

1. RC ATTACHMENT ASYMMETRIES

Variation in Relative Clause (RC) attachment across languages (a,b) ([1], a.o.):

LOW ATTACHMENT, LA

a. Someone shot the maid₁ of the acress₂ that₂ was standing on the balcony

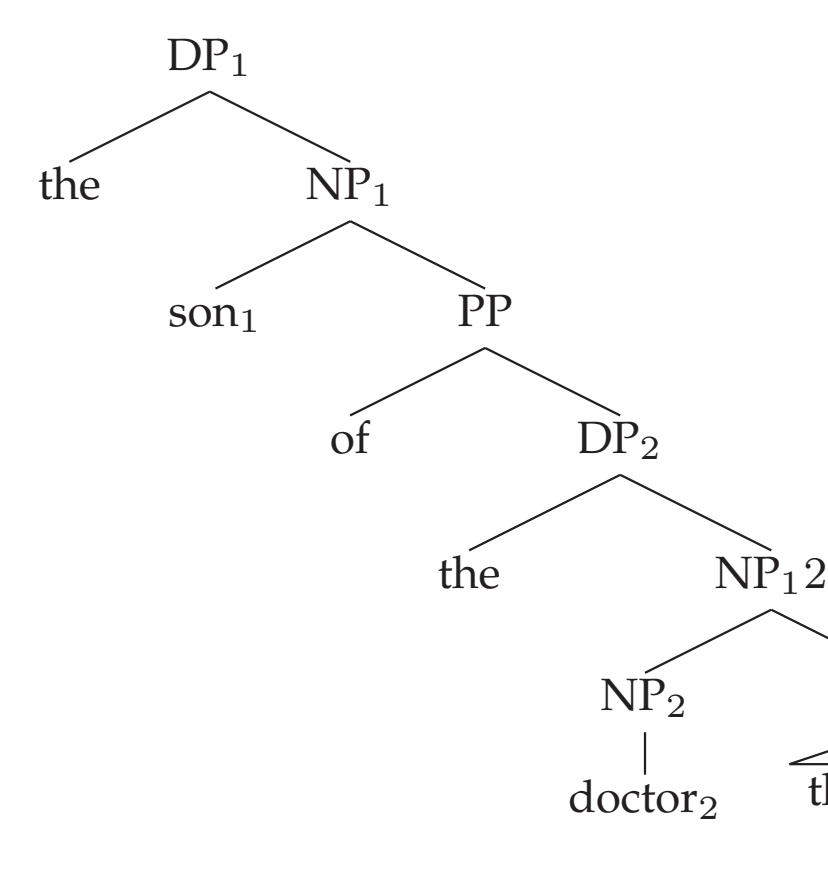
HIGH ATTACHMENT, HA

b. Algúien disparó contra la criada₁ de la actriz₂ que₂ estava en el balcón

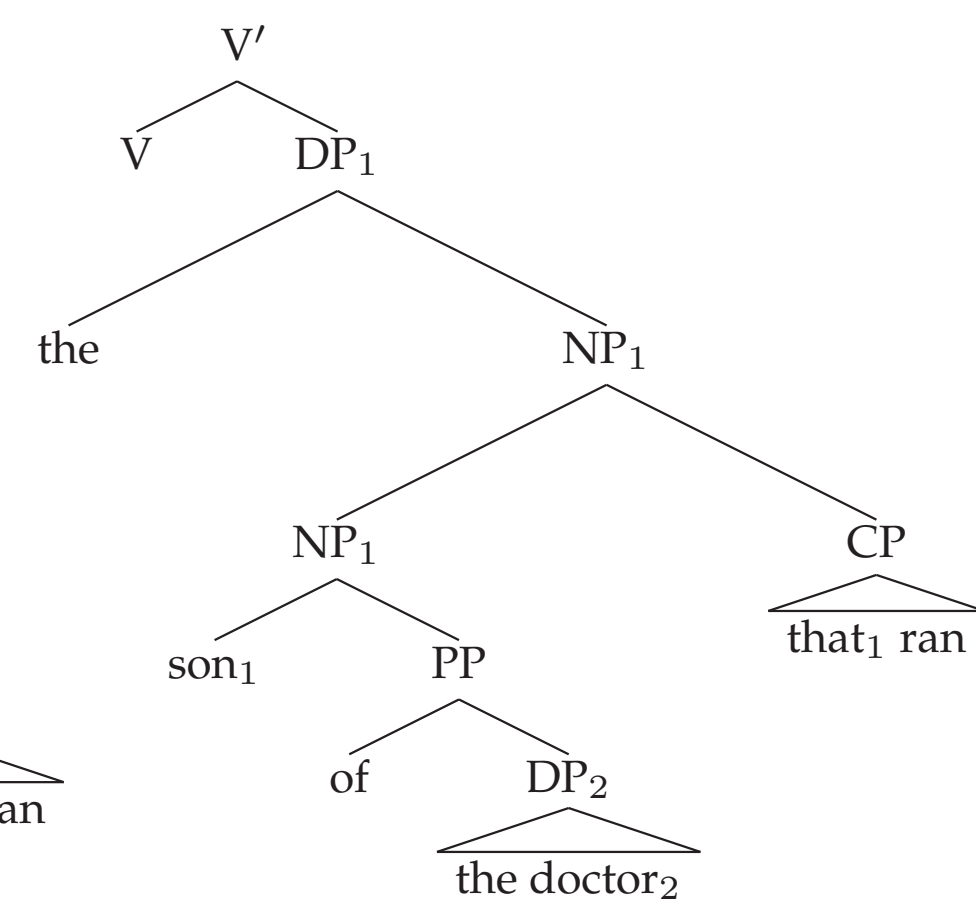
LOW ATTACHMENT, LA

A number of factors have been shown to influence attachment (including e.g. syntactic position, prosody, referentiality, animacy), and several accounts for the asymmetry have been proposed. However, there is a general consensus that none of them is fully satisfactory [3, a.o.].

a. Low Attachment



b. High Attachment



3. EXPERIMENT 1: TIMED QUESTIONNAIRE

To test the role of PR in attachment preferences we manipulated PR availability through verb type: event-introducing (PR ok) vs. states-introducing (*PR) Verbs (e.g. see vs. live with). [see 2, for additional results from EP]

Method: Timed Questionnaire, with *psyscope*. Participants: (n=24) European Portuguese Speakers. Materials and Design: 24 stimuli, minimal pairs contrasting PR-availability, 48 fillers. Stimulus sentences were matched for number of syllables, plausibility, referentiality and animacy. Counterbalanced materials and questions.

Stimuli

A. PR / RC

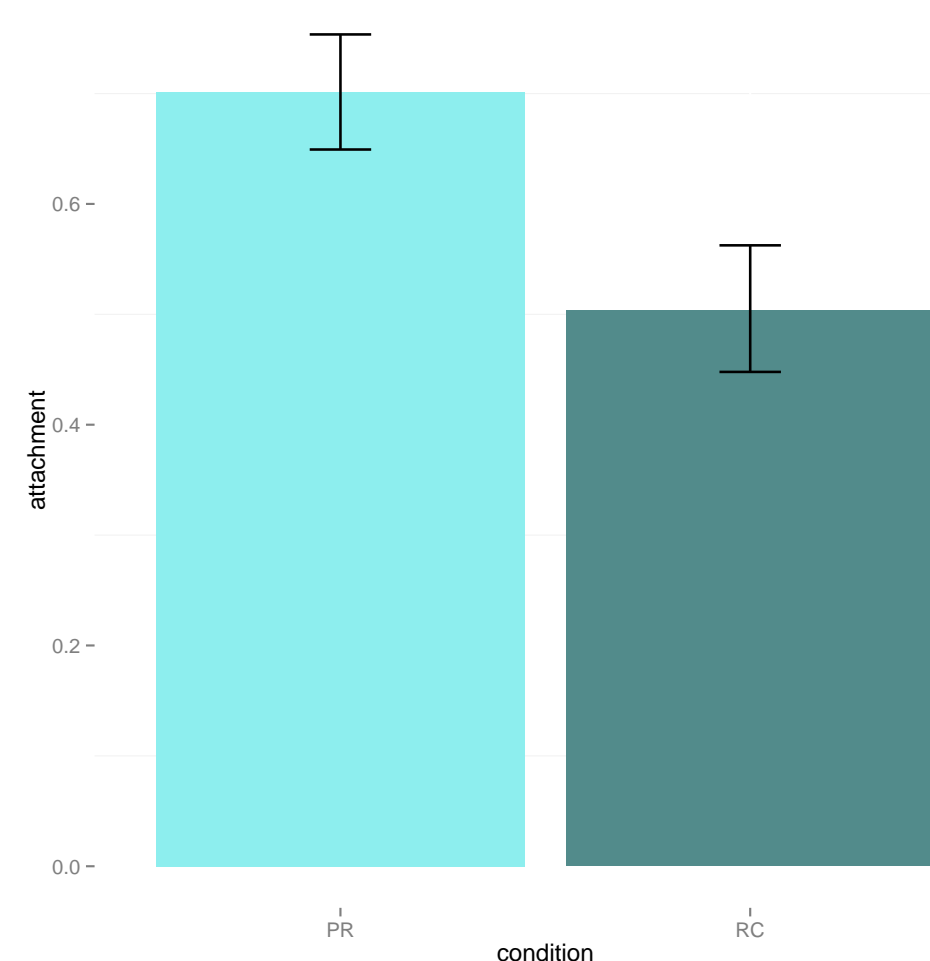
O João viu o estudante do professor que estava a jantar no café
João saw the student of the professor that was dining at the café

B. RC Only

A Paula concorda com o aluno do professor que estava a jantar no café
Paula agrees with the student of the professor that was dining at the café

RESULTS TQ

ATTACHMENT PREFERENCE



→ Significant effect of V-type: Higher proportion of HA in PR than RC

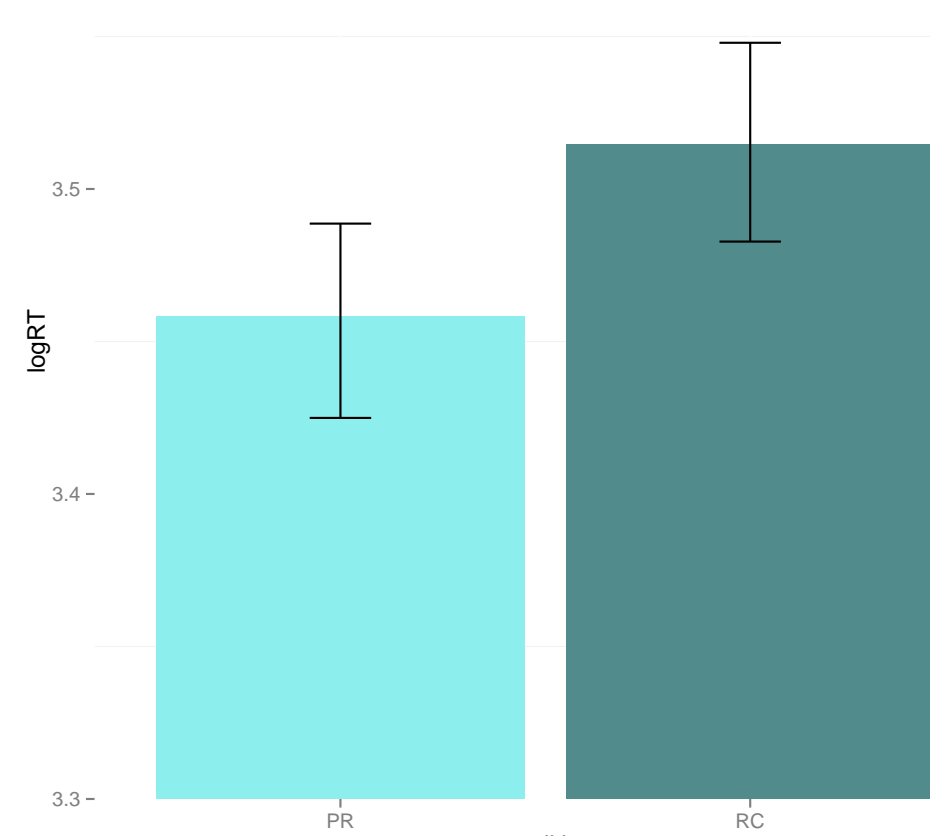
Table 1: Results of linear mixed model fit for Attachment Preferences in Experiment 1. Items and participants were crossed random factors.

contrast	coefficient	SE	z-value	Pr(> z)
HA in PR vs. RC	-0.9743	0.2587	-3.766	0.000166 ***

RESPONSE TIME

Table 2: Mean RT per Condition

PR	RC
3508.281	4041.976



→ Significant effect of V-type: Faster Response Times with PR than RC

Table 3: Results of linear mixed model fit for RTs. Items and participants were crossed random factors.

contrast	coefficient	SE	t-value
PR vs. RC	-0.05639	0.02650	-2.13

→ Similar results obtain from manipulation of Small Clause availability in English:

- Significantly > HA preference with SC than with RC-only (p < .0001).
- Significantly faster RTs with SC than RC-only (t-value = 2.04).
- We also found an interaction between vtype and attachment (t-value = -2.01), showing that the timing effect is driven by RC-only, i.e. there was no significant difference in RTs between HA and LA for the PR condition.

In the following experiment in EP, we further investigate the timing of PR / RC disambiguation and attachment.

4. EXPERIMENT 2: SELF-PACED READING

Method: Self-paced reading, PC running *Linger* (Doug Rodhe, http://tedlab.mit.edu/dr/Linger). Participants: (n=48) EP speakers divided in two groups. Materials and Design: 2between(V-type: PR / noPR) X 2within(attachment: local / nonlocal) X 2within(number disambiguation: singular / plural); 2 sets of 24 target sentences (4 versions each, adapted from previous study), 48 fillers; item sentences were tested for plausibility and matched for number of syllables. Counterbalanced materials and questions. 3 subjects performed at chance in comprehension questions and were eliminated from analysis.

To avoid potential effects of Attraction triggered by the intervention of a different number marking we used all combinations of Singular and Plural for disambiguation. See [5] for evidence of Attraction effects in nonlocal attachment in EP.

Stimuli (NP1_{PLURAL} NP2_{SINGULAR} version)

A. PR, nonlocal

O Eduardo ouviu os irmãos do jovem que estavam a cantar no largo.
Eduardo heard the brothers of the youngster (that were) singing in the street.

B. PR, Local

O Eduardo vive com os irmãos do jovem que estava a cantar no largo.
Eduardo heard the brothers of the youngster (that was) singing in the street.

C. RC, nonlocal

A Matilde vive com os irmãos do jovem que estavam a cantar no largo.
Matilde lives with the brothers of the youngster that were singing in the street.

D. RC, Local

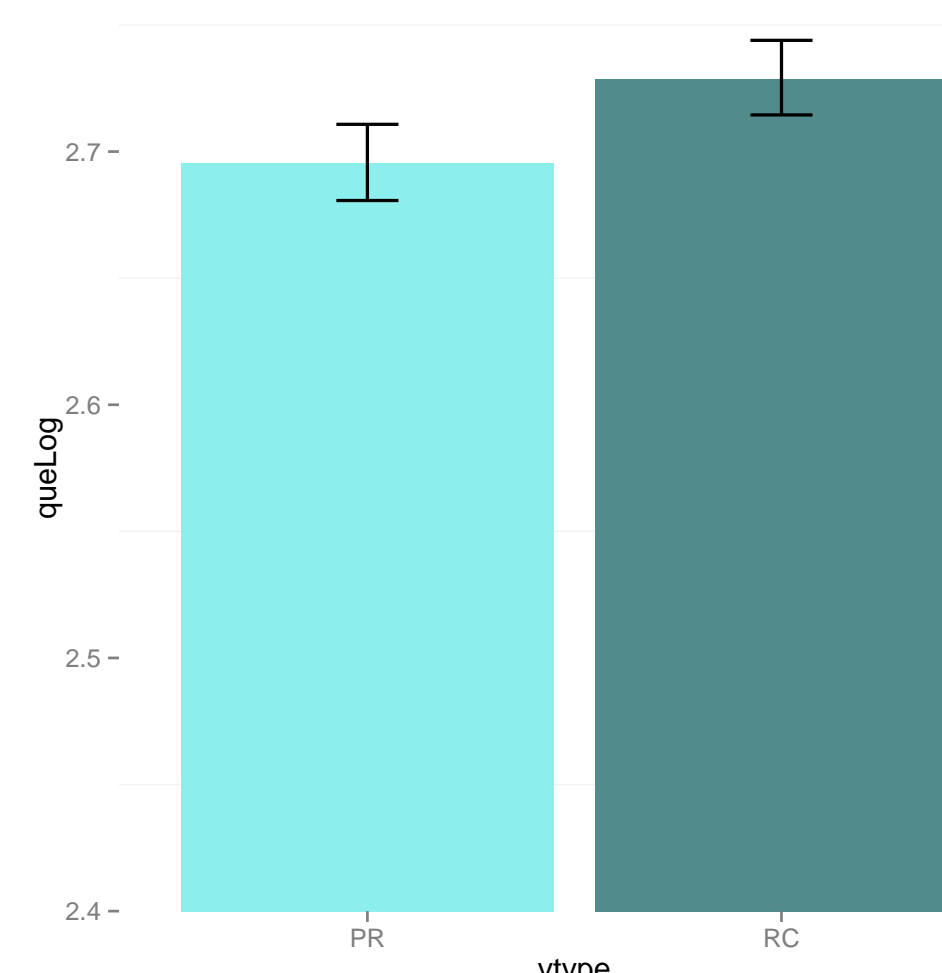
A Matilde vive com os irmãos do jovem que estava a cantar no largo.
Matilde lives with the brothers of the youngster that was singing in the street.

RESULTS SPR

RTs AT COMPLEMENTIZER

Table 4: RTs at Comp

PR	RC
544	578



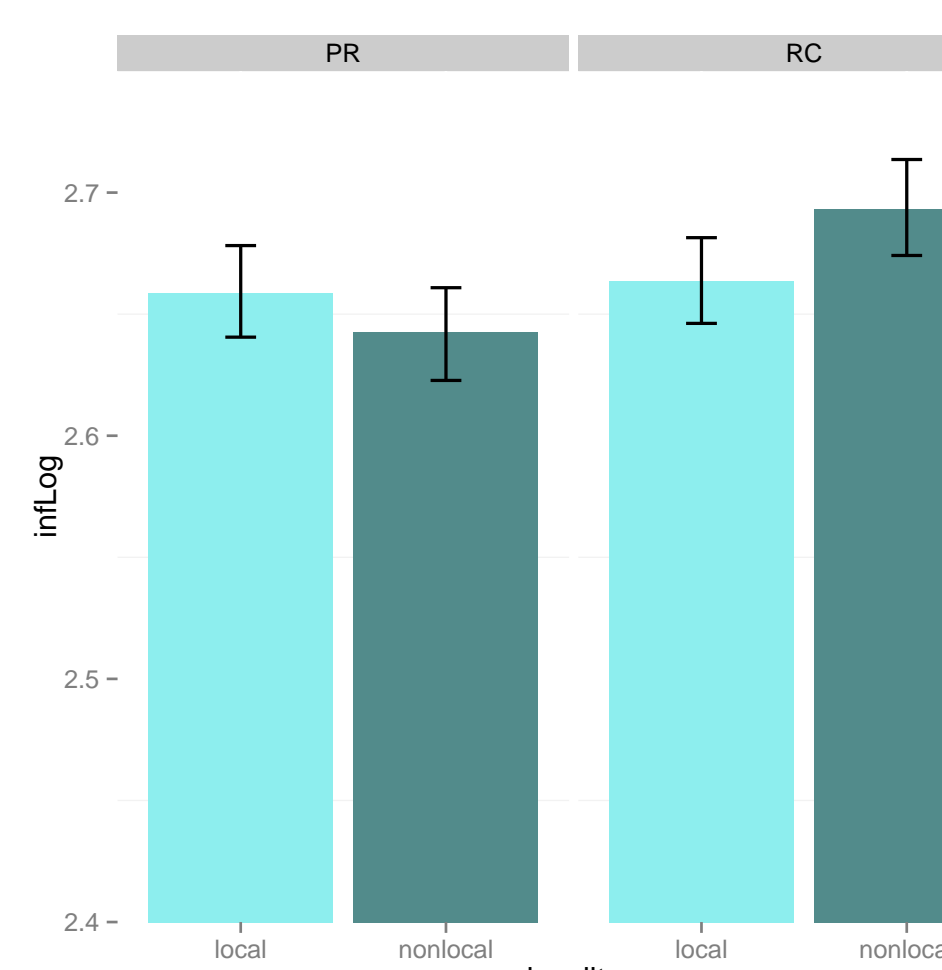
→ Significant effect of V-type: faster RTs with PR than RC-only at Comp.

contrast	coefficient	SE	t-value
PR vs. RC	0.033197	0.010779	3.1

RTs AT INFINITIVAL MARKER

Table 5: RTs one word downstream from disambiguation point

	Local	NonLocal
PR	494	477
RC	489	529



→ Significant interaction V-type*locality: Faster RTs for local than nonlocal attachment in RC condition only.

contrast	coefficient	SE	t-value
vtype*locality	0.047371	0.015135	3.13

2. THE PR CONFOUND

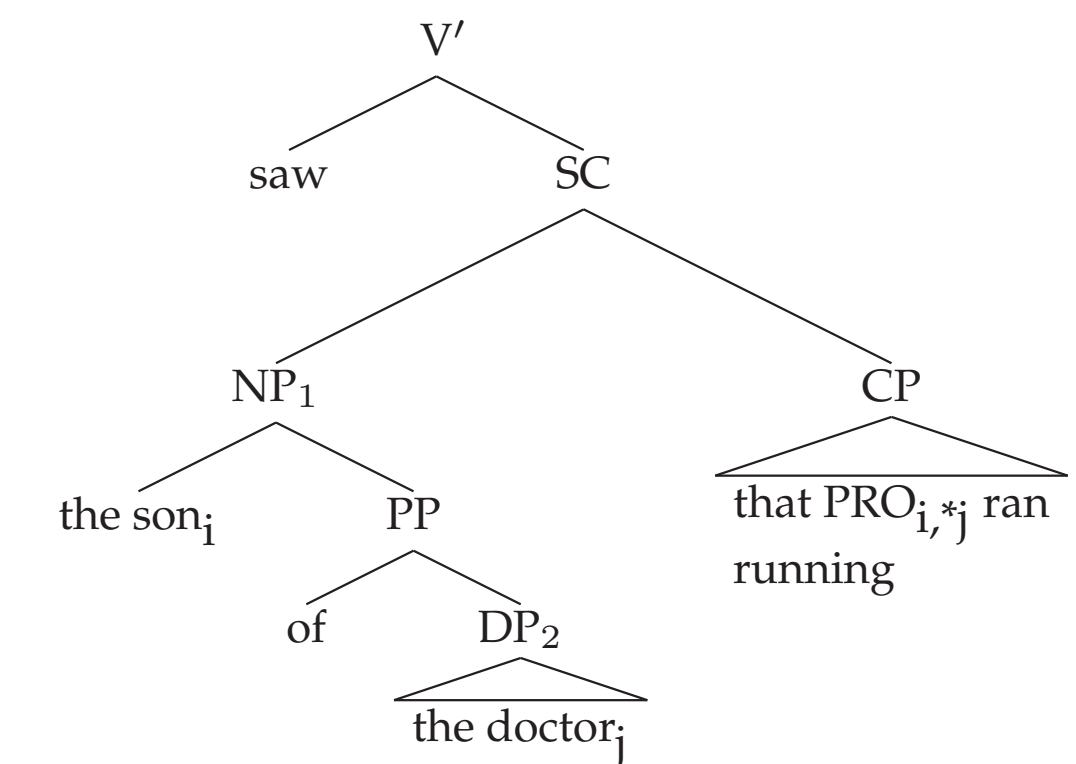
Grillo & Costa 2012 [4]: In some languages and structures, apparent RCs can also be interpreted as Pseudo Relative Small Clauses (PRs).

- (1) a. Ho visto [PR Gianni che correva] / He visto a [PR Juan que corria]
b. *I saw John that ran / I saw [SC John running]

PRs and RCs are string identical, but have very distinct structural and interpretive properties:

→ CRUCIALLY, WHEN PR IS PROJECTED IN COMPLEX NP CONTEXTS, DP2 IS NOT AN ACCESSIBLE SUBJECT:

- (2) a. Ho visto [SC il figlio_i del medico_j che EC_i/s_j correva]
b. I saw [SC the son_i of the doctor_j; running_i/s_j]



PR-first Hypothesis (Grillo & Costa 2013):

- When PRs are available, everything else being equal (e.g. lexical, contextual and prosodic factors), they will be preferred over RCs.
- Rationale: PRs are both structurally and interpretively simpler than RCs.
- Consequences:

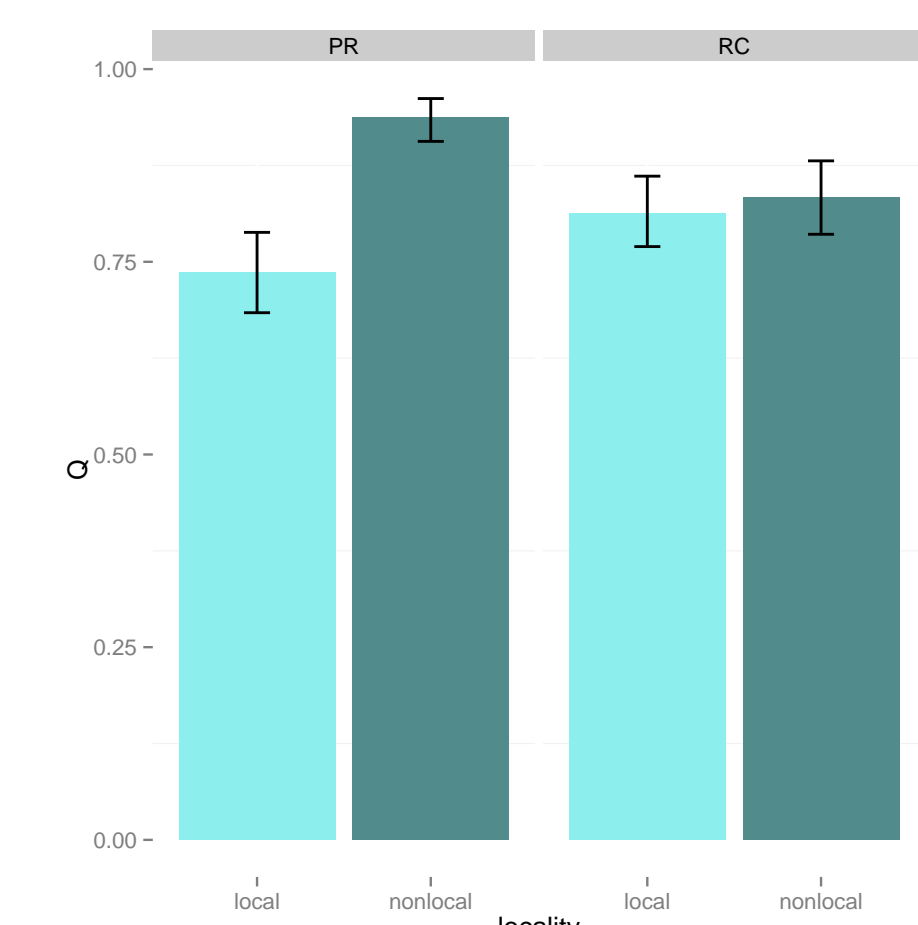
- A. Low Attachment preference with genuine restrictive RCs, i.e. PRs not available, across languages and structures.
- B. High Attachment preference in languages and structures which allow PR.

5. MORE RESULTS SELF-PACED READING

ACCURACY AT COMPREHENSION Qs

Table 6: Mean % Correct Responses

	PR	RC
LA	73.6	81.3
HA	93.7	83.3



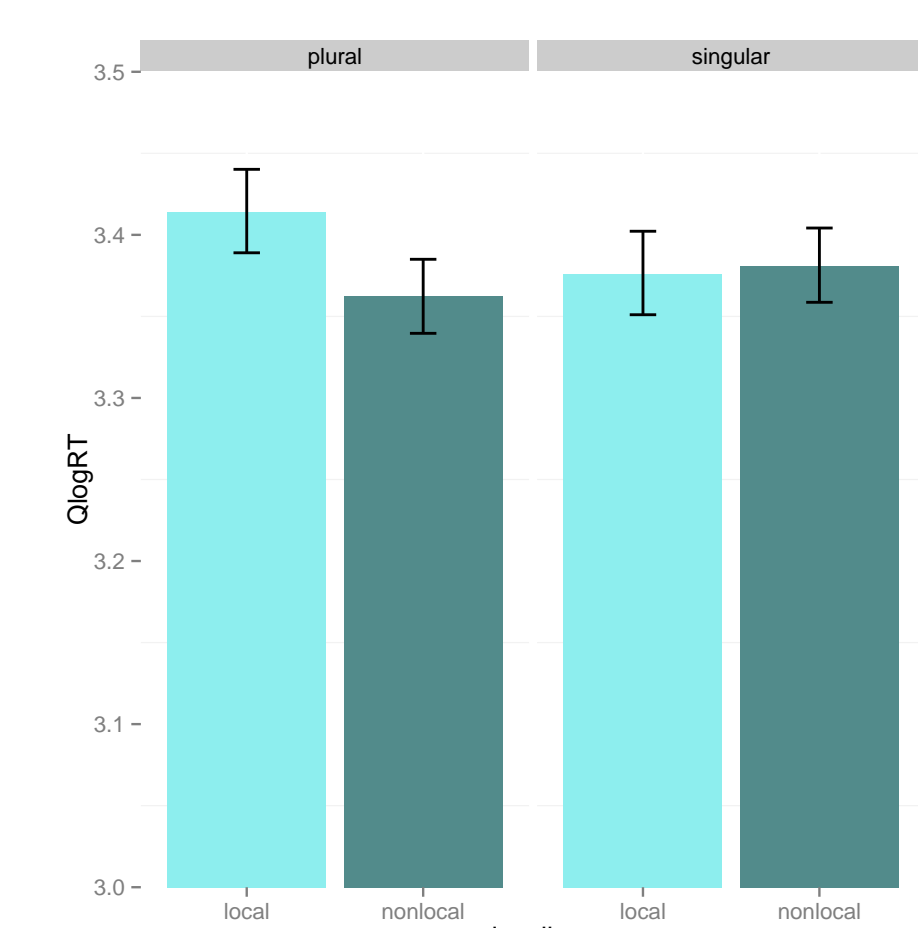
→ Main effect of locality: Better comprehension with non-local than local, → Significant vtype*locality interaction: Better comprehension with Non-Local PR than local PR, no effect of RC across locality.

contrast	coefficient	SE	z-value	p
vtype*locality	-1.88769	0.43889	4.301	p<.0001***

RESPONSE TIMES

Table 7: Mean Response Time

	Plural	Singular
Local	2961	2698
nonLocal	2570	2684



→ Significant locality*number interaction: significantly longer RTs for local-plural than non-Local-plural attachment.

contrast	coefficient	SE	t-value
locality*number	0.055767	0.021428	2.60
vtype*locality	0.046895	0.026979	1.74 (not significant)

6. CONCLUSIONS

1. Greater proportion of HA in the PR than in the RC-only condition.
2. Faster RT for PR/RC than RC-only condition at the first point of ambiguity (i.e., complementizer)
3. Faster offline RT for HA than LA in PRs.

1 and 3 are clearly in line with the PR-first Hypothesis, as is 2 when further considered. The PR/RC condition has 2 potential sources of ambiguity (structural and attachment) but RC-only has one (attachment). In conjunction with the data from the disambiguating region, it seems the parser keeps both structural options available without making any attachment decisions, whereas in the case of RC-only the parser makes an early LA decision. The effect of 2 is thus accounted for by the cost of making an attachment decision in RC-only and further supported by a larger RT for HA over LA at the point of disambiguation in this condition only.

Limitations: Finally, the non-significant tendency to favour HA in the PR condition (t-value = 1.74) appears to contradict an early preference for PRs over RCs, and calls for further investigation.

REFERENCES

- [1] Cuetos & Mitchell. 1988. Cross-linguistic differences in parsing. *Cognition*, 30.
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- [4] Grillo & Costa. 2012. A novel argument for the universality of parsing principles. 25th CUNY Conference.
- [5] Lourenço-Gomes, Costa & Maia. 2011. Number and gender integration in sentence processing. 10th Symposium of Psycholinguistics, Donostia.

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