

# A dependency prosodic grammar for Italian

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## Abstract

Research on Italian intonation is mainly based on the autosegmental-metrical framework, aiming to provide a prosodic grammar that adequately accounts for all well-formed sequences of phonological prosodic events. An alternative approach to account for sequences of tone patterns, or alternatively melodic contours, is presented here, using a set of dependency rules operating on accent phrases pitch events. The resulting prosodic dependency grammar was tested on a large set of more than 2700 recorded sentences read by up to 10 speakers, allowing to detect the prosodic invariants among the realizations observed between speakers when the dependency rules are applied.

Keywords: dependency grammar, Italian, prosodic structure, intonation, Siwis corpus

## Introduction

In the past 30 years, a significant amount of research has been conducted on sentence intonation in Italian (e.g., Avezani, Gili Fivela 2020, De Dominicis 2010). A comprehensive list of references can be found in Gili Fivela & al. (2015)). Most studies are based on the autosegmental-metrical framework, although another approach can be found in Cresti, Moneglia (2018). Various aspects of the domain have been analyzed, including syntactic, semantic, and informational. Prosodic events are described as being aligned with syntactic boundaries, such as left and right dislocation, SN right edges, or related to informational categories, such as contrastive and narrow focus, yes/no questions, and exclamation. Although these efforts mostly pertain to short sentences in laboratory conditions, they aim to the elaboration of an intonation grammar capable of generating all well-formed sequences of prosodic events.

However, it is possible to approach prosodic structure as an autonomous linguistic object, a priori independent of the other structures of the sentence. As in the Autosegmental-Metrical (AM) model, the prosodic structure PS results from a hierarchical grouping of accent phrases (AP), the minimal prosodic units, into intermediate intonation phrases (ip), then into intonation phrases (IP), and finally into PS. Specific prosodic markers must then exist to indicate these successive groupings of accent phrases. The objective of prosodic phonology, as applied to Italian, is to describe the markers and their functions, rather than to describe well-formed sequences of tone patterns based on the sentence morphosyntactic structure.

## Prosodic events

The SIWIS analysis corpus (Goldman et al. 2016) comprises over 2760 sentences read by up to 10 different native speakers of “standard” Italian, as spoken on public TV channels RAI. The corpus includes a balanced number of declarative and interrogative sentences, with word counts ranging from 3 to 48.

Prosodic events are typically associated with the most perceptually salient speech objects, i.e. vowels and possibly final voiced consonants of accent phrases stressed syllables.

Pitch accents are usually phonetically described in terms of pitch change, duration and intensity. Instead, the glissando parameter is used integrating all three acoustic parameters into one to characterize melodic variations in the sentence. Although an approximation of the listener's actual perception, the glissando value compared to a threshold allows to distinguish pitch changes perceived as such from those perceived as static tones (Rossi, 1971).

Rather than use high or low melodic targets located on accent phrase boundaries, melodic contours located of stressed syllable are retained as markers of the prosodic structure. The classes of prosodic events are then:

- a. Sentence terminal declarative reaching the lowest pitch value in the sentence **Cdec** ↓ (L\*L%)
- b. Sentence terminal interrogative reaching the highest pitch value in the sentence **Cint** ↑ (H\*H%)
- c. Rising above the glissando threshold **Cris** ↗ (L\*H-)
- d. Falling above the glissando threshold **Cfal** ↘ (H\*L-)
- e. Rising or falling below the glissando threshold **Cneu** → (H\*)

Two additional contour categories are also taken into consideration: 'complex' which is instantiated on two syllables in the accent phrase, the stressed and the final (merged into one syllable if the final syllable is stressed), rising or generally falling below the glissando threshold on the accent phrase stressed syllable, and rising above the glissando threshold on the accent phrase last syllable vowel for interrogative, or below the glissando threshold but higher frequency level.

- f. Sentence terminal interrogative complex (a variant of Cint) (LL\*H%)
- g. Sentence non-terminal complex **Ccom** √ (LL\*H-), corresponding to the H\* boundary tone in AM.

The crucial aspect here concerns the glissando value of each prosodic event. This value distinguishes between melodic changes above or below the threshold, which are perceived as static tone rather than a melodic change. In classical annotation, all such changes would be labeled as H\*L- or L\*H-, regardless of their glissando value relative to the threshold.

## Prosodic dependency rules

Prosodic dependency rules govern the merging of accent phrases or groups of accent phrases based on the phonological contours described above.

**Cneu**  $\rightarrow \Rightarrow$  {**Cfal**  $\searrow$ , **Cris**  $\nearrow$ , **Ccom**  $\surd$ , **Cdec**  $\downarrow$ , **Cint**  $\uparrow$ } The neutral contour, rising or falling but below the glissando threshold, depends on any other class contour located later in the sentence (dependency “to the right”).

**Cris**  $\nearrow \Leftarrow$  **Cfal**  $\searrow$  (Dependency “to the left”). The falling contour above the glissando threshold depends on the first Cris found earlier in the sentence. No falling contour above the glissando threshold can be in initial position in the PS. However, falling contours below the GT may occur in initial position.

**Cris**  $\nearrow \Rightarrow$  {**Ccom**  $\surd$ , **Cdec**  $\downarrow$ } The rising contour above the glissando threshold depends on the first Ccom  $\surd$  or Cdec  $\downarrow$  found later in the sentence (dependency “to the right”).

**Ccom**  $\surd \Rightarrow$  **Cdec**  $\downarrow$ . The complex continuity contour depends on the terminal Cdec occurring later in the sentence.

## Examples

Examples in Figures 1 and 2 demonstrate how the merging of the first three accent phrases of the examples varies in congruence with syntax.

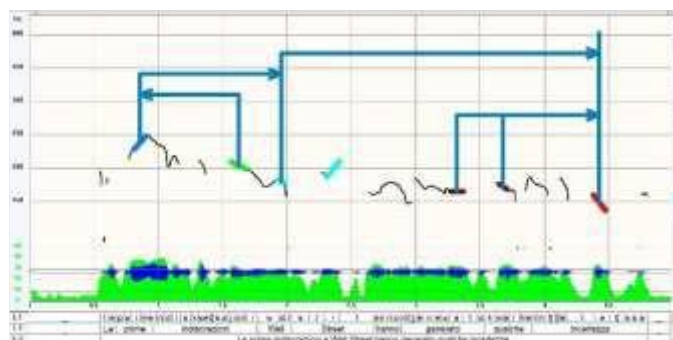


Figure 1. Color coded melodic contours aligned on stressed syllable vowels: **Cris**  $\nearrow$  (in blue) rising above the glissando threshold (GT), **Cfal**  $\searrow$  (in green) above GT, **Ccom**  $\surd$  (in turquoise) complex non final, **Cneu**  $\rightarrow$  (in brown) below GT, **Cneu**  $\rightarrow$  below GT, and terminal **Cdec**  $\downarrow$  (in red) [Le *pr*ime]  $\nearrow$  [indiscrezi*On*]  $\searrow$  [a *W*all Str*EE*]  $\surd$  [hanno gener*A*to]  $\rightarrow$  [qu*Al*che]  $\rightarrow$  [incert*E*zza]  $\downarrow$  “The first rumors on Wall Street have generated some uncertainty” (SIWIS it\_a1\_08\_123).

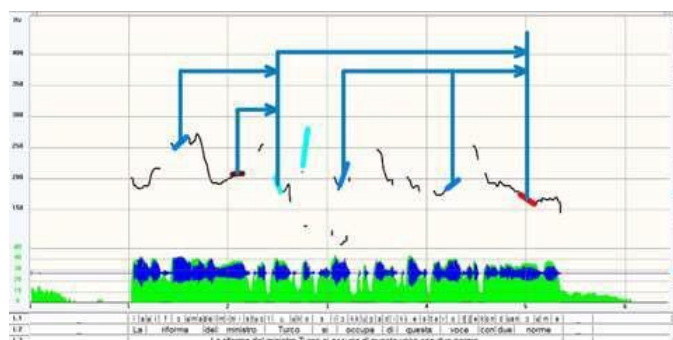


Figure 2. [La rifOrma] ↗ [del minIstro] ↘ [TUrcO] ↗ [si Occupa] ↘ [di questa vOce] ↗ → [con due nOrme] ↘ “The reform of the Turkish minister deals with this item with two rules” (SIWIS it\_c\_22\_164), is an example showing the local prosodic structure reflecting syntax ((La riforma) ((del ministro) (Turco))...

Table 1. Realizations of melodic contours by 10 speakers (Figure 1 example).

SIWIS ref	Le prime	indiscrezioni	A Street	Wall	Hanno generato	qualche	incertezza
it_a1_08	↗	↘	√		→	→	↓
it_b_14	↗	↘	√		→	→	↓
it_b_17	→	→	√		→	→	↓
it_b_19	↗	↘	√		→	→	↓
it_b_21	↗	↘	√		↗	→	↓
it_b_18	↗	→	√		→	→	↓
it_b_27	↗	→	√		→	→	↓
it_b_40	↗	↘	√		→	→	↓
it_b_32	↗	↘	√		→	→	↓
it_b_38	↗	↘	√		↗	→	↓

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