the initial steps of processing was observed in many studies and taken to support constraint-based approaches to sentence processing (Garnsey et al., 1997, MacDonald, 1994; Trueswell et al., 1993).
- The Grammatical Competence approach of Pritchett (1992) suggests that rather than probabilistic information, **what guides processing is the parser's attempt to satisfy the Theta Criterion as soon as possible, given the maximal thematic grids of the available verbs.**

The current experiment

Optionally transitive (OT) verbs varying in their transitivity bias were incorporated into Garden Path (GP) sentences of two types:

- Adjunct condition: OT verb embedded in a temporal adjunct
- Subject Relative (SR) condition: OT verb embedded in a relative clause, preceded by an obligatorily ditransitive verb.
- The baseline for each GP sentence included an intransitive (IN) verb.

Predictions

Constraint-based approaches:

- The probability of wrongly analyzing the post-verbal noun phrase (NP) as an object of the verb increases for more transitive-biased verbs.
- Transitivity bias should play a role in both sentence types**

Pritchett's approach:

- Transitivity bias should not affect the adjunct condition, as the maximal thematic grid of the verb includes a second argument, invariably leading to a wrong association of the verb with the following NP, to satisfy the Theta Criterion.**
- In contrast, in the SR condition, the Theta Criterion can also be satisfied by associating the post-verbal NP to the higher verb. When such optionality arises, transitivity bias becomes relevant, with more transitive-biased verbs inducing larger GP effects.

Method:

- 62 native Hebrew speakers (mean age: 23.48, range: 19-29)
- 24 experimental sets and 72 filler sentences
- Transitivity bias of OT verbs was defined as the proportion of the verb's occurrence with a direct object, based on a manually coded google sample (range: 20%-86%).
- A plausibility pre-test verified that the post-verbal NP in the SR condition could be plausibly attached to both the lower and upper verb.
- Lists were created using a Latin Square design; order of items was randomized for each participant.
- Each target sentence as well as some fillers were followed by an instruction to write the last sentence.

References:

Garnsey, S. M., Pearlmutter, N. J., Myers, E., & Lotocky, M. A. (1997). The contributions of verb bias and plausibility to the comprehension of temporarily ambiguous sentences. *Journal of Memory and Language*, 37, 58-93. | MacDonald, M.C. (1994). Probabilistic constraints and syntactic ambiguity resolution. *Language and Cognitive Processes*, 9, 157-201. | Pickering, M. J., & Traxler, M. J. (2003). Evidence against the use of subcategorisation frequency in the processing of unbounded dependencies. *Language and Cognitive Processes*, 18, 469-503. | Pritchett, B. L. (1992). Grammatical Competence and Parsing Performance. *University of Chicago Press*. | Trueswell, J. C., Tanenhaus, M. K., & Kello, C. (1993). Verb-specific constraints in sentence processing: Separating effects of lexical preference from Garden Paths. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 19, 528-553.

Example set (translated from Hebrew):

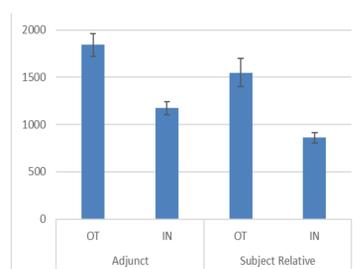
OT, Adjunct	After the guests drank water flowed from the tap
IN, Adjunct	After the guests woke up water flowed from the tap
OT, Subject Relative	The owner brought the guests who drank water last night at the farm
IN, Subject Relative	The owner brought the guests who woke up water last night at the farm
Example filler:	The guy brought the boy who ate pizza a delicious cake this afternoon

The critical phrase is marked in bold.
The vertical bar (|) indicates presentation regions
Sentences were presented in Hebrew.

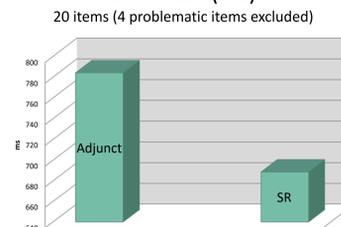
Results:

- Log-transformed RTs were analyzed using mixed-effects linear regression
- Main effect for Thematic frame ($p=.001$), with increased RTs to OT relative to IN sentences
- Main effect for Sentence type ($p=.003$), with increased RTs to adjunct sentences
- Two-way interaction between Thematic frame and sentence type ($p=.004$), with the GP effect (i.e. the RT difference between OT and IN) larger for SR sentences. Importantly, the last effect was driven by four sets which included problematic 'IN adjunct' sentences (e.g. with homophonous words)
- Three-way interaction between Thematic frame, Sentence type and Transitivity bias ($p=.003$):**
 - Interaction of Transitivity bias and Thematic frame in SR conditions ($p=.004$)
 - No interaction of Transitivity bias and Thematic frame in adjunct sentences ($p=.569$).

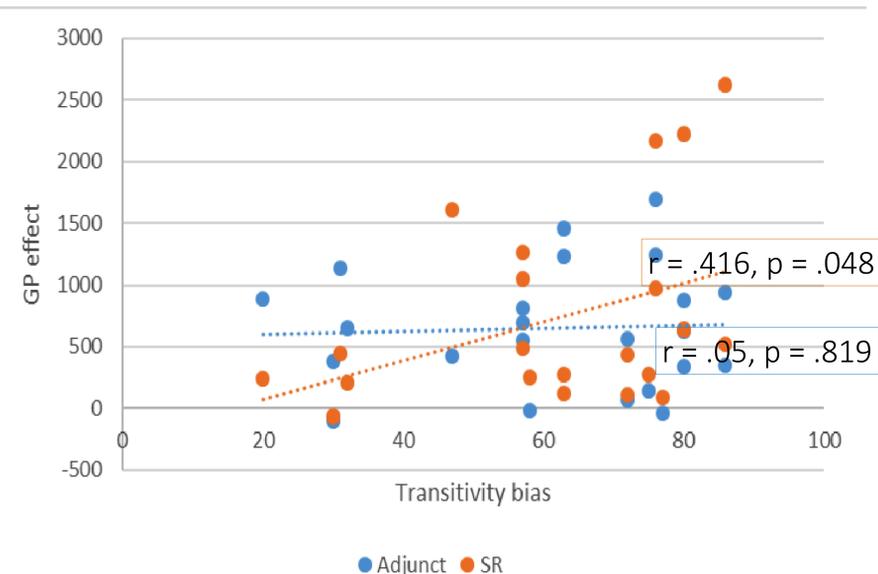
RTs (ms) of critical region by condition
all items



GP effect (ms)
20 items (4 problematic items excluded)



Correlations between Transitivity Bias and GP effect by Sentence Type



Discussion:

- Participants were sensitive to the verb's transitivity bias only in the SR, and not in the adjunct conditions.
- We argue, based on Pritchett (1992), that this dissociation is a result of the **precedence, during parsing, of the rapid satisfaction of the Theta Criterion**, a global grammatical principle.
- While the significant impact of transitivity bias on the processing of SR sentences confirms the role of probabilistic thematic information in sentence processing, the absence of a similar effect in the adjunct condition suggests that this information does not always guide processing (cf. Pickering & Traxler, 2003)