# A prosodic account of Italian exclamative sentences: a gating test

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## Abstract

This study investigates the intonation of Bari exclamative sentences. In this Southern variety of Italian, the prosodic features of non-wh exclamatives and broad focus statements have been studied in both production and perception. By means of a gating experiment, stimuli of partial or complete utterances were presented to listeners in order to verify the melodic differences between sentence minimal pairs, i.e. exclamative vs. assertive. Results obtained with listeners suggest that the initial *f0* pattern has a very strong effect on the perception of exclamatives.

**Index Terms**: Italian language, exclamative sentences, intonation, gating paradigm.

## 1. Introduction

Among non declarative sentences, the intonation of exclamatives has not yet received much attention. Previous works dedicated much effort to establish a set of syntactic and semantic aspects of exclamative clauses [1], [2], [3], [4], [5]. All exclamative sentences convey a surprising effect, differing from both statements and questions. In the world's languages, exclamatives can be expressed by a lot of formal constructions, such as: question words, declarative sentences, degree adverbs [2]. The most frequent structure is a sentence opening with a wh-modifier, for instance *How beautiful you are!*, followed by the structure without wh-word, *The train!*

In many languages, like Italian, the non-wh-exclamative has generally the same structure of a statement (e.g. *Piove!* vs. *Piove.* It's raining), while the wh-exclamative may be identical to a wh-question (e.g. *Quanto costa!* vs. *Quanto costa?* How much is it?). In absence of syntactic elements, the difference is prosodic. Both assertive and exclamative clauses encode a propositional content which is assumed to be true, but while the assertive meaning is informative, the exclamative one is expressive.

According to [3], exclamatives have three semantic properties that contribute to differ them from wh-questions: 1) factivity, 2) scalar implicature, 3) question/answer relations. Exclamatives are factive because they presuppose a propositional content. They convey a scalar implicature of highest degree: their value is always surprising, nevertheless the speaker's emotional reaction is not encoded at the lexical level, so it has to be inferred. At last, exclamatives cannot introduce a true question and cannot be used to answer to a wh-question [3]; unlike interrogatives, their prototypical function is not asking for information.

Another exclamative's semantic property is scalarity. The exclamation meaning involves a scalar degree that is formally expressed by a wh-modifier or a degree adverb. The degree in question is extreme that it refers to phenomena on high positions of a quality/quantity scale. So, in some way or another, the exclamations show a deviation from norms.

## 2. Prosodic aspects

Exclamatives are primarily used to express the speaker's own feelings (surprise, joy, astonishment etc.). The literature on exclamative intonation is scarce; on this topic there are only short comments. In most languages, exclamatives are reported as having a final falling contour and an initial extra high pitch [6], [7], [8]. According to [9], the connection between intonation and exclamation is 'both broad and deep'. Generally, an exclamative sentence is spoken with an extremely high pitch; in wh- exclamatives, this high pitch matches with the degree word. There is a great deal of variation concerning the exclamative melodic contours, for this reason it's difficult to identify 'an intonation of exclamation'. Nevertheless, the intonation contours always tend to reach for the extreme.

Although a number of studies have already discussed punctual aspects of Italian intonation, the exclamatives have received little attention. At present, instrumental phonetic surveys are very few [10], [11]. In spoken Italian, intonation plays a leading role in conveying the exclamative modality. Frequently, the intonation acts as the only index in sentence types disambiguation. This point can be illustrated by the pairs of sentences such as those listed below.

*(1a) Il treno è già partito!* *(1b) Il treno è già partito.*

(The train has already left)

*(2a) Quanti libri ci sono!* *(2b) Quanti libri ci sono?*

How many books are there?)

The exclamative sentences often employ the same words in the same order of statements; no grammatical or lexical markers are required. Therefore, the illocutive force of the exclamative is wholly expressed by means of the intonation, determining a linguistic contrast.

### 2.1. Method

This study intended to examine the acoustic and perception features of Bari exclamative sentences. In order to investigate the strength of intonation cues to the declarative vs. non-wh exclamative sentence types distinction, an acoustic analysis was performed. To explore the intonation of exclamative sentences, we designed a corpus of twenty dialogic texts, each containing a target sentence. A group of 20 non-wh exclamatives was analysed in pairs with 20 assertive sentences (e.g. *E' arrivato in ritardo!* vs. *E' arrivato in ritardo.* 'He arrived late').

Five graduate speakers of Bari Italian were recorded while reading the dialogic texts. All the subjects were female native Bari speakers aged between 30 and 38. At all, the speech corpus was formed by 200 sentences.

The digital recordings were run in a quiet laboratory room, using a TASCAM DR-07, frequency sample of 22050 Hz and a 32 bits resolution. Target sentences were analysed,

segmented and hand labelled by means of PRAAT. For each sentence the following acoustic parameters were measured:

a) Overall duration;

b) Duration of the last stressed and unstressed vowels;

c) Overall Pitch Range (in semitones, henceforth ST);

d) Onset and Offset *f0* values (respectively the *f0* value on the first and on the final unstressed syllables of the sentence);

e) Average *f0* mean (*f0*x).

The statistical significance was examined by means of one-way Anova.

## 2.2. Phonetic description

The melodic contour of non-wh exclamatives was characterized by an initial extra high *f0* level. This pattern spread over the utterance; a relevant falling movement was observed only at the proximity of the last word. The prenuclear contour realized a melodic plateau, a sustained pattern without considerable frequential variations. This means that a raised baseline was a typical aspect of the exclamatives as compared with statements, consequently the *f0x* value was significantly high too. The exclamative sentences showed high Onset values, this difference was about 4 ST; on the contrary Offset frequencies were similar in both sentences. In Table 1 f0 values of exclamatives and statements were reported.

*Table 1: f0 differences (in ST) between non-wh exclamatives and statements*

| Sentence types | Onset | Offset | f0x | Pitch Range |
|---|---|---|---|---|
| Non-wh Excl./Statement | + 4 | + 0,8 | + 3 | + 4 |
| Anova test | p>.001 | p>.05 | p<.01 | p<.001 |

In the data collected, non-wh exclamatives were produced at high pitch level; a general high prenuclear *f0* stretch was observed; their pitch range was always wide (cf. Table 1). The frequency range contributed to the melodic identity of the exclamatives. On the contrary, in broad focus statements a gradual pitch compression was found: pitch range decreased up to a level of the baseline at the end of the utterance. As it's widely kwown, pitch range plays a great expressive function: the speaking up raises the overall tonal space. This points to a positive correlation between the effect of surprising degree and the increase of the pitch range. The pragmatic meanings of exclamative sentences vary with regard to the tonal range: for instance, a more compressed pitch range was observed in sentences conveyed a mild surprise, whereas a wider pitch excursion occurred in sentences with a strong astonishment degree. Results proved that pitch range may be used to express a gradient difference in the meaning of exclamative sentences.

The duration pattern behaved differently too. Usually, exclamations showed a remarkable lengthening of the final stressed syllable. The nuclear vowel was considerably longer reaching a total of 160 ms or more. In Table 2 data for final stressed and unstressed vowels were plotted.

The auditive impression was that exclamatives were faster in their beginning, but slower in their terminal part with respect to statements. This difference was confirmed by temporal values. Duration seems to be a reliable acoustic parameter related to speaker's expressive stance.

Intensity also followed the same tendency: in general exclamatives displayed a great mean intensity (+ 4/5 dB), this divergence was more evident if we compared the final position of the two sentence types.

*Table 2: mean duration in ms, for final stressed vowel (FSV) and final unstressed vowel (FUV); in brackets standard deviation*

| Sentence types | FSV | FUV |
|---|---|---|
| Non-wh Excl. | 160 (18) | 111 (20) |
| Statements | 130 (16) | 93 (16) |
| Anova test | p<.0001 | p<.001 |

## 2.3. Phonological description

Even if both sentence types have a falling contour, their intonation was not identical. As mentioned before, in the exclamatives, the presence of a persistent high level gave a typical perceptual effect. Normally, the use of the high pattern was not located on a single syllable or word, but it spread over a large part of the utterance leading to a long melodic plateau and to a widespread emphasis. From a phonological point of view, we proposed to represent this prenuclear contour by means of a left boundary tone, namely %H. A left peripherical high tone had been already postulated in Florence Italian [12]. In Bari variety, %H seems to have a functional meaning, as prove the experimental findings of a perceptual identification test carried out on manipulated speech stimuli [10]. However further research is needed in order to establish whether the introduction of initial edge tone %H can be considered an Italian exclamative's mark.

Bari exclamatives and statements also differed in their nuclear pitch accent. The general shape of the melodic contour of a neutral broad focus statement was gradually falling, the final syllables reached the lower register of the speaker's range. The nuclear pitch accent was generally produced as a bitonal falling tone, H+L*; very often the high target was phonetically downstepped, i.e. !H+L* [cf. also 11], the boundary tone was low, L%. (cf. Figure 1).

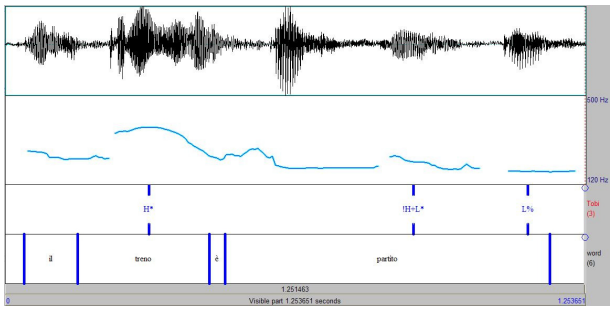


*Figure 1: waveform, f0 contour and ToBI transcription of the assertive sentence 'Il treno è partito.'*

On the contrary, the nuclear pitch accent of a non-wh exclamative was high (H*); the *f0* peak was aligned to the right end of the nuclear syllable, the *f0* maximum was shortly maintained before falling (cf. Figure 2).

A certain variability among speakers was observed; in some sentences, the falling movement started before: the nuclear pitch accent was so labelled as H*+L. The final contour was always falling, in ToBI transcription L%. We noted that the typical nuclear pitch accent of exclamatives never occurred in neutral statements. In Table 3 a summary of the nuclear configuration of the two sentences was reported.

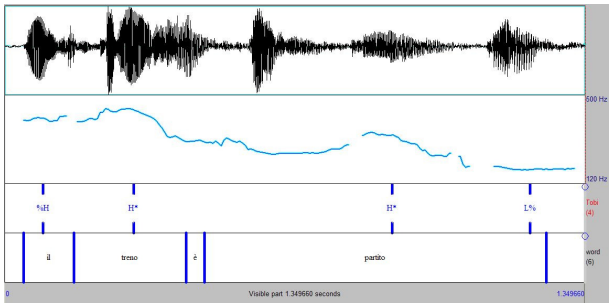


*Figure 2: waveform, f0 contour and ToBI transcription of the exclamative sentence 'Il treno è partito!'*

*Table 3: Nuclear Pitch Accent (PA) and Boundary Tone (BT) in Bari non-wh exclamatives and broad focus statements*

| Sentence types | PA | BT |
|---|---|---|
| Non-wh exclamatives | H*/ H*+L | %H……L% |
| Broad focus statements | H+L*/!H+L* | L% |

## 3. Perception gating test

In order to get a better understanding of the role of the intonation cues, a gating test was carried out. The gating task was chosen to verify if the distinction between statements and non-wh exclamatives was possible before hearing the end of the sentence.
The gating paradigm was initially developed for word recognition [13], [14]; then it was also applied for sentence recognition and intonation description [15], [16], [17].

### 3.1. Stimuli description

To this purpose, four pairs of sentences were used. The speech stimuli have been extracted from the same corpus employed for the acoustic analysis. In each pair of stimuli there were two identical segmental sentences, both produced by the same speakers, once as declarative, the second time as exclamative. In our experimental paradigm, target sentences were cut into smaller pieces of increasing duration. We developed a phonetic criterion to gate the sentences: the fragments were determined by the location of stressed vowels, based on the assumption that stressed vowels were relevant prosodic points in the *f0* contour. See Table 4 for an example of a sentence gating.

*Table 4: Example of sentence gating*

| | | | | |
|---|---|---|---|---|
| Gate 1 | Mari | | | |
| Gate 2 | Marina arri | | | |
| Gate 3 | Marina arriva stase | | | |
| Gate 4 | Marina arriva stasera | | | |

A total of 64 gated stimuli was obtained (4 sentence pairs= 8 sentences x 4 fragments). According to gating methodology, we considered the Isolation Point (IsP), that is the point on the stimuli where correct identification was achieved and maintained over fragments of the same sentences till its end. The percent values of correct identification for each Gate were examined too.

### 3.2. Subjects

Twenty four Bari native subjects (10 males and 14 females) took part in the experiment. They were University students aged between 20 and 25. None had any special background in prosody and none had hearing difficulty.

### 3.3. Procedure

Before starting, subjects were presented with written instructions containing preliminary information on the hearing task. Subjects were asked to listen to fragments of sentences and to classify them as statement or exclamative by crossing a box on a sheet. The gated stimuli were orthographically written without punctuation and numbered from one to sixty four. The subjects were instructed to answer after each gate and to judge whether they believed the utterance a declarative or an exclamative. The audio stimuli were produced through the computer in a silent room. Each stimulus was preceded by a warning tone and followed by five seconds of silence. In average, the experiment took 20 minutes. The gated stimuli were presented to listeners in a sequential order, from beginning to end; in other words they were first presented with the only first gate, then with the two gates and so on.

### 3.4. Results

Overall, results showed that both sentences were identified before the end of the utterance. Figure 3 shows the percent values for the four pairs of stimuli. Listeners made use of intonation from the first Gate in perceiving sentence types. As it is apparent in the Figure, at Gate 1, subjects were 68% accurate in identifying intended exclamatives, but only 40% accurate in perceiving statements. At Gate 1, exclamative fragments were better recognized than assertives ones: this seems to suggest that the height of the initial *f0* contour was an important intonation feature to sentence type perception; listeners showed remarkable precision in distinguishing sentence types based only on the Onset value. This Gate was positively correlated with sentences discrimination, the correlation was statistically significant at the p>0.001. At Gate 2, overall accuracy of statements jumped to 75%, whereas exclamatives judgment remained almost constant, precisely 70% (p>0.05). Once Gate 3 was presented, the identification percent values increased for both sentence types; in the exclamatives the accuracy was of 98%, while in the assertives was 97%. As expected, the hearing precision of the complete stimulus (Gate 4) was total, i.e. 100%.

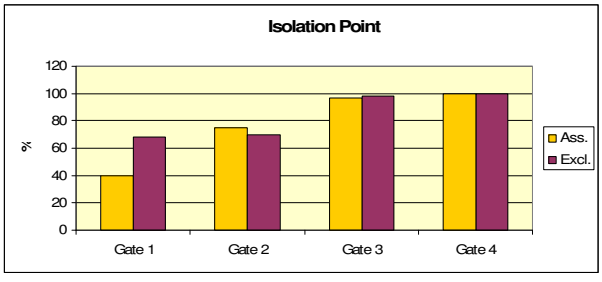


*Figure 3: percent values of Isolation Point*

An interesting aspect was immediately evident from these findings: the initial part of the sentence was crucial in the perception of sentence minimal pairs. It seems to work as an illocutive parameter determining a better accuracy of exclamatives. These results confirmed the importance of the *f0* onset, listeners made use of the height of the initial *f0* value in

their perception of sentences. The identification of the statements increased when Gate 2 was presented to the listeners. In this point of the sentence, that is the second stressed syllable of the utterance, declaratives already showed a gradual falling contour, while exclamatives intonation pattern was still high. This was a very stable perceptual cue attesting the relevance in exclamative types of a sustained prenuclear pattern. Gate 3 was also important. The realization of a different nuclear pitch accent played a strong role in communicating the illocutive force to the listeners. The different factors were both melodic and temporal. In the sentence's point corresponding to Gate 3 we observed for exclamatives a greater duration of vocalic nucleus, an increase of energy and a wider pitch range as compared to statements. In addition, the nuclear pitch accent was phonologically different from that of statements. This suggests that all sentences were successfully identified by listeners before hearing the complete version. Coherently, once Gate 4 was presented, the recognition of the utterance was complete. However, an alternative explanation could be considered: it is possible that other prosodic indeces, different from f0 contour, such as duration or pitch excursion, were responsible for this modal discrimination. Although the Gate 1 was always very short, the amount of acoustic information needed for identifying the stimuli was probably already included.

## 4. Discussion and conclusions

In Italian non-wh exclamatives and neutral statements may have a same linguistic structure; in this case the contrast was performed by intonation. This study allowed us to discover some differences in the identification of sentence types and to understand which acoustic and perceptual cues operate in such a direction. The gating test suggested that Bari listeners were able to distinguish broad focus statements and non-wh exclamatives even when the nuclear contour was absent. As a rule, exclamations appeared to be better recognized in an hearing task. The perception results have to be linked to their phonetic consistence. The exclamative sentences exhibit a relevant prosodic characterization, coherently with their expressive status, always out of norms. From an acoustical point of view, all exclamatives have an extra high *f0* contour and a wider pitch span with respect to declarative sentences. A remarkable lengthening of the final syllables was observed too. The perceptual effect is both typical and distinctive; the intonation features act as linguistic indicators of illocutionary force.

The gating test allowed us to understand how much prosodic information we needed to achieve a correct classification of each stimulus. Listeners may be able to recognize both exclamations and statements before the end of the utterance, nevertheless the identification of statements occurs later than the exclamatives. It's widely known that the final *f0* movement plays a crucial role in the illocutive distinction of utterances. In Bari Italian, statements and exclamatives share a similar terminal contour (L%); this study proves that during a perception task, listeners retain not only the terminal information, but also what happens at the beginning of a sentence. In exclamatives, the presence of an high Onset represents a reliable non-final cue to sentence discrimination.

To sum up, the experimental findings suggest that exclamatives have a marked structure, whereas broad focus statements are unmarked sentences. Therefore, exclamative verbal acts are always 'out of control'. We think that this peculiar status reflects the semantic properties of the exclamatory sentences. From a pragmatic point of view, exclamatives are prominent utterances because, as mentioned before, they convey an extreme semantic degree. Their meaning is salient and the speaker finds this content surprising. There is a kind of correspondence between the prosodic realization of an exclamative act and its expressive degree. The exclamative prosodic structure, in some way or in another, conveys semantic and pragmatic meanings. In any case, intonation is the essential linguistic indicator of the illocution. This research constitute a valid basis for deeper investigations on the prosody-pragmatic interface; nevertheless our knowledge is still incomplete in some respects. At present, the role of pitch span, speech rate and intensity in the statement/exclamative prosodic contrast is not fully clear. In particular, which prosodic features lead listeners to the correct perceptual discrimination of identical sentences? As a consequence, further research is necessary in order to improve our knowledge in this specific direction.

## 5. Acknowledgements

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