

## TONAL CORRELATES OF DISCOURSE STRUCTURE

Antonis Botinis

Phonetics Laboratory, Department of Linguistics  
University of Athens, Greece

### ABSTRACT

The results of the present investigation indicate that discourse boundaries and tonal boundaries coincide and each topic constituent is aligned with tonal boundaries as a rule. Topic onset boundaries have a rising tonal pattern onto the first stressed syllable and topic offset boundaries have a falling tonal pattern off the last stressed syllable. Major topic constituents are reflected on tonal structure but the hierarchical structure of discourse does not correspond to tonal structure.

### INTRODUCTION

This paper is an investigation of discourse tonal correlates in Greek. Tonal segmentation is an acoustic correlate of discourse structure as it defines tonal phrase boundaries which may be aligned with variable discourse structure units. Furthermore, tonal (i.e. intonation) phrases may be combined into larger tonal structures with distinctive binding patterns and coherence relations. Both segmentation and binding are related to information structure as the former defines the speech units as information units and the latter combines information units in larger information structures. Tonal segmentation patterns and binding distinctions in Greek discourse are outlined in recent reports ([1], [2]). In the present contribution tonal segmentation correlates and tonal reflections of discourse structure are investigated in a short news corpus. Our analysis is concentrated to tonal segmentation strategies with reference to different discourse domains of tonal segmentation applications.

### SPEECH ANALYSIS

Speech material. The speech material of the present investigation consists of four short news reports from a Greek radio station. Each report was about one minute long and referred to national and international news. The recordings were carried out in four consecutive days. The language style is quite compressed, and elliptical structures may occur, to the extent they do not produce ambiguous interpretations. Topic constituents are well-structured and topic changes are very abrupt and well defined.

Speaker characteristics. The speaker was a male professional news speaker, rather young, and spoke standard (Athenian) Greek. He spoke at a rather fast tempo and sounded as if he had memorised the text and uttered the news in a natural and fluent way.

Experimental analysis. The speech material was recorded at the Athens University Phonetics Laboratory and the acoustic analysis was carried out at the Lund University Phonetics Laboratory with the ESPS/Waves+ software package.

Speech analysis. The speech material was segmented into topic constituents and classified in three kinds of topics: simple topics, compound topics, and minor topics. Simple Topics (TS) refer to a single topic of discussion and may be composed of a simple or a compound sentence. Compound Topics (TC) refer to a topic of discussion which has several aspects and may be composed by several minor topics which correspond to different aspects of the topic. Minor Topics (TMr) may be composed by a simple or a compound sentence, or by an

elliptical sentence with close attachment to another topic constituent.

F0 measurements covered all topic constituents and were taken at five points: (1) at Topic Onset (TON), (2) at Topic First Stressed Syllable (FSS), (3) at Topic Maximum F0 (TM), (4) at topic Last Stressed Syllable (LSS), and (5) at Topic Offset (TOF). The TM F0 is an independent measurement, regardless of the TON and the FSS F0 values. Furthermore, topic pause durations (not shown at figures) were measured. Two TC TOFs showed an alternative tonal realisation (tonal rise) from the rest of the material and were not included in the presentation.

### TONAL SEGMENTATION

Intratopic (syntagmatic) and intertopic (paradigmatic) tonal relations are referred to as Tonal Conditions and Topic Conditions respectively.

Figure 1 shows tonal correlates of the first news report. This material is composed of 12 topics from which 7 are TSs and 5 are TCs. The TCs are composed of 13 TMr (from 2 to 4 TMr for each TC). Thus, there were 20 topic condition measurements.

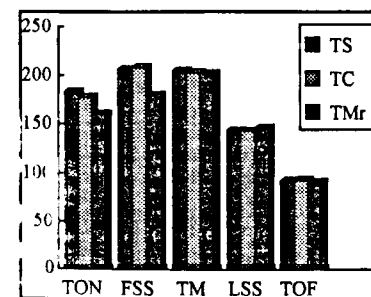


Figure 1. Tonal distribution of Simple Topics (TS), Compound Topics (TC) and Minor Topics (TMr) (see text).

The tonal condition indicates the following: First, there is a tonal anthesis from TON to the FSS. Second, there is

hardly any difference between FSS and TM except for the TMr tonal condition. Third there is a LSS tonal catathesis and, fourth, a tonal fall from LSS to TOF which reaches the speaker's tonal floor.

The topic condition indicates the following: First, there is a slightly descending order from TS to TC to TMr for TON. Second, there is an equal tonal distribution to TS and TC for the FSS but a lower one for the TMr topic condition. Third, the TM, the LSS, and the TOF for all topic conditions are the same.

Figure 2 shows tonal correlates of the second news report. This material is composed of 9 topics from which 6 are TSs and 3 are TCs. The TCs are composed of 12 TMr (from 2 to 6 TMr for each TC). Thus, there were 18 topic condition measurements.

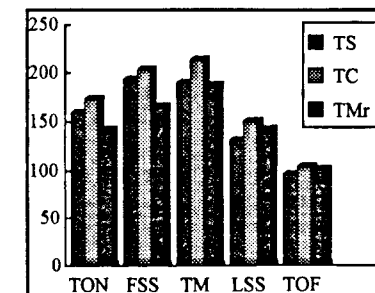


Figure 2. Tonal distribution of Simple Topics (TS), Compound Topics (TC) and Minor Topics (TMr) (see text).

The tonal condition indicates the following: First, the FSS and TM conditions do not have major F0 differences except for the TMr tonal condition. Second, both FSS and TM have higher F0 than the TON condition for all topic conditions. Third, the LSS has lower F0 than the TON and FSS conditions for all topic conditions and, fourth, the TOF condition has the lowest F0 than all tonal conditions for all topic conditions.

The topic condition shows the following regularities: First, the TC condition has the highest F0 for all tonal conditions, most for the TON, FSS and TM conditions between the TC and TMr and least for the LSS and TOF tonal conditions. Second, the TS condition has higher F0 than the TMr condition for the TON and FSS tonal conditions, equal F0 for the TM condition but lower F0 for the LSS and TOF tonal conditions.

Figure 3 shows tonal correlates of the third news report. This material is composed of 11 topics from which 5 are TSs and 6 are TCs. The TCs are composed of 15 TMr (from 2 to 4 TMr for each TC). Thus, there were 20 topic constituency measurements.

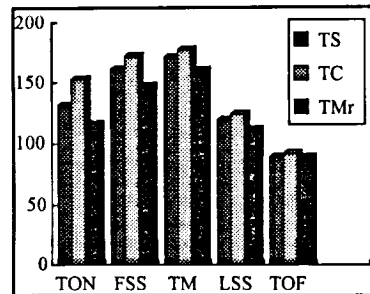


Figure 3. Tonal distribution of Simple Topics (TS), Compound Topics (TC) and Minor Topics (TMr) (see text).

The tonal condition indicates the following: First, the FSS and TM conditions do not have major F0 differences except for the TMr topic condition. Second, both FSS and TM have higher F0 than the TON tonal condition for all topic conditions. Third, the LSS has lower F0 than the TON and FSS conditions for all topic conditions and, fourth, the TOF condition has the lowest F0 than all tonal conditions for all topic conditions.

The topic condition shows the following regularities: First, the TC condition has the highest F0 than the TS

and TMr conditions, most for the TON, FSS and TM tonal conditions between the TC and TMr and least for the LSS and TOF conditions. Second, the TS topic condition has higher F0 than the TMr one for all but the TOF tonal conditions.

Figure 4 shows tonal correlates of the fourth news report. This material is composed of 9 topics from which 2 are TSs and 7 are TCs. The TCs are composed of 21 TMr (from 2 to 5 TMr for each TC). Thus, there were 23 topic condition measurements.

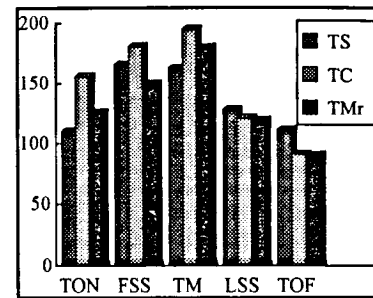


Figure 4. Tonal distribution of Simple Topics (TS), Compound Topics (TC) and Minor Topics (TMr) (see text).

The tonal condition indicates the following regularities: First, there is an anathetic structure from TON to FSS and from FSS to TM for all topic conditions except for the TS condition between FSS and TM. Second, there is a catathetic structure onto TOF for all topic conditions. Third, The LSS has lower F0 than the TOF for TC and TMr and, fourth, the TOF condition has the lowest F0 for all topic conditions.

The topic condition shows the following: First, the TC condition has the highest F0 for the TON, FSS and TM tonal conditions whereas the TS condition has the highest F0 for the LSS and the TOF tonal conditions. Second, TMr has higher F0 than TS for TON and TM but not FSS. Third, TC and TMr

have the same F0 for LSS and TOF tonal conditions.

Figure 5 shows an average of the tonal conditions and topic conditions of all four news reports.

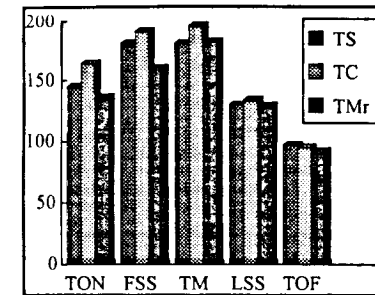


Figure 5. Tonal distribution of Simple Topics (TS), Compound Topics (TC) and Minor Topics (TMr) (see text).

In summary, the tonal condition shows an anathetic structure from the Topic Onset onto the First Stressed Syllable and no major difference between the First Stressed Syllable and the Topic Maximum. On the other hand, there is a catathetic structure onto the Last Stressed Syllable and a final fall to the Topic Offset. The topic condition shows a hierarchic structure for the Topic Onset and the First stressed Syllable with Topic Compound highest, Topic Simple next, and Topic Minor last. The Topic Simple and Topic Minor conditions are neutralised for Topic Maximum. The topic condition is neutralised for the Last Stressed Syllable and the Topic Offset conditions. The most constant tonal segmentation correlate in the present analysis has been the Topic Offset tonal fall which reaches the speaker's tonal floor as a rule (about 90 Hz). Pause distribution at topic boundaries vary considerably (from 2.5 to 6.0 cs) with no regular relation between Topic Condition and pause durations.

## DISCUSSION AND CONCLUSIONS

The results of the present investigation indicate that topic segmentation may be correlated with tonal segmentation in terms of lower tonal distribution at topic last stressed syllable and topic offset boundary. Topic segmentation and topic structure may be reflected on tonal structure in terms of higher tonal distribution at topic onset boundary and first stressed syllable. Tonal structure does not however have a one to one hierarchical correspondence to discourse structure. This implies that discourse units (e.g. Grosz and Sidner [3]) and textual features (cf. Hirschberg [4]) may have variable effects on tonal structures in accordance with the communicative requirements of the message in which every topic constituent should be one information unit. Other types of Greek material (e.g. [1], [2]) may show different types of tonal segmentation and binding patterns with complex information structures.

## REFERENCES

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