

# Text punctuation and prosody in Greek

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## Abstract

A production experiment was carried out, in order to investigate text punctuation, including standard as well as ungrammatical (communicative) punctuation marks, and prosody relations. It is shown that punctuation is directly related to the duration of pauses, leading to the following structure: question mark>exclamation mark>full stop> colon>comma> ellipsis. Pitch resetting occurs in all cases, except for commas and ellipses, and gender differences seem to be significant. Ungrammatical punctuation is more prominently marked by both temporal and tonal means.

Key words: prosody, discourse, punctuation, pauses, F0, Greek

## Introduction

The present study concentrates on the relation between text punctuation and prosody in Greek. The following questions are addressed: (i) Which are the relations between prosody and text punctuation?, (ii) what are the effects of pause productions?, (iii) How does prosody interact with grammatical and ungrammatical (communicative) punctuation? The aim of the study is to provide evidence concerning the prosodic interpretation of punctuation. A variety of punctuation marks were examined (comma, full stop, colon, ellipsis, question mark, exclamation mark), as well as their ungrammatical uses, based on oral readings of a newspaper's opinion article by 10 speakers.

Given that in written language, especially in Greek, the use of punctuation is not always subject to strict rules, texts are as a rule punctuated according to two basic principles: (i) a semantico-syntactic, according to which punctuation reflects syntactic relations and affects the meaning of the sentence, and (ii) a communicative, according to which punctuation emphasizes important information included in the text. The latter function is referred to as ungrammatical punctuation, i.e. the use of a specific punctuation mark in cases where a grammatical rule prohibits it (e.g. a comma before the conjunction "and") (Panaretou, 1995, 2002).

The relation between spoken "intonation units" and "punctuation units" is often mentioned in the bibliography (Chafe, 1987; Panaretou, 1995, 2002; Nirgianaki, 2005). Significant work has also been carried out on discourse structure and its prosodic correlates (e.g. Botinis, 1991; Botinis et al., 2004, 2007; Witchmann, 2000). However, the relation between text punctuation and prosody is in general underexamined, particularly in Greek.

## Methodology

A production experiment was carried out, based on a political-opinion article written in a weekly Greek newspaper. It is a text of 402 words and its duration is around 2.5 minutes. It consists of 14 paragraphs, which include: 27 full stops, 43 commas, 4 question marks, 6 exclamation marks, 2 colons and 1 ellipsis, from which 15 full stops, 1 question mark, 1 exclamation mark where ungrammatical (communicative punctuation).

Ten speakers (5 male and 5 female, 20-30 years old, native speakers of standard Athenian Greek) read aloud the text in normal tempo. The recordings were made in the recording booth of the Phonetics Laboratory of the University of Athens (with a dynamic Samson S11 microphone, 16bit mono, 22050 Hz).

Measurements were taken for pauses, intra-pause text duration, and pre-pause and post-pause pitch. Data were organized in MS Excel, the acoustic analysis was carried out with Praat, and the statistical processing with StatView.

## Results

According to the results of the production experiment, 97.78% of the pauses were produced in accordance with written punctuation, whereas 2.22% of the pauses were produced within the text reading without any punctuation mark. The longest pauses (Figure 1) were produced after question marks (735 ms) and the shortest after ellipses (279 ms), whereas pauses were also produced within the text with no punctuation mark (237 ms). It should be noted that, in all cases, pauses produced after ungrammatical (stylistic) punctuation were longer (464 ms) than the ones after grammatical punctuation (527 ms), with a significant difference ( $t(df)=636$ ,  $p<0.01$ ). Pauses produced at the end of paragraphs, as noted by the first author, were significantly longer (686 ms) than pauses produced within the text (408 ms) ( $t(df)=636$ ,  $p<0.01$ ).

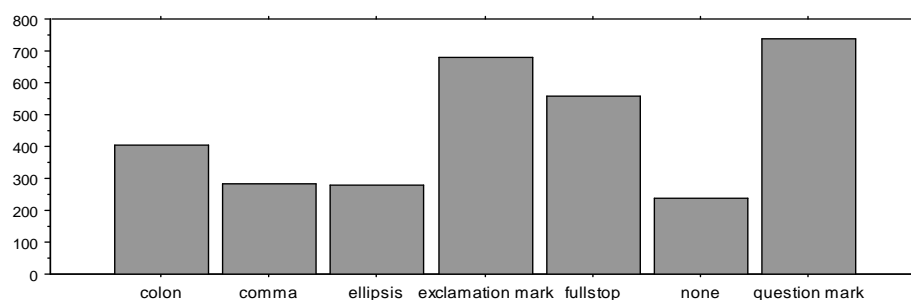


Figure 1. Mean pause durations (ms) with reference to punctuation marks.

No correlation was found between intra-pause text duration and pause durations for all punctuation marks ( $r < 0.7$ ). The longest intra-pause text duration was noted in relation to question marks (2100 ms) and the shortest one in relation to ellipsis (543 ms).

Mean pre-pause pitch (152 Hz) was in most cases lower than post-pause pitch (171 Hz), with a significant difference ( $t(df)=636$ ,  $p < 0.01$ ), denoting resetting (Figure 2). However, this is not the case for commas, ellipses, and pauses produced without any punctuation mark noted, where pre-pause pitch was higher than post-pause pitch. Noticeably, ungrammatical punctuation was marked with significantly more prominent pre-post pause pitch differences ( $t(df)=173$ ,  $p < 0.01$ ), in comparison to grammatical punctuation ( $t(df)=416$ ,  $p < 0.01$ ) (Figure 3).

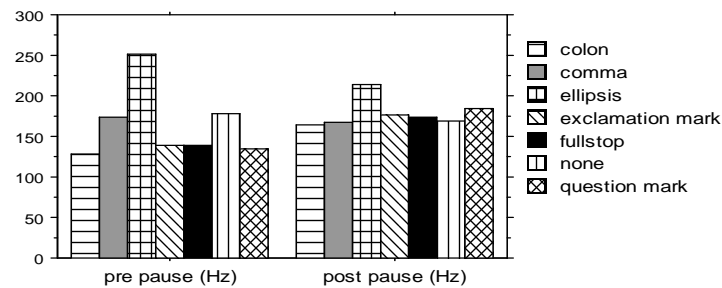


Figure 2. Mean pre-pause and post-pause pitch (Hz) with regards to punctuation marks.

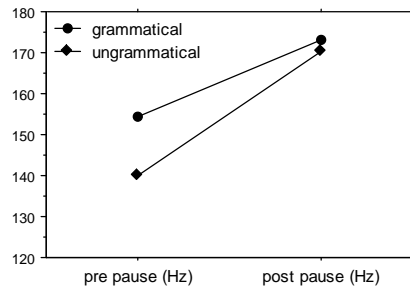


Figure 3. Mean pre-pause and post-pause pitch (Hz), as a function of grammatical and ungrammatical (stylistic) punctuation.

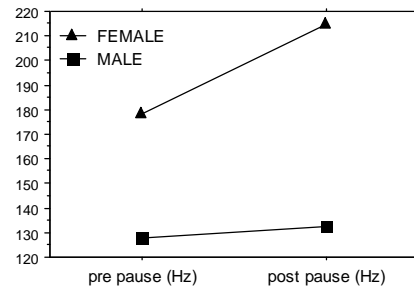


Figure 4. Mean pre-pause and post-pause pitch production (Hz), as a function of female and male gender.

Gender differences regarding pause durations in accordance with punctuation were not significant ( $F(6,623)=0.562$ ,  $p > 0.05$ ). However, gender differences regarding pitch resetting (pre-post pause pitch) were found to be highly significant ( $t(df)=636$ ,  $p < 0.01$ ), (Figure 4).

### Conclusions

To recapitulate, the results of the present experiment indicate: (i) punctuation is directly related to the average duration of pauses. The structure based on pause durations is the following: question mark > exclamation mark > full stop > colon > comma > ellipsis, (ii) produced pauses were longer after ungrammatical (communicative) punctuation marks.

Pitch resetting was evident, with regards to all punctuation marks, except for commas and ellipses, whereas resetting was more evident for ungrammatical punctuation.

Ungrammatical punctuation, in general, seems to be most prominently marked by all prosodic means examined. This finding reinforces the view that ungrammatical punctuation highlights text information.

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