Prosodic manipulation in child directed speech: a cross-linguistic study

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Prosody and CDS

**Characteristics** (e.g. Albin & Echols, 1996; Fernald & Simon, 1984; Garnica, 1977; Grieser & Kuhl, 1988; Stern et al, 1982):

- higher and greater range of pitch, especially in stressed syllables
- higher amplitude
- slower speech rate
- longer duration of individual words, shorter utterances and longer pauses (and possibly more reliable positioning of pauses at phrase boundaries, though see Kempe et al, 2009)
- more prominent final lengthening

• ‘the essential acoustic property of CDS is the exaggeration or modulation of characteristics that are already present in ADS’ (Dominey & Dodane (2004: 128)

**Function?**


• Claimed role in language acquisition (Fisher & Toukura, 1996, Soderstrom et al, 2008, Seidl, 2007). Though others argue that CDS may be less informative about syntactic structure (Fernald & McRoberts, 1996)
Present research questions

i) Rhythm
   a) Do adults vary their speech rhythm when addressing young children? If so:
   b) Do they exaggerate the specific rhythmic characteristics of their language (as observed in ADS)?
   c) Are cross-linguistic differences in rhythm still evident?

ii) Prosodic lengthening
    a) Is there evidence, more generally, of more exaggerated prosodic lengthening in CDS, or is it just final lengthening?
    b) Are adults more selective in prosodic lengthening when they address infants?
    c) To what extent might differences in prosodic marking account for differences in rhythm metrics?

iii) Intonational contours
    a) Do adults typically select different pitch accents / contours when addressing infants, or do they simply modify the phonetic detail (e.g. pitch range)?
Our material

• Subjects: 9 Catalan-speaking, 9 Spanish-speaking and 9 English-speaking female adults, interacting with their children (for CDS), aged 2, 4 and 6 years, and an adult interviewer (for ADS)

• semi-structured dialogues elicited through short, animated clips shown on a computer

• Mothers repeat what the child has said:
  – (Mother): What’s Tom doing?
  – (Child): Cutting his hair!
  – (Mother): Yes, he’s cutting his hair!
Rhythm analysis

Vocalic and consonantal intervals segmented, labelled and extracted (in Praat)

Application of metrics: %V, ΔV; VarcoV; ΔC; VarcoC; rPVI-V; nPVI-V; rPVI-C; nPVI-C (cf Grabe & Low, 2002; White & Mattys, 2007) and calculation of speech rate
Prosodic lengthening analysis

- Only English and Catalan; only CDS towards 2 year-olds
- Extracted two most common syllable types, CV and CVC (total = 1170) and labelled according to:

  level of prominence:
  - lexically unstressed
  - lexically stressed + accented
  - nuclear accented

  phrase position:
  - initial, medial or final

  word position:
  - initial, medial or final
Results
More vocalic (higher %V): Catalan only

Lower vocalic variability (lower VarcoV)

Lower consonantal variability (lower ΔC)

More ‘syllable-timed’

Supports ‘exaggeration’ hypothesis

- More vocalic (higher %V): Catalan only
- Lower vocalic variability (lower VarcoV)
- Lower consonantal variability (lower ΔC)
- More vocalic (higher %V)
- Lower vocalic variability (lower VarcoV)
- Lower consonantal variability (lower ΔC)

More ‘syllable-timed’
Goes against
‘exaggeration’ hypothesis
• Not an exaggeration of ADS rhythm (English CDS more ‘even-timed’)

• Nor a straightforward accommodation to rhythm in child speech
  – lower %V and lower vocalic interval variability, but higher consonantal interval variability (Payne et al, under review; Post, today)
Cross-linguistic differences in CDS

English has lower %V and higher consonantal and vocalic interval variability than Catalan (all metrics)

Spanish distinct from English only for rPVIc, nPVIv, %V and speech rate

Catalan distinct from Spanish only in normalised vowel metrics (nPVI-V and VarcoV)

**ADS categories maintained but more weakly** (between Spanish and English)
Summary of rhythm findings

• More ‘even rhythm’: Spanish, Catalan and English (Payne et al, 2009; in press)
  • Lower vocalic interval variability (VarcoV)
  • Lower consonant interval variability (ΔC)
  • Higher %V (Catalan and English)

  — Differences across rhythmic ‘categories’ weaker, compared with ADS (especially between English and Spanish)

  — Neither an exaggeration of ADS properties nor a straightforward accommodation to rhythm of child speech
Prosodic Lengthening results: overview

• Language-specific modifications in the parameters of lengthening for CDS

• Selective enhancement of certain structures, notably phrase-final lengthening and (in English) nuclear accented syllables

• Apparent ‘suppression’ of other structures

• Could be contributing to greater regularity of interval timing in CDS, cross-linguistically
Marking of phrase boundaries: patterns in ADS

**English**

- Position in phrase: main effect (p<0.001)
- Syllables in phrase-final position longer than phrase-medial (p<0.001) and phrase-initial (p<0.001)
- Phrase-initial syllables marginally longer than phrase-medial syllables (p<0.05)

**Catalan**

- Position in phrase: main effect (p<0.001)
- Syllables in phrase-final position longer than phrase-medial (p<0.001) and phrase-initial (p<0.001)
- No evidence for phrase-initial lengthening
Modification in CDS: English

- **CDS**
  - Position in phrase: main effect (p<0.001)
  - Phrase final syllables longer than phrase-medial (p<0.001) and phrase-initial (p<0.001)
  - Difference between phrase-initial and phrase-medial not significant

- Clear phrase-final effects, but unlike ADS, no evidence of boundary-initial lengthening in CDS

- **Effectively enhances RELATIVE salience of phrase-final lengthening**
Modification in CDS: Catalan

- CDS
  - Position in phrase: main effect ($p<0.001$)
  - Phrase final longer than phrase-medial ($p<0.001$) and phrase-initial ($p<0.001$)

- Clear phrase-final effects, but no evidence of boundary-initial lengthening in ADS or CDS

- No apparent modification
Clear durational marking of **nuclear** accent in both languages.

Durational marking also of other accented syllables, though not as pronounced in Catalan (mean difference 29ms, compared with 80ms in English).
Durational marking of lexical stress and pitch accents: modification in English CDS

Use of lengthening to differentiate nuclear accented syllables from other accented syllables. **Nuclear accented syllables even longer in CDS**

However, no clear durational difference between accented and unstressed syllables, away from nuclear accent. In particular, there is **less unstressed syllable reduction**
Use of lengthening to differentiate nuclear accented syllables from other accented syllables. However, unlike English, **nuclear accented syllables are shorter in CDS**

No clear durational difference between stressed and unstressed syllables, away from nuclear accent. As in English CDS, there is **less unstressed syllable reduction**
Summary of prosodic lengthening findings

- Evidence of modifications in prosodic marking in CDS for both Catalan and English

- *Cannot* be interpreted as an exaggeration of characteristics in ADS
  - Except for nuclear accented syllables in English CDS, there are no clear cases of longer duration

- Instead, we find selective enhancement of certain structures, notably phrase-final lengthening and (especially in English) nuclear accented syllables

- This enhancement is brought about by apparent ‘suppression’ of other structures

- Phonological, rather than phonetic, exaggeration
Overall summary and next steps

• Evidence for prosodic modification in speech directed towards children
  • More even-timed, irrespective of language (or rhythmic category)
  • Selective enhancement of certain structures (phrase-final lengthening and nuclear accents) and apparent suppression of others
    • Results in greater RELATIVE salience of these structures and a less variegated system overall of prosodic marking
    • Could be contributing to greater regularity of timing in intervocalic intervals in CDS, cross-linguistically

• Actual suppression of prosodic marking (across the board), or do other phonetic cues, e.g. pitch movement and intensity, continue to do the work?

• To what extent do these patterns reflect child speech to which it is a response?

• Intonational contours
Thank you!

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# Data set: number of utterances

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</table>
• PVI scores no different
- Lower vocalic variability (lower VarcoV)
- Lower consonant variability (lower ΔC)
- PVI and %V scores no different

More ‘syllable-timed’
• More vocalic (higher %V)
• Lower vocalic variability (lower VarcoV)
• Lower consonantal variability (lower $\Delta C$)
• PVI scores no different

More ‘syllable-timed’
Effects of syllable structure

- Unlike English, Catalan shows less durational variability as a function of syllable structure in CDS than in ADS
  - mean syllable duration longer in CDS than in ADS ($p<0.001$)
  - no significant interaction with syllable structure
- no main effect of speech style, but significant interaction between style and syllable structure ($p<0.05$)
- open syllables longer in CDS than in ADS, but closed syllables shorter
- More uniform duration across syllable structure types in CDS
In English, syllables are longer in CDS when in word-initial position and particularly in word-final position, but not word-medially. In Catalan, syllables are longer in CDS when word-medial and particularly in word-final position, but not when word-initial, or for monosyllables.