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Exploring the prosody of the RC attachment construction in English and Spanish

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We re-examine and supplement—with expanded duration analyses and new pitch contour analyses—the preliminary report of Fernández et al. (2003) on patterns of phrasing in English and Spanish sentences containing the relative clause (RC) attachment construction, see (1). That study, prompted by the findings of Hemforth et al. (submitted), examined utterances elicited using written stimuli, as in (2). Prosodic analyses bear on an account of behavioral findings under two assumptions (Fodor, 1998): that implicit prosody projected during silent reading factors into attachment decisions, and that projected prosody resembles explicit prosody. Our goal (as in Fernández et al.) is to determine what aspects of attachment preference do and do not have prosodic correlates.

Hemforth et al.'s study of attachment preference, contrasting the construction's usual post-verbal object placement with pre-verbal subject placement, replicates the cross-linguistically invariant effect of RC length (higher attachment for longer RCs), and reveals two notable new features. Uniformly across languages, pre-verbal placement weakens the effect of RC length on attachment. Additionally, for Spanish but not English, mean rates of N1-attachment shift across sentence types: Spanish attaches higher than English post-verbally, but lower pre-verbally.

Fernández et al. establish that phrasing patterns correlate with Hemforth et al.'s findings for RC length, but not for attachment shift. In N2 durations, where final-lengthening plus optional pausing accompany the N2][RC phrase-break which arguably promotes N1-attachment, they report a length-by-placement interaction. For both languages, N2 durations are reliably greater before long RC, but this effect is reduced for N2 durations in sentences with N1-*of/de*-N2-RC placed pre-verbally. This interaction plausibly originates in the global prosody of pre-verbal placement sentences: an obligatory phrasing break between the super-heavy subject and its matrix verb reduces the likelihood of a break internal to N1-*of/d*e-N2-RC.

However, N2 durations altogether lack the language-by-placement interaction required if Spanish attachment shift (and English non-shift) were similarly correlated with modulation of the likelihood of N2][RC phrasing breaks. To definitively rule an account in these terms of attachment shift, our expanded analyses of N2 duration incorporate comparisons of target-sentence N2 with corresponding measures drawn from the preamble sentences of the elicitation protocol. The latter provide estimates of N2's intrinsic duration, and these baselines are critical since phonetic content inevitably varies in a cross-linguistic study, e.g., *bridegroom* versus *novio*. Analyses here confirm the finding of a null language-by-placement interaction.

Acknowledging that sentence prosody recognizes not only the siting of phrasing breaks but also their intonational category, we consider also the possibility that pre-verbal and post-verbal placement can trigger N2][RC breaks of different kinds. Our pitch contour data suggest that in Spanish this may be so. The rising contour assigned by Spanish to N2 in post-verbal materials is reserved for the close of RC in pre-verbal materials, where N2 carries instead a falling contour. Since in English N2's contour uniformly falls, N2][RC phrasing tunes indeed correlate with the behavioral pattern. Still to be determined is what translation different pitch contour patterns have in formal prosodic analyses, and how in turn these might factor into a prosodic account of attachment preference.

Examples

(1) a. The guest impressed the brother of the bridegroom who (often unknowingly) snores.
b. The brother of the bridegroom who (often unknowingly) snores impressed the guest.

(1′) a. El invitado impresionó al hermano del novio que (a menudo inconscientemente) roncaba.
b. El hermano del novio que (a menudo inconscientemente) roncaba impresionó al invitado.

(2) a. The guest impressed the brother of the bridegroom.
(The brother of the bridegroom impressed the guest.)
b. Which bridegroom? The bridegroom who (often unknowingly) snores.

(2′) a. El invitado impresionó al hermano del novio.
(El hermano del novio impresionó al invitado.)
b. ¿Qué novio? El novio que (a menudo inconscientemente) roncaba.

References

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Hemforth, B., Fernández, S., Clifton, C. Jr., Frazier, L., Konieczny, L., & Walter, M. (submitted). Relative clause attachment in German, English and Spanish: Effects of position and length.

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BACKGROUND TO THE STUDY

- Our aim is to characterize the default (i.e., discourse-neutral) prosody assigned to complex sentence types for which formal prosodic analyses are as yet unavailable.
- Fodor's (1998, 2002) Implicit Prosody Hypothesis claims that prosody projected during silent reading influences parsing.
- The RC-attachment ambiguity is the parade case.

ATTACHMENT PREFERENCE DATA

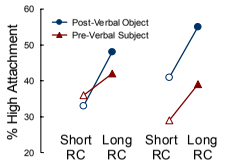
- Hemforth et al.'s (submitted) cross-linguistic study expands the database on RC attachment preferences. The innovation is to contrast the usual **post-verbal object** placement of the N1-N2-RC construction with **pre-verbal subject** placement.
- Materials manipulate placement and RC length, factorially.
- Data were gathered in offline study employing standard questionnaire format.
- We focus here on the data patterns for native speakers of American English and of Castillian Spanish.

POST-VERBAL The guest impressed the brother of the bridegroom who snores.
El invitado impresionó al hermano del novio que roncaba.
(Long RC) who often unknowingly snores
que a menudo inconscientemente roncaba

PRE-VERBAL The brother of the bridegroom who snores impressed the guest.
El hermano del novio que roncaba impresionó al invitado.

HEMFORTH et al. FINDINGS

- Pre-verbal subject placement of N1-N2-RC attenuated effects of RC length in both languages.
- Additionally, overall attachment differed strikingly for Spanish — but not for English — between pre- and post-verbal placement.



OVERT PROSODY DATA (PRELIMINARY)

- Fernández et al. (2003) elicited utterances corresponding to a selected subset (sentences = $8 \times 2 \times 2$ for each language) of Hemforth et al.'s materials. Elicitation (from 8 speakers for each language) employed a "Post-to-Times" protocol ensuring that RC was read restrictively, and that RC was disambiguated for low attachment (Bradley et al., 2003), e.g.,

S1 The guest impressed the brother of the bridegroom.
The brother of the bridegroom impressed the guest.
Which bridegroom?
S2 The bridegroom who (…) snores.
TARGET The guest impressed the brother of the bridegroom who (…) snores.
The brother of the bridegroom who (…) snores impressed the guest.

- Assuming final lengthening (plus optional pausing) to be the acoustic signature of phrasal breaks:
  - N2 duration will be informative of the likelihood of N2][RC, a phrasing pattern predicted to promote attachment to N1.
  - RC-Verb duration will be informative of the likelihood of NP][VP in sentences with N1-N2-RC placed pre-verbally.

Fernández et al.'s preliminary analysis identifies prosodic correlates of RC-length effects, shared across languages, but *no such correlates* in duration of the cross-linguistic difference turning on pre- versus post-verbal placement.

OBJECTIVE: Supplement preliminary analysis with new analyses of pitch movement, and of duration

DATA EXTRACTION AND TREATMENT

- In **TARGETS** only, we focus on sites which Fernández et al.'s analysis identifies as final in default phonological phrasing:
  N2 = phrase-final in N2][RC
  RC-Verb = phrase-final in NP][VP (pre-verbal), and sentence-final (post-verbal)
- All pitch-track errors, doubling and halving (< 3% of dataset), were identified and corrected.
- Mean F0 for N2 and RC-Verb was calculated for each of five 50 ms bins in each utterance. Bin definition was offset-locked and partitioned the final 250 ms of phonation.
- Line graphs display **F0 values** at each bin's midpoint.
- Bar graphs display **F0 change** for a time-span 200 ms = four bin steps. The data calculation uses slope coefficients in linear regressions for each utterance.

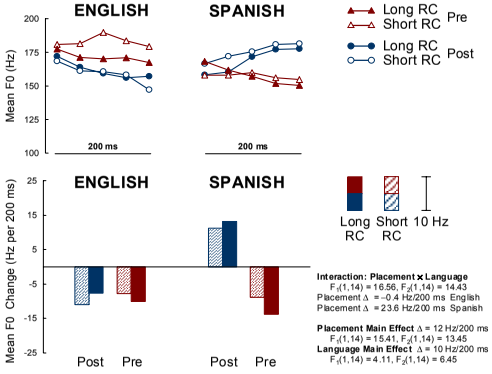
DATA EXTRACTION AND TREATMENT

- Acoustic landmarks, consistent for any item across speakers, permitted reliable segmentation of utterances into regions of specific interest
- Duration values for N2 in the complex NP were extracted for:
  S1 = 1st simplex sentence
  S2 = 2nd simplex sentence
  TARGET = 'Times' sentence
- Duration values for RC-Verb (always constituent-final, and sentence-final in post-verbal targets and simplex sentences) were extracted for:
  S2 = 2nd simplex sentence
  TARGET = 'Times' sentence
- Outliers (< 2% of dataset) were replaced by cutoff limits

N2 PITCH DATA

Data reflect boundary tones instantiated phrase-finally at the right edge of the complex noun phrase.

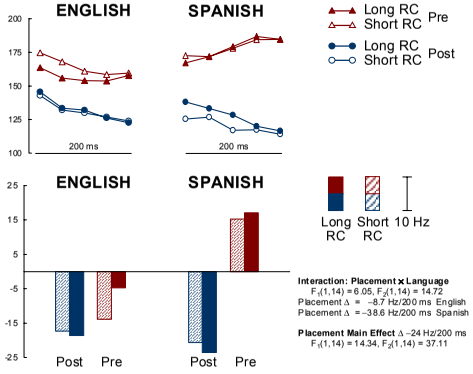
The guest impressed the brother of **the bridegroom**][who (…) snores.
The brother of **the bridegroom**][who (…) snores impressed the guest.



RC-VERB PITCH DATA

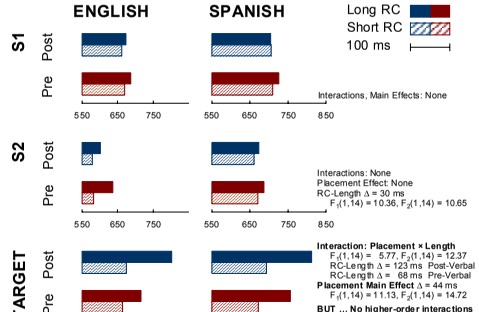
Data reflect boundary tones instantiated sentence-finally or sentence-medially at the right edge of RC.

The guest impressed the brother of the bridegroom who (…) **snores**.]
The brother of the bridegroom who (…) **snores**][impressed the guest.



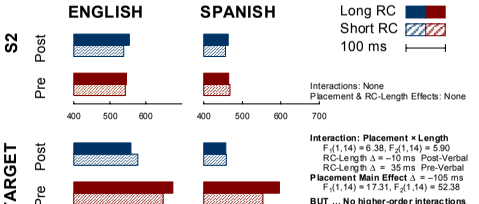
N2 DURATION DATA

Longer N2 in targets indicates that N2][RC break is more likely.



RC-VERB DURATION DATA

Longer RC-Verb in targets with pre-verbal N1-N2-RC indicates that NP][VP break is more likely. In S2 and targets with post-verbal placement, RC-Verb is sentence-final. Thus, measures of duration can capture lengthening but not optional pausing, necessarily. These data provide a control for unavoidable differences between English and Spanish in phonetic content, e.g., *snores* vs. *roncaba*, and for differences in speech rate.



SUMMARY OF DATA OUTCOMES

- Pitch movements, which we assume reflect boundary tones, accord with the *differences* across languages observed by Hemforth et al: Where overall attachment shifts between pre- and post-verbal N1-N2-RC (in Spanish), N2 takes different tones (falling, rising). Where no shift is evident (in English), a falling tone on N2 is uniform in the two sentence configurations.
- Final lengthening patterns accord with *similarity* across languages in effects of RC length: Effect magnitude has its parallel in changing N2][RC likelihood.

CONCLUSIONS AND SPECULATIONS

- A prosody claim surely draws comfort from the fact that language-common *and* language-particular aspects of the attachment preference data are indexed in the prosodic patterns of Spanish and English.
- But what is the source of contrasting sentence-medial tunes in Spanish, variously rising and falling? It remains a matter for formal prosodic theory to determine whether such contours can be projected entirely within the syntax-prosody interface without appeal to, e.g., information structure.