Syntactic Late Closure and Rational Speaker Effects: Evidence from Turkish

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Background

Speer et al. (1996) and Kjelgaard and Speer (1999; henceforth, SKS) investigated **Late Closure** / **Early Closure** ambiguities with cooperating, conflicting and neutral ('baseline') prosody.

|| prosodic break / syntactic break bold face: focal accent

(1)

	Prosody	**Syntax**		
a.	Cooperating	LC	When Roger leaves the house || / it's dark.	☺
b.	Cooperating	EC	When Roger leaves || / the house is dark.	☺
c.	Conflicting	LC	When Roger leaves || the house / it's dark.	☹
d.	Conflicting	EC	When Roger leaves / the house || is dark.	☹
e.	Neutral	LC	When **Roger** leaves the house / it's dark.	😐
f.	Neutral	EC	When **Roger** leaves / the house is dark.	😐

A series of experiments: acceptability judgment, end-of-sentence comprehension, and cross-modal naming tasks:

Cooperating prosody	<	Neutral prosody	<	Conflicting prosody
LC = EC		LC < EC		LC < EC

SKS conclusion: The parser resorts to a syntactic LC strategy when prosodic phrasing is absent (neutral prosody) and also when it is unsupportive of syntax (conflicting prosody).

Alternative hypothesis: Could constituent length distribution have influenced the findings?

***Rational Speaker Hypothesis*:** Prosodic breaks flanking **short** constituents are treated by perceivers **as more informative** about the syntactic structure of an utterance than prosodic breaks flanking long constituents (Clifton, Carlson, & Frazier, 2006)

How does this relate to SKS findings?

3 + 2 PWds: Less informative prosodic boundary, easier to disregard?

(1) c. Conflicting prosody, LC syntax: When Roger leaves || the house / it's dark. 😐
d. Conflicting prosody, EC syntax: When Roger leaves / the house || is dark. ☹

4+1 PWds: More informative prosodic boundary, difficult to disregard?

Can the syntactic Late Closure strategy be eliminated in favor of prosodic phrasing effects (explicit or implicit)?

This Study

A temporary ambiguity in Turkish, with LC and EC interpretations: Both are [*pro* [Subj + VP] matrix verb]

	[Pro [	Subject	+	VP	]	matrix verb]
(2) a. LC:	Ø (Yaklaşık) yedi	öğrenci-nin	psikoloğ-u	|| (oldukça)	sev-**il-di**	san-dı-m.
	Pro (nearly) seven	student-GEN	psychologist-**3SG.POSS**	(much)	like-**PASS-PAST**	think- PAST-1SG
	'I thought that the psychologist of (nearly) seven students was (much) liked.'					
b. EC:	Ø (Yaklaşık) yedi	öğrenci-nin	|| psikoloğ-u	(oldukça)	sev-**diğ-in-i**	san-dı-m.
	Pro (nearly) seven	student-GEN	psychologist-**ACC**	(much)	like-**FN-3SG.POSS-ACC**	think-PAST-1SG
	'I thought that (nearly) seven students liked the psychologist (much).'					

Notes: The morpheme '-u' on *psikolog* can be POSSessive or ACCusative.
LC: the subject ends at POSS morpheme in (2a).
EC: the subject ends at GEN morpheme in (2b).
Prosodic boundary always follows the subject (= default topic) (Erguvanli, 1984; Kamali, 2008).
Embedded verb form resolves the ambiguity: intransitive for LC, transitive for EC

Task: End-of-sentence 'got it' judgment, auditory presentation

2 listening experiments: Experiment 1: phrase lengths similar to SKS
Experiment 2: manipulate phrase lengths in reverse

	Cooperating Prosody	**Conflicting** Prosody	**Neutral** Prosody
Experiment 1 (Length conditions similar to SKS)	LC (4+2 PWds) EC (3+3 PWds)	LC (3+3 PWds) EC (4+2 PWds)	LC (4+2 PWds, syntactic) EC (3+3 PWds, syntactic)
Experiment 2 (Conditions manipulate length in reverse)	LC (3+3 PWds) EC (2+4 PWds)	LC (2+4 PWds) EC (3+3 PWds)	LC (3+3 PWds, syntactic) EC (2+4 PWds, syntactic)

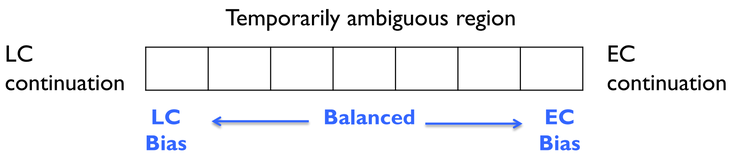
To manipulate length: Insert an extra word, either in the subject ('nearly'), or in the VP ('much') → 6 PWds in total
Optimal phrase length in Turkish = 3 PWds (Nash, 1973)
Optimal balanced length: 3 + 3 PWds

Predictions *('got it' RT)*	**LC Only**	**RSH Only**		**LC and RSH**	
	Experiments 1 and 2	Experiment 1	Experiment 2	Experiment 1	Experiment 2
Cooperating prosody	LC ≤ EC	LC < EC	EC < LC	LC < EC	LC = EC
Conflicting prosody	LC < EC	LC < EC	EC < LC	LC < EC	LC = EC
Neutral prosody	LC < EC				

Pre-tests

Normative Study: *To eliminate any inherent semantic/pragmatic bias*

40 NP-NP sequences: from a corpus (Sak et al., 2008)
matched for LC/EC interpretation frequency
→ 40 sentences each in two versions: Lengthened subject
Lengthened VP
Plausibility judgment on 7-point Likert scale by 4 linguistically-informed native speakers (cf. Webman Shafran, 2011).



24 sentences with minimum bias were selected for use in the main experiments.
Average rating: Lengthened subject: 3.8
Lengthened VP: 3.9
No significant rating difference between the length conditions ($t(23) = .923$, $p = .366$)

Pronunciation Acceptability: *To establish the intended prosody*

24 sentences recorded with three prosodies: cooperating, conflicting and neutral
Cooperating prosody: IP boundary after the subject
Conflicting prosody: LC prosody for EC syntax and EC prosody for LC syntax
Neutral prosody: No prosodic boundary. Contrastive accent on the AP in the subject

Participants: 12 linguistically-informed native speakers

Task: Listen to the recordings & rate the speakers' pronunciation as 'okay' or 'erroneous'.
If the prosody supported or was compatible with the syntactic structure: 'okay'
If the prosody and sentence structure conflicted: 'erroneous'

Sentences which couldn't pass the criteria were re-recorded and judged again.

Acceptability ratings: Cooperating prosody: 100%
Neutral prosody: 99%
Conflicting prosody: 3%

Phonetic Analyses: *Acoustic confirmation of the intended prosody*

Durational measures and fundamental frequency (F_0) analyses on the temporarily ambiguous region.

Prosodic boundary: pre-boundary word lengthening, high pitch on the pre-boundary word, pause

Cooperating prosody: Prosodic boundary after: NP2 in LC syntax
NP1 in EC syntax
Conflicting prosody: Prosodic boundary after: NP1 in LC syntax
NP2 in EC syntax

Significant durational and F_0 differences on NP1 between LC and EC syntax conditions, and likewise for NP2, in both cooperating and conflicting prosody conditions (t's > 2)

Neutral prosody: No prosodic boundary after NP1 or NP2

No significant durational and F_0 differences for NP1or NP2 between LC and EC syntax conditions (t's < 2).

Experiment 1

Conditions:

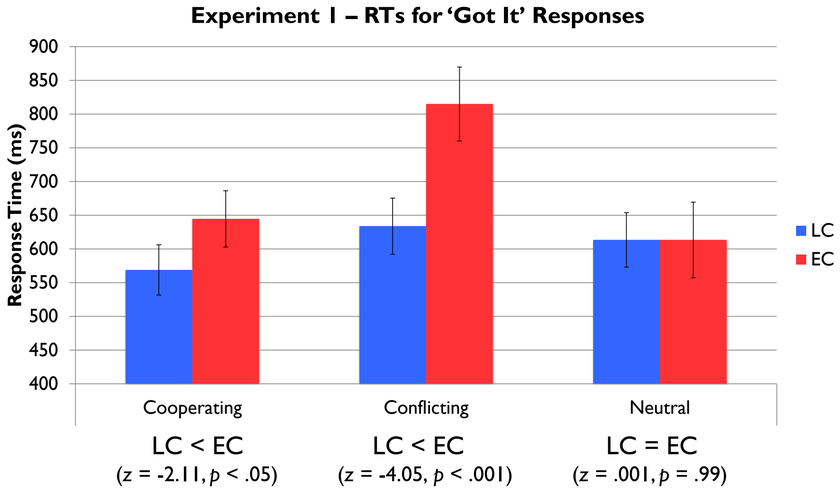
Prosody	**LC Syntax (4 + 2 PWds)**	**EC syntax (3 + 3 PWds)**
Cooperating prosody	4+2 PWds (unbalanced)	3+3 PWds (balanced)
Conflicting prosody	3+3 PWds (balanced)	4+2 PWds (unbalanced)
Neutral prosody	(no break)	(no break)

Materials: 24 experimental sentences each in these six versions
48 unambiguous fillers: 24 with cooperating, 24 with neutral prosody

Participants: 54 native speakers of Turkish

Task: Listen to the sentences carefully
Indicate if 'got it' (i.e., understood) by pressing 'yes' or 'no' button
Comprehension questions at random intervals to ensure attention (after 25% of items)

Results: Response times for 'got it' responses, analyzed using mixed effects modeling.



Interpretation:

Cooperating & Conflicting:
- LC advantage.
- Could be due to syntactic LC strategy and/or RSH (interface).

Neutral Prosody:
- RSH is not applicable.
- No LC-advantage suggests LC strategy did not apply.
- Or else LC bias is offset by a preference for 3+3 balance (which favors EC here).

Experiment 2

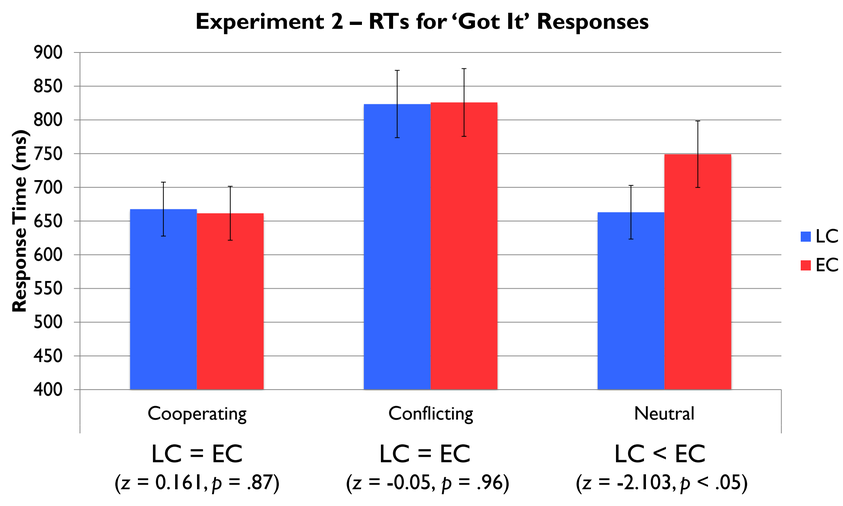
Conditions:

Prosody	**LC Syntax (3 + 3 PWds)**	**EC Syntax (2+ 4 PWds)**
Cooperating prosody	3+3 PWds (balanced)	2+4 PWds (unbalanced)
Conflicting prosody	2+4 PWds (unbalanced)	3+3 PWds (balanced)
Neutral prosody	(no break)	(no break)

Materials and procedure were otherwise same as Experiment 1

Participants: 52 native speakers of Turkish

Results:



Interpretation:

Cooperating & Conflicting:
- LC advantage disappears.
- Suggests Exp 1 advantage was not solely due to syntactic LC.
- But also no EC advantage as predicted by RSH.
- Suggests a trade-off between syntactic LC bias (= anti-EC bias) and RSH.

Neutral Prosody:
- LC advantage suggests LC strategy applies when RSH does not.
- Or else a preference for 3+3 balance (which favors LC here).

Conclusion

- With overt prosodic boundaries (Cooperating & Conflicting prosody): Syntactic LC strategy and RSH are both at work, as revealed by Experiment 2.
- In the absence of overt prosodic phrasing (Neutral prosody), the only account consistent with both experiments is: Syntactic LC strategy plus a preference for balanced phrasing.
- We assume that listeners mentally project prosodic boundaries when they are absent in the stimulus, with a bias toward typical and/or balanced phrase lengths. (See our other poster for Uniformity effects in reading.)
- ***Overall conclusion:*** RSH indeed has powerful effects that can outweigh Late Closure. Nevertheless, the syntactic Late Closure strategy **cannot be eliminated** in favor of prosodic interface constraints.

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