the stressed syllable. According to some other studies, however, this peak can be found even later in the utterance: Navarro (1944) reports that, in the case of initial tonic groups, this peak can be found in the syllable following the stressed one. This effect has also been found in later studies, such as Garrido (1991) or Garrido *et al.* (1993), even for internal stressed syllables. However, the results of these analyses indicate that this effect is not regular: the peak can be found either in the stressed syllable or in the following one, but no explanation for this fact is given there. The results presented in Prieto *et al.* (1994, 1995b) and Llisterri *et al.* (1995) seem to indicate that there are several factors which interact in the placement of the peaks:

1) the duration of the stressed syllable

Prieto *et al.* (1994, 1995b) show that there is some relationship between duration of the syllable and peak delay: the more the vowel and the onset are long, the more the peak is delayed. Anyway, this factor seems to be related to peak delay within the stressed syllable, rather than across syllables.

2) the vicinity of some prosodic/syntactic boundaries

Both Llisterri *et al.*'s (1995) and Prieto *et al.*'s (1994, 1995b) studies report variations on peak placement due to the presence of specific prosodic or syntactic boundaries. In general, the vicinity of boundaries such as word, intermediate phrase, intonational phrase or NP/VP boundaries tends to inhibit peak delay: the closer is the syllable to a prosodic boundary, the less the peak is delayed. They seem to be a 'barrier' for peak shifting to the following unstressed syllable. Peak delay inhibitions related to the presence of a pause, reported by Llisterri *et al.* (1995), can be interpreted in the same way.

3) rhythmic factors

The results presented in Prieto *et al.* (1994, 1995b) also suggest that rhythm (or 'stress-clash') is an additional factor determining peak placement. Their results show that peak delay increases whith the distance to the next stressed syllable. According to this, the location of peaks seems to be also controlled by rhythm constraints which determine the distance to the adjacent peaks.

4) individual factors

The results of Prieto *et al.* (1994, 1995b) show individual variations in some of the analysed variables. This leads to hypothesize that peak shift is also related to specific 'choices' of the speaker.

Anyway, it can be inferred from the results of these studies that the location of peaks is related to many factors different than the location of the stressed syllable. Then the presence of the peak in the stressed syllable does not seem to be a necessary cue to identify stressed syllables. The intonational cue of lexical stress can be the rising movement found in the stressed syllable, rather than the inflection point placed at P level.

The data presented in section 4.5. also show the presence of this phenomenon, with cases of P inflection points in the same stressed syllable and in the syllable following the stressed one. It is out of the scope of this work to analyse in detail all the possible factors affecting peak shift. However, considering that a model of intonation has to predict the location of inflection points, the problem has been briefly addressed. A more detailed analysis of the data used for the definition of the patterns has been performed, in order to provide additional information about the factors that determine this peak shift in Spanish.

The goal of the analysis presented here was to study the relationship between the location of the 'P' and 'M' inflection points (the 'peaks') in the initial and internal patterns defined in section 4.5, and the location of the stressed syllable. It was aimed at checking to what extent a shift in the location of the stress syllable determines also a shift in the location of the 'P' or 'M' inflection point.

The study has been limited to the analysis of the 'Rising-P-Falling' and 'Rising-M-Falling' inflection points, that is, to the cases of 'pointed peaks'. 'Flat peaks' have not been considered. Accordingly, in the case of initial patterns, only patterns number 3, 4, 7, 8, 9 and 11 (only those containing 'Rising-P-Falling' and 'Rising-M-Falling' points) have been analysed. In the case of internal patterns, patterns 1, 2, 3, 4, 5, 6, 7, 8 and 9 were considered.

The distribution of the 'Rising-P-Falling' and 'Rising-M-Falling' as a function of the location of the stressed syllable in initial and internal patterns is presented in two tables that can be found in appendix 3 (section 4.1). It can be observed in these tables that:

1) when the stress is placed on the antepenultimate syllable of the group, the peak is placed in almost all cases after the stressed syllable: 100% of

the times in the case of the initial patterns, and 87.5% in the case of the medial patterns.

2) when the stressed syllable is the penultimate one, there is also some preference for the placement after the stressed syllable, but the percentage of cases of matching inflection point-stressed syllable increases compared with the previous case. In the case of initial patterns, 30.18% of the times the inflection point coincides with the stressed syllable, and 56.60% of the times it appears in the syllable following the stressed one. In medial patterns, 33.33% of the analysed inflection points match the stressed syllable, and 59.26% of the points are placed after the stressed one.

3) when the stress is in the last syllable of the word, the tendency seems to be to place the 'P' point mainly in the stressed syllable, although there are also many cases of peaks in the syllables following the stressed one. The data obtained for initial patterns show that 46.94% of the analysed points are placed in the stressed syllable, and 40.82% after the stressed syllable. In internal patterns, the preference for the placement at the same stressed syllable in even larger: 71.43% of the cases were located at the stressed syllable, for 25% only after the stressed one.

According to these data, it can be hypothesized that the location of the 'P' points in these patterns is dependent in some way of the location of the stressed syllable: the more the stressed syllable is close to the end of the word (or tonic group), the more the number of 'P' points placed at the stressed syllable increases. These results agree with the findings of previous studies, supporting the idea that the vicinity of a prosodic or syntactic boundary (word or tonic group boundary, in this case) inhibits peak delay. More research would be needed to check, for example, the effects of distance to the following stressed syllable, not considered in this analysis.

4.7.1.2. Stress in final groups

Previous analyses of the Spanish intonation contours in final position have focused, as was discussed in chapter 1, on the definition of the shape of the final movement. According to the direction and extent of this movement, different patterns have been defined. However, very little attention has been paid to the relationship between the shape of these patterns and the location of the stressed syllable. Only Fant (1984) presents some data about this question, suggesting some influence of the stress in the evolution of the final patterns. The description presented in section 4.5 supports this hypothesis. For these reasons, a more detailed analysis of the relationship between the location of the inflection points in final patterns and the location of stressed syllable has been attempted here.

The analysis has been focused in the inflection point closest to the stressed syllable in each type of patterns. Three separated studies have been carried out, one for the falling patterns, a second one for rising patterns, and a third one for rise-fall patterns. The goal of the analysis in the three cases has been to test whether the location of a specific inflection point is related to the location of the stressed syllable. These studies are presented in the following sections.

4.7.1.2.1. Stress and falling patterns

The analyses presented here try to describe the behavior of two different points appearing in these final falling patterns: 'Level-M-Falling' and 'Falling-V-Level'. Both can appear in the stressed syllable or in the syllable just before it, according to the data presented in section 4.5.

As was defined in that section, falling patterns 6 and 7 present 'Level-M-Falling' inflection points close to the stressed syllable of the last tonic group. The location of this point in both patterns is marked in figures 4.36 and 4.37:
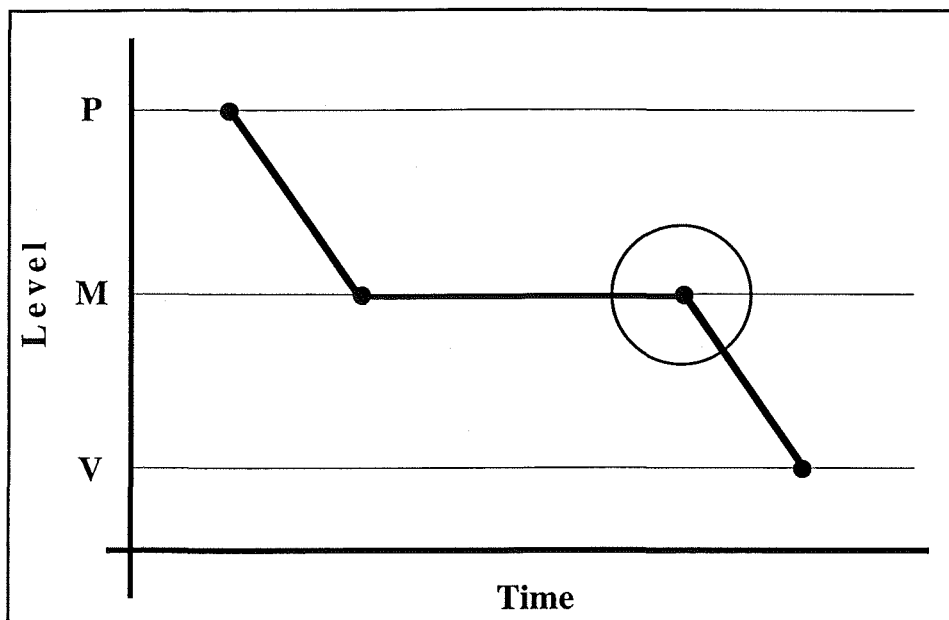
Figure 4.36. Schematic representation of falling pattern number 6. The circle indicates the location of the ' Level - M - Falling' inflection point.
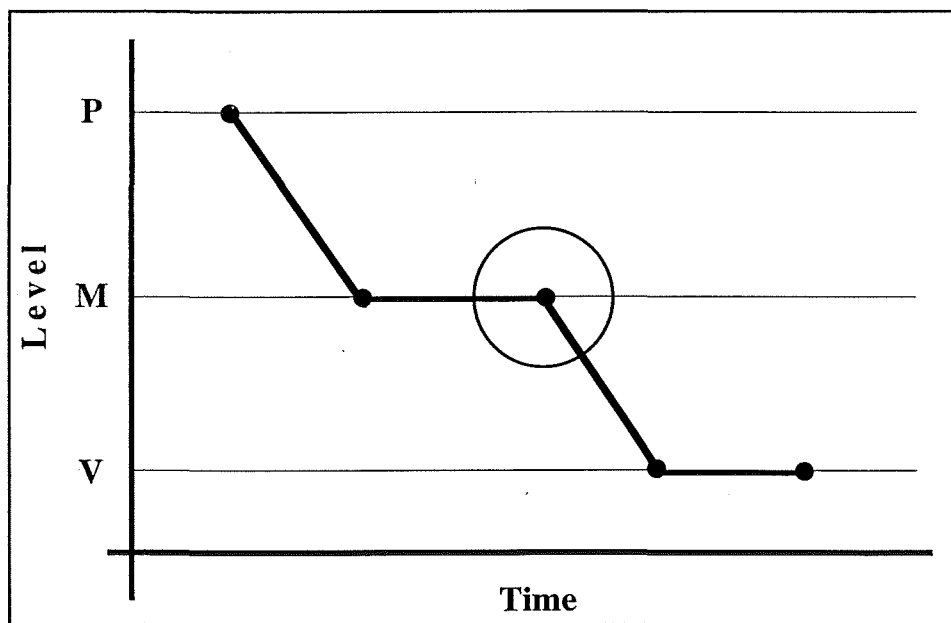

Figure 4.37. Schematic representation of falling pattern number 7. The circle indicates the location of the ' Level - M - Falling' inflection point.

The location of the 'Level-M-Falling' point in these two patterns has been analysed as a function of the location of the stressed syllable, in order to check whether a change in the position of the stressed syllable determines a shift in the location of the stressed syllable. A table containing the results of this analysis can be found in appendix 3 (section 4.2.1.1).

The results presented in the table show that, when the stress is in the penultimate syllable, the inflection point appears 50% of the times in the

stressed syllable and 50% before the stressed one. When the stress is in the last syllable of the group, the only analysed case was located before the stressed syllable. The inflection point appears then in the vicinity of the stressed syllable, but there is no clear preference for a specific location. Anyway, the small number of analysed cases (only 5) does not allow to be more precise in the conclusions.

The 'Falling-V-Level' inflection point appearing in patterns 3 and 4 can be located in the vicinity of the stressed syllable, according to the data presented in appendix 3 (section 1.4.2). Figures 4.38 and 4.39 indicate the location of this point in these two patterns:
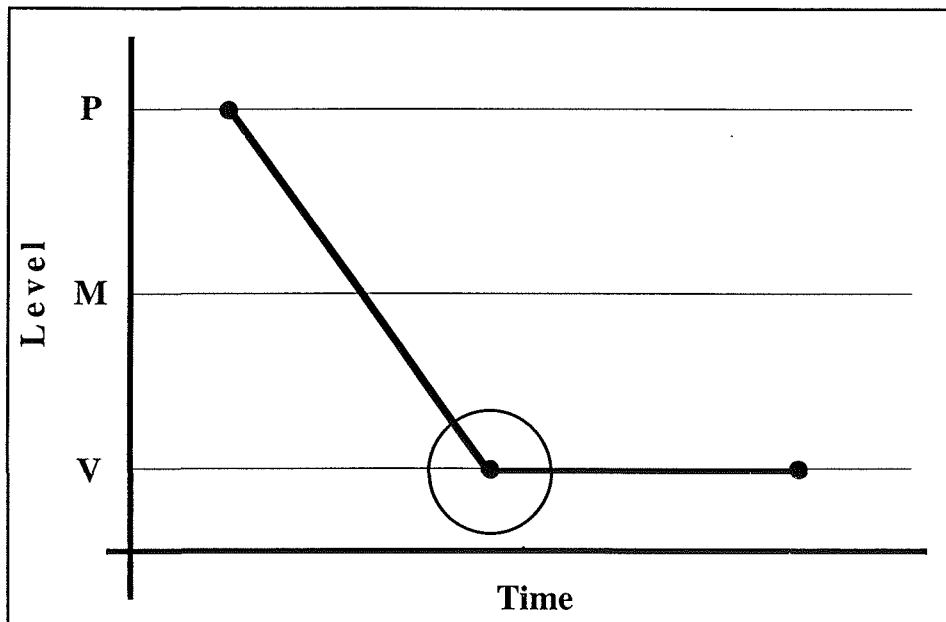

Figure 4.38. Schematic representation of falling pattern number 3. The circle indicates the location of the 'Falling - V - Level' inflection point.
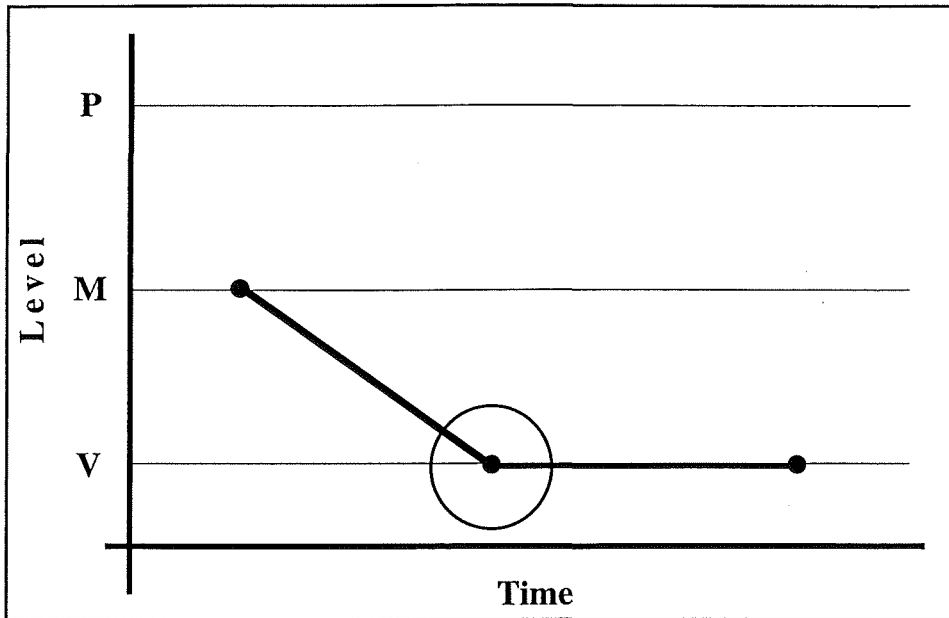
Figure 4.39. Schematic representation of falling pattern number 4. The circle indicates the location of the 'Falling - V - Level' inflection point.

As in the previous case, the location of this 'Falling-V-Level' point in these two patterns has been analysed as a function of the location of the stressed syllable. The complete results of this analysis are presented in a table that can be found in appendix 3 (section 4.2.1.2).

In this case, the results do not seem to indicate a clear relationship between the inflection point and stressed syllable: the inflection point appears most frequently before the stressed syllable when stress is located two syllables before the end (100% of the cases), and when stress coincides with the last syllable (77.78% of the cases); however, when the stressed syllable is the penultimate one, the inflection point tends to be located on this syllable (53.33% of the cases).

The results obtained for these four different falling patterns, then, do not provide clear evidences supporting the idea that the location of the analysed inflection points is dependent on the location of the stressed syllable in falling patterns.

4.7.1.2.2. Stress and rising patterns

As has been established in section 4.5, rising final patterns of type A and B have in common the presence of two inflection points ('Falling-Rising' or 'Level-Rising'), both appearing at the beginning of the last rising movement of the pattern, and usually located in the vicinity of the stressed syllable. The goal of this section is to assess to what extent the location of these points is related to the location of the stressed syllable.

First, 'Falling-Rising' points have been analysed. 'Falling-V-Rising' and 'Falling-M-Rising' inflection points, both in 'type A' and 'type B' patterns, have been included in this analysis. Accordingly, 'type A' patterns numbers 1, 2, 3, 8 and 9, and 'type B' patterns 1 and 2, all containing this kind of inflection points, have been considered. An example of this type of points is given in figure 4.40.
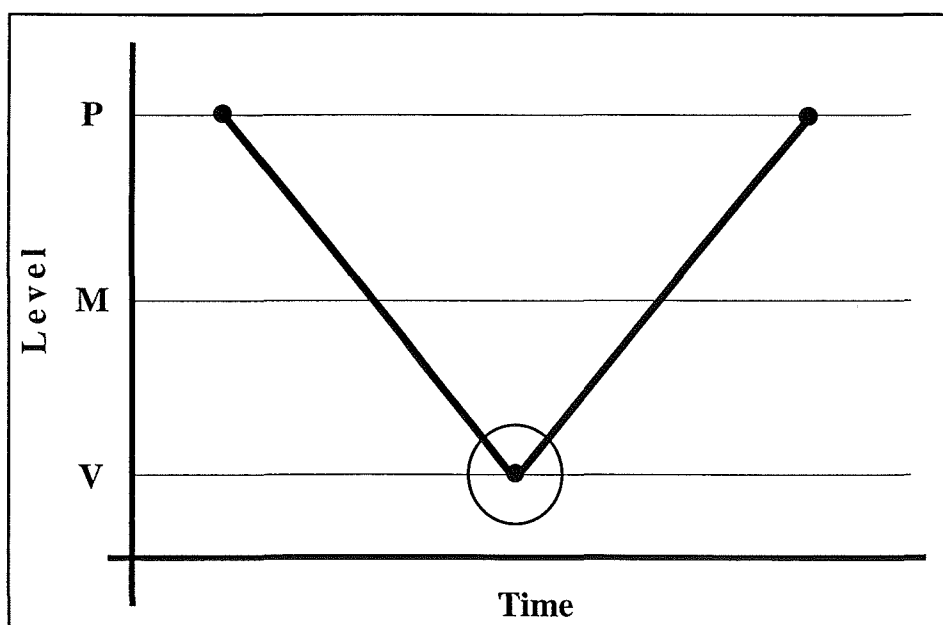

Figure 4.40. Schematic representation of rising final pattern (type A) number 1. The circle indicates the location of a 'Falling-V-Rising' inflection point preceding the last rising movement.

The location of the 'Falling-V-Rising' and 'Falling-M-Rising' inflection points in the two types of patterns, as a function of the location of the stressed syllable, can be found in two tables included in appendix 3 (section 4.2.2.1). The analysis of the data contained in both tables shows the following tendencies:

   a) when the stressed syllable is the antepenultimate one, there is a clear tendency to find the inflection point after the stressed syllable, that is, on the penultimate syllable of the group or later (50% of the times in type A patterns, and 100% of the times in type B patterns);

b) when the stressed syllable is the penultimate one, most inflection points are found on the stressed syllable itself (42.86% in type A patterns; 66.67% in type B patterns) or on the syllable preceding it (42.86% in type A patterns; 33.33% in type B patterns);

c) when the stressed syllable is the last one, the inflection point is always found in the syllable preceding the stressed one, that is, the penultimate syllable of the group (100% of the cases both in type A and in type B patterns).

This data suggests that the inflection point tends to be located in the penultimate syllable, irrespective of the position of the stress, rather than being dependent on the location of the stressed syllable.

A second analysis has been carried out to check the relationship between the 'Level-V-Rising' inflection point and the location of the stressed syllable. For this analysis, the data of 'type A' rising patterns number 4, 5, 6 and 10 have been used. An example of this type of point is presented in figure 4.41.
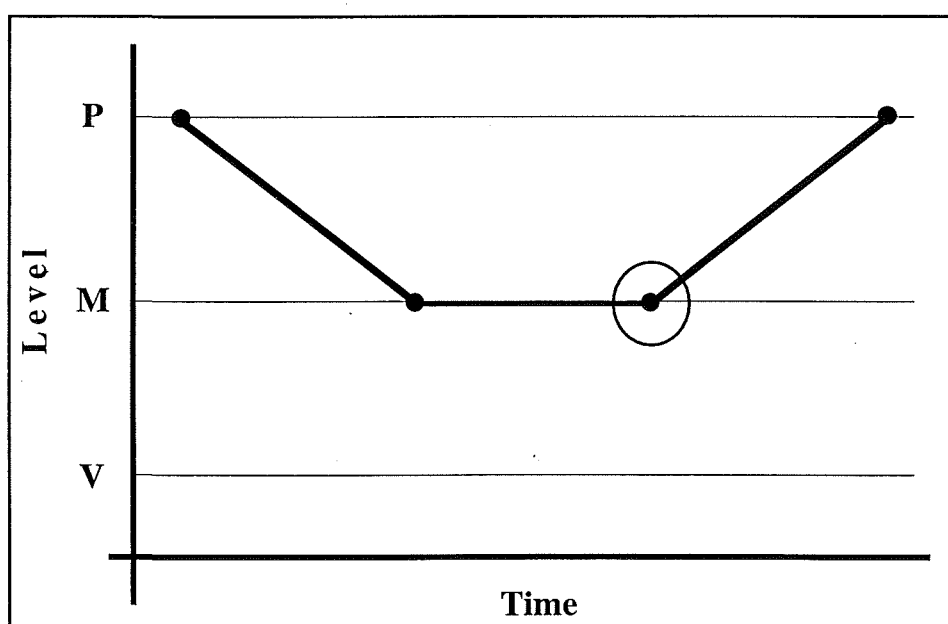

Figure 4.41. Schematic representation of rising final pattern (type A) number 6. The circle indicates the location of a V inflection point preceding the last rising movement.

The distribution of locations of this inflection point, depending on the position of the stressed syllable, is presented in the corresponding table of appendix 3 (section 4.2.2.2). The data presented in that table can be analysed in the following way:

a) when the stress is placed on the penultimate syllable, the inflection point is mostly located in the stressed syllable, that is, the penultimate one

(66.67% of the cases), although it can also be found in the last syllable (33.33%);

b) when the stressed syllable is the last one, the inflection points appear to be located equally frequently in the syllable before the stressed syllable, the penultimate syllable of the group (50%), and in the stressed syllable itself, the last syllable (50%).

These tendencies seem to confirm the hypothesis outlined in the analysis of the 'Falling-Rising' points: the location of the inflection point starting the final rising in these patterns seems to be independent on the location of the stressed syllable. This inflection point seems to be located usually in the vicinity of the penultimate syllable, independently of the location of the stressed syllable. However, a more accurate analysis seems necessary to confirm this hypothesis, due to the small number of cases handled here.

4.7.1.2.3. Stress and rise-fall patterns

As indicated in section 4.5, rise-fall patterns present as common feature the appearance of a 'Rising-Falling' scheme in the vicinity of the final stressed syllable. For this reason, a more detailed analysis has been carried out to determine to what extent the location of this 'Rise-fall' scheme is dependent on the location of the stressed syllable. This analysis has been focused in the location of the 'falling-rising' point, that is, the intermediate point in the rise-fall scheme. The location of this point is exemplified in figure 4.42.
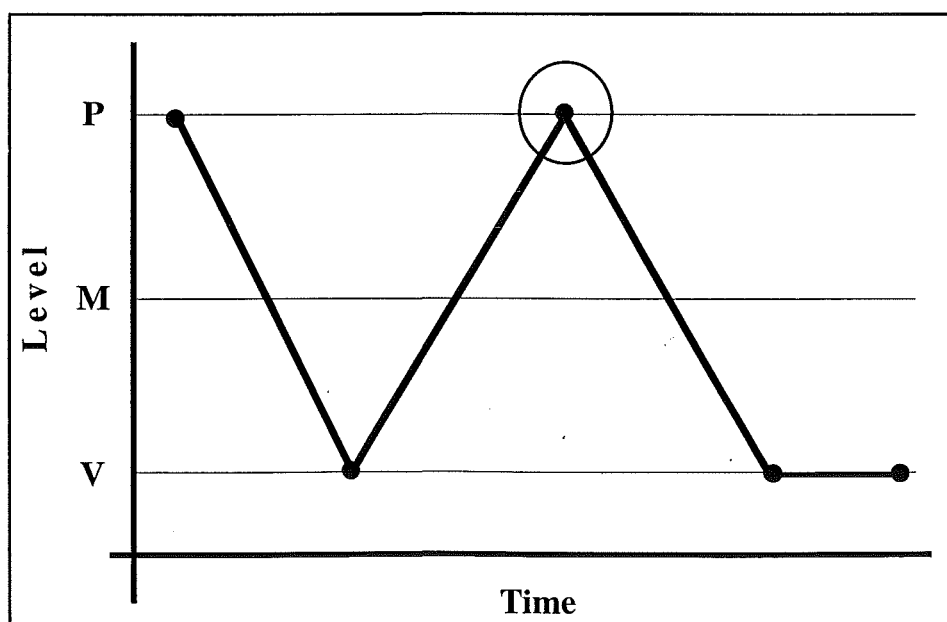

Figure 4.42. Schematic representation of rise-fall final pattern (type A) number 6. The circle indicates the 'peak' point of the rise-fall scheme.

The location of the 'Rising-P-Falling' and 'Rising-M-Falling' inflection points in relation with the location of the stressed syllable has been analysed in type A, type B and type C patterns. Tables containing the distribution of these inflection points in relation to the position of the stressed syllable for each type of pattern are presented in appendix 3 (section 4.2.3).

The data presented in these three tables seem to indicate that there is a relationship between the location of the 'Rising-P-Falling' inflection point and stress, since this point is mostly placed in the stressed syllable, irrespective of the location of the stress in the group:

a) when the stress is in the antepenultimate syllable, the stressed syllable is the most frequent location of the inflection point: 60% of the cases in type A patterns, the only type where this location has been analysed.

b) when the stressed syllable is the penultimate one of the group, the inflection point is mostly located on the stressed syllable: 81.25% of the analysed type A cases, 100% of the cases in type B, and also 100% in type C patterns.

c) when the stress is in the last syllable, the most frequent location of the inflection point is also the stressed syllable: 75% of the type A cases, 33.33% of the type B cases, and 100% of the type C cases.

It can be hypothesized that the rise-fall scheme tends to coincide with the stressed syllable, as Navarro (1944) reported already. However, the small amount of data does not allow to establish definite conclusions about this point, as in the case of the previous patterns.

4.7.1.2.4. Summary

In this section, the relationship between the shape of the final patterns and the location of the last stressed syllable of the phonic group has been analysed. The collected data seems to indicate that some dependency exists, but that it differs according to the type of pattern: rise-fall patterns seem to be the most dependent of the location of the stress, while falling patterns do not seem to be dependent at all. In the case of rising patterns, the beginning of the rise tends to be located at the penultimate syllable, irrespective of the position of the stressed syllable.

4.7.2. Local patterns and sentence type

As has been discussed in chapter 1, final movements are the main intonational cue for sentence type in Spanish and other languages. This

section presents the results of a study on the use of the final movements in relation to sentence type. Four different sentence types have been considered for this analysis: 'declarative', 'yes-no question', 'wh- question', and 'exclamative'.

The analysis consisted of the classification of the final patterns appearing in sentence-final phonic groups, according to sentence type. The figures obtained in this analysis are presented in the corresponding table of appendix 3 (section 5). The observation of the data contained in this table shows that:

a) Declarative sentences, as expected, are marked usually with different variants of falling patterns (82.61% of the analysed cases); however, some rise-fall patterns have also been found in this type of sentences (17.38%).

b) 'Yes-no' questions show falling, rising and rise-fall movements at their end. The most frequent ones are, anyway, rising patterns (46.67%), followed by rise-fall patterns (33.34%).

c) 'Wh-' questions show also examples of the three types of patterns, being rising (50%) the most frequent one. Second is the group of falling patterns (33.33%).

d) Exclamative sentences show cases with falling, rising and rise-fall endings as well. Falling and rising patterns (40%) appear to be equally frequent, followed by rise-fall patterns (20%), although the number of cases is too small to pay much attention to these percentages.

The first conclusion that can be extracted from this data is that there is no absolute identification of a pattern with a specific sentence type. Almost any kind of pattern can appear in any type of sentence. Only rising movements seem to be clearly excluded from declarative sentences. Tendencies are observed, and most preferred patterns can be established, but other types of patterns can be used instead of the 'typical' ones. Their perceptual and linguistic value should be explored in further analyses.

Apart from this fact, the description made in previous studies seems to be confirmed by this reduced analysis:

a) The typical movements for declarative sentences are the falling patterns, as Navarro (1944), Canellada & Kuhlmann (1987), Quilis (1981) or Garrido (1991) reported previously.
b) 'Yes-no' questions are typically marked by rising movements at their end, according also to previous descriptions.

c) 'Wh-' questions are marked mainly with final rising movements, but they can be equally marked with falling movements, as the descriptions of Navarro, Canellada & Kuhlmann and Quilis point out.

d) Exclamative sentences can show both rising and falling movements at their end, as reported by Navarro (1944). They can also show a rise-fall movement, also predicted by Navarro.

However, some differences can also be found when comparing these analyses with the results presented here. The main one is the use of 'rise-fall' patterns in sentence-final phonic groups, that emerge then as alternative cues for the patterns described in classical studies:

a) Rise-fall patterns appear also to be a possible alternative for marking declarative sentences. This use of the rise-fall pattern was not described by Navarro and following studies.

b) 'Yes-No' questions show as a second choice the use of rise-fall patterns, that Navarro and other studies reserved for exclamative sentences and relative questions. Falling movements also seem to be a likely choice for this type of questions.

c) The use of rise-fall patterns at the end of 'Wh-' questions is not considered by Navarro, but appears here as an unlikely choice, in very few cases, for the analysed speakers.

It seems necessary, however, to analyse the perceptual function of the rise-fall pattern, that seems to be an alternative pattern for the expression of any sentence type, but which is reserved for 'expressive' or 'emotional' intonation according to Navarro (1944) description.

4.7.3. Local patterns and syntactic structure

This section deals with the relation of syntactic structure of sentences and the local final patterns appearing at the end of non sentence-final phonic groups, a linguistic factor widely recognized as determining the shape of intonation contours (see chapter 1, section 2, for a review of this question in the case of Spanish intonation).

The analysis of the relation between local patterns and syntactic structure in the material described in this work has been limited to two aspects:

a) the study of the relation between final patterns appearing in non-sentence-final phonic groups and the immediate syntactic boundary, described in section 4.7.3.1.

b) the study of the validity of the Navarro's 'tension part/'distension part' hypothesis in the material analysed here, presented in section 4.7.3.2.

4.7.3.1. Prepausal syntactic boundaries and final patterns

As was discussed in section 1.2, the use of special intonation movements at the end of phonic groups as a cue for special syntactic boundaries has been proposed in several studies on Spanish intonation. The following analysis focuses on the description of the distribution of final patterns defined in section 4.5 in non-sentence final phonic groups, that is, the relation between the syntactic boundaries that coincide with these pauses and the type of movement appearing before them.

This task involved a previous labelling of the syntactic boundaries appearing after each one of the final tonic groups. It is important to note that some of the boundaries found in this study have not been considered in previous analyses. This is the case of the 'Beginning of a Direct Object', or the 'Beginning of a Noun Complement' boundaries. The complete labelling of the boundaries, and a description of the 15 different syntactic labels used in this work, can be found in appendix 7 (section 2).

Once the different analysed cases were associated with the corresponding syntactic label, the number of occurrences of each defined pattern at each defined boundary was computed. The results of this analysis can be found in the corresponding table of appendix 3 (section 6.1). In the following paragraphs, a brief presentation of the patterns appearing at some specific boundaries is given, and a comparison with the results obtained in previous studies (summarized in section 1.2.3.2) is established:

1) Subject/predicate boundary

The analysed subject/predicate boundaries present different movements, falling (42.86% of the cases), rising (35.71%) and falling-rising (21.43%). The use of rising patterns in this type of boundaries has been reported by Canellada & Kuhlmann (1987) in those cases in which the end of the 'tension part' coincides with this syntactic boundary. Nothing has been reported, however, about the shape of the final movement in the rest of cases.

2) Fronted elements

The 5 analysed cases of the sub-corpus show rising patterns (60%) and rise-fall patterns (40%). The use of rising patterns was previously described by Navarro (1994) and Canellada & Kuhlmann (1987), but nothing is said about the use of rise-fall patterns. Navarro (1944) considers that falling movements can also appear in some cases, but no

examples with this type of patterns have been found in the present analysis.

3) Parenthetical elements

In the case of the 6 analysed final movements appearing before a parenthetical element, 5 of them (83.33%) show a falling pattern, and only 1 (16.67%) presents a rising pattern. Navarro (1944) predicts for this location a half-rising or half-falling movement, depending on the location of the boundary ('tension part' or 'distension part').

5 examples of movements at the end of a parenthetical element have been found. They show patterns of the three defined types: falling (1 case, 20%), rising (1 case, 20%) and rise-fall patterns (3 cases 60%). This boundary has not been previously described by other Spanish intonation studies.

4) Restrictive elements

Only examples at the beginning (but not at the end) of a restrictive element have been found in the analysed material (3 cases). As in parenthetical elements, the three types of final patterns have been found (1 case each, 33.33%). Traditional descriptions have reported a rising movement before this type of boundary.

5) Non-restrictive elements

Patterns of the three defined types have been found in the cases located at the beginning of a non-restrictive element: falling (5 cases, 38.46%), rising (4 cases, 30.77%) and rise-fall (4 cases, 30.77%). Only falling movements had been reported previously in this position.

In the case of the movements at the end of a non-restrictive elements, only rising (5 cases, 55.56%) and rise-fall (4 cases, 44.44%) patterns have been found. No data about the type of movement appearing in this position are available in previous descriptions.

6) Coordinate elements

Coordinate elements are marked in the analysed cases mainly with rise-fall (5 cases, 50%) and falling (4 cases, 40%) patterns. The distinction between 'first degree' (inclusive and exclusive coordinations) and 'second degree' coordinations (coordinations using 'pero', for example), established in previous studies of Spanish intonation, has not been considered for this analysis. For this reason, it is not possible to analyse in detail the relation between each type of movement and different types

of coordination. Anyway, it can be pointed out that rising patterns, that are considered in previous analyses as the basic movement associated to 'first degree' coordinations, have been the less frequent type of patterns found in the analysed material.

7) Asyndetic coordinations

5 cases of asyndetic coordinations have been registered in the analysed material. They show falling patterns in 2 cases (40%), rising patterns in 1 case (20%), and rise-fall patterns in 2 cases (20%). Classical descriptions of Spanish consider that falling is the typical shape of the final movement at this boundary.

The data outlined above show that there is no one-to-one mapping between syntactic boundaries and final patterns. Almost any type of pattern can appear at any syntactic boundary, although, in some cases, some of them are more frequent than others. Syntactic boundaries do not seem then to determine pattern selection; other types of factors have to be related to this process. However, a deeper analysis, that is out of the scope of this work, is needed to consider this question in more detail.

4.7.3.2. Final patterns and the 'tension part'/'distension part' hypothesis

As has been discussed in section 1, the 'tension part'/'distension part' hypothesis proposed by Navarro (1944) states that sentences are split in two main parts. According to this hypothesis, these two parts partially determine the shape of the final movements at the end of the different phonic groups of a sentence, following these general principles:

a) The last phonic group of the 'tension part' shows a final rising movement;
b) Phonic groups appearing within the 'tension part' show a half-falling final movement;
c) The last phonic group of the 'distension part' presents a falling final movement;
d) Phonic groups appearing within the 'distension part' present a half-rising final movement.

The data obtained in this work have been used to evaluate the validity of this model. The goal was to check to what extent the model predicts the occurrences of the movements in the analysed sub-corpus. Only the movements extracted from declarative sentences have been taken into account, because the model has been applied exclusively to this type of sentences.

The final patterns of the declarative sentences of the sub-corpus were classified according to their position within the 'tension part'/'distension part' scheme. First, the selected sentences were divided into rama tensiva and rama distensiva, following the criteria given in Canellada & Kuhlmann (1987), and presented in section 1.2.3.2. The results of this task can be found in appendix 7 (section 3). Then, in a second step, the final patterns handled in this analysis were classified using one of the following labels:

1) 'Final 'tension part''
2) 'Final 'distension part''
3) 'Internal 'tension part''
4) 'Internal 'distension part''

After classification, the number of cases for each type of pattern at each position was computed. The results are presented in the corresponding table of appendix 3 (section 6.2.1).

The analysis of the data presented in the table reveals that:

a) Groups found in internal position of the 'tension part' ('internal 'tension part'') show both falling (4 cases, 50%) and rising (4 cases, 50%) patterns at their end.
b) The groups labelled as 'final 'tension part'' usually present a rising final pattern (9 cases, 52.94%), although rise-fall (5 cases, 29.41%) and falling (3 cases, 17.65%) patterns have also been found.
c) Groups in internal position of the 'distension part' ('internal 'distension part'') show the three types of final patterns: rising (10 cases, 45.45%), falling (7 cases, 31.82%) and rise-fall (5 cases, 22.74%).
d) The end of the 'distension part' ('final 'distension part'' groups) is marked mainly with falling final patterns (19 cases, 82.61%) but also with rise-fall patterns (4 cases, 17.4%).

It can be observed that, as far as the end of each part is concerned, the most frequent patterns are those predicted by Navarro's model: rising in the case of the 'tension part' (52.94%), and falling in the case of the 'distension part' (82.61%). However, other types can also appear in these two positions. In the case of the internal position of each part, the spreading of the results is higher. A slight preference for the rising patterns is found in the case of the 'distension part', as is predicted by Navarro's model, but in the case of the 'tension part', falling and rising patterns are equally frequent. It is not clear, however, whether these results are dependent of the number cases analysed (there are, for example, very few examples of 'internal 'tension part'' groups). Anyway, it seems that this model makes better predictions than a model exclusively considering syntactic constraints, already discussed in the previous section.

A second analysis was carried out in order to obtain more detailed data about the distribution of the patterns according their location within the 'tension' or the 'distension part' , and the syntactic boundary appearing at their end. The results of this study are presented in a table included in appendix 3 (section 6.2.2).

Although there are not many examples to establish definitive conclusions, some facts can be pointed out from the data presented in the table:

a) Several boundaries show examples of the three types of patterns even when they appear within the same part. This is the case, for example, of the 'beginning adjunct' (2 cases of falling patterns, 2 cases of rising patterns and 1 case of rise-fall pattern) or the 'coordinate elements' boundary (2 cases of falling, 1 case of rising and 1 case of rise-fall patterns) when they are included in the 'distension part'.

b) The same type of pattern can be used for a boundary when it appears in the 'tension part' or in the 'distension part'. In the case of the 'Beginning non-restrictive element' boundary, for example, rising patterns are used both when the boundary appears in the 'tension part' (2 cases) and when it appears in the 'distension part' (1 case).

The type of pattern appearing at the boundary does not seem then to be directly related to the location in a specific part. Other non-syntactic factors should be explored, one of them being that the use of an specific pattern can be in some cases simply a choice of the speaker.

4.7.3.3. Summary

The data obtained in this study of the relationship between syntactic structure and the use of final local patterns seem to indicate, as Fant (1984) stated, that there is no one-to-one matching between specific final patterns and syntactic boundaries. The 'tension part'-'distension part' model seems to predict better the use of these patterns in the analysed material, but their predictions are far from being very precise: it can predict in a reasonable number of cases the final pattern appearing at the end of each part, but it fails in the prediction of the patterns appearing at the end of the phonic groups within each part. These results seem to indicate that other types of factors different from the purely syntactic ones are involved in the selection of final patterns.

4.8. General summary

In this chapter, the results of an analysis of the intonation contours of a sub-corpus of tonic groups have been presented. The goals of this analysis, stated already in the introduction of this chapter, can be summarized in the following four points:

1) to propose and apply a formal framework for the description of the local movements;
2) to analyse the validity of the tonic group as an intonation domain in Spanish;
3) to define a set of intonation patterns for local movements in Spanish using the defined framework;
4) to study the relationship between the defined patterns and some phonetic and linguistic phenomena that can determine their shape and use.

A formal framework has been proposed for the description of local movements in the analysed material. According to this framework, intonation contours can be viewed as series of movements ('Rising', 'Falling' or 'Level') and levels ('Peak', 'Mid' or 'Valley') that define their shape. Levels are associated with specific inflection points of the stylized and postprocessed contours where a significant change in the direction of the contour is located, while movements indicate the direction of the segments of the contours between two consecutive levels, as can be observed in figure 4.43:
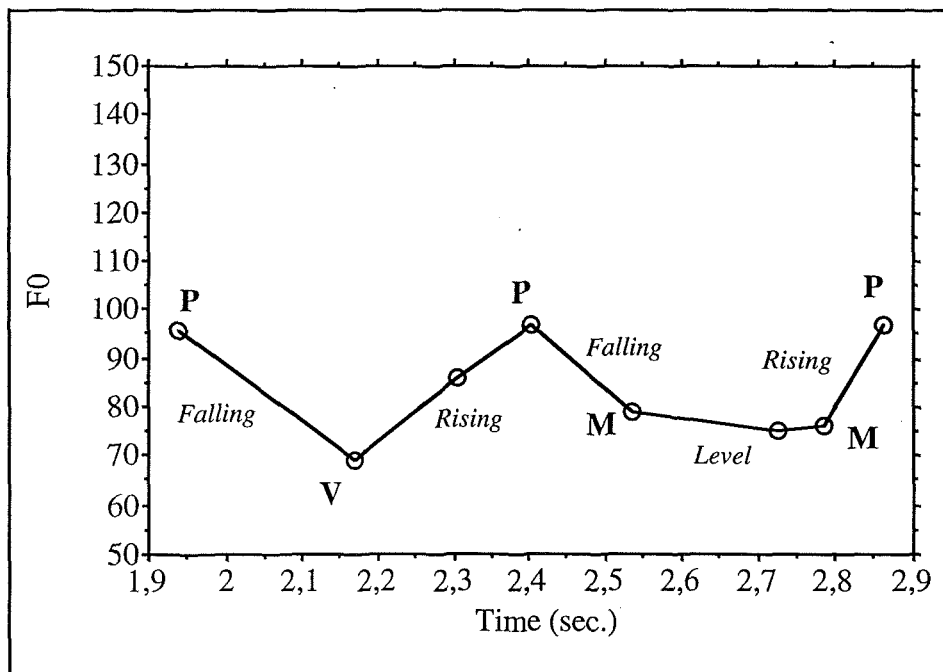

Figure 4.43. An example of representation in terms of movements and levels of a sample stylized and postprocessed intonation contour.

The stylized contours of the tonic group sub-corpus were annotated using this descriptive framework. The analysis of the obtained annotated versions led to question the validity of the tonic group as the natural domain of local movements in Spanish. Examples of mismatch between the scope of local movements and their corresponding tonic group have been given here as arguments against this hypothesis. The data seems to indicate, however, that some relation exists between the location of the stressed syllable and the beginning and end of the local movements.

The definition of the local patterns appearing in the analysed material has been attempted then independently of their domain, using their shape as the basic defining parameter. A total of 66 local intonational patterns have been reported in the analysed contours. Each one has been described as a series of movements and levels defining their typical shape. The patterns have been grouped into different sets using some common characteristics. A first division into three main sets (Initial, Medial and Final), according to their location within the intonation group, has been established. Within medial patterns, a second classification in 'Post-Initial' and 'Internal' patterns has also been considered. In the case of final patterns, three different groups have been created (Rising, Falling and Fall-Rise), according to the shape of the patterns. The location of the inflection points corresponding to each type of patterns has also been analysed and described.

Finally, the use of these sets of patterns in the intonation contours has been analysed in relation with some phonetic and linguistic factors:

a) The length of the tonic group corresponding to each pattern has been the only phonetic variable considered in this study. The results seem to indicate a positive correlation between the number of syllables in the corresponding tonic group and the chosen pattern.

b) Stress location is the first linguistic variable considered for analysis in this chapter. The obtained results seem to indicate that the location of the stressed syllable is important for the placement of the inflection point that corresponds to the beginning of the rising movement of a pitch accent. However, the location of the inflection point corresponding to the peak appears to be more unpredictable: it can be placed both on the stressed syllable itself, or on some syllable following it, depending on several factors. The data obtained here indicate some tendency to locate the 'peak' inflection point before the word or tonic group boundary; this fact could suggest that this inflection point is a cue for syntactic or prosodic boundaries rather than for the location of the stressed syllable. In the case of final patterns, the influence of the location of the stressed syllable seems less important than in the case of initial and medial patterns, although some effects, specially in the case of the rise-fall patterns, have also been found.

c) The influence of the sentence type in the selection of final patterns appearing at sentence-final phonic groups has also been analysed as another linguistic factor which can determine the use of local patterns. The results in this case support in general the previous descriptions of Spanish intonation, although some new facts have been reported. The use of rise-fall patterns at the end of declarative sentences is perhaps the most relevant one.

d) Syntactic structure has been the third linguistic factor considered for this analysis. Syntactic structure has been analysed in relation to the use of final patterns appearing at the end of non-sentence-final phonic groups. The results seem to indicate that the choice of a final pattern is not directly related to syntactic factors.

Chapter 5

SPANISH INTONATION CONTOURS AT THE INTONATION GROUP LEVEL

The second level of analysis considered in this work is the intonation group. This chapter outlines the results of the analysis of a sub-corpus of intonation groups extracted from the collected material.

The intonation group has been assumed in this study to be equivalent to the phonic group. As was discussed in chapter 1, it is generally accepted that phonic groups (parts of discourse between two pauses) tend to coincide with intonation groups. Despite the fact that some mismatches between phonic and intonational groups have been reported - when the end of an intonational pattern does not coincide with a pause, for example -, the phonic group has been chosen as a good approach to the analysis of intonation groups.

Three basic goals have been defined for this study:

1) The selection of a formal framework for the description of intonation movements at the phonic group level, based on the topline-bottomline approach.
2) The definition, using this framework, of a pattern (or patterns) describing the shape of intonation contours of the phonic groups included in the analysed corpus.
3) The analysis of the relationship between the defined pattern(s) and several specific phonetic and linguistic functions.

Section 5.1 presents the analysed sub-corpus and the variables considered. The descriptive framework is developed in section 5.2. The defined basic

global pattern is presented in section 5.3. The influence of the phonetic factors in the shape of this basic pattern is analysed in section 5.4. Finally, the analysis of the variations of the pattern according to linguistic factors is presented in section 5.5. Section 5.6 summarizes the main results.

5.1. Definition of the phonic groups sub-corpus

As in the case of tonic groups, a set of phonic groups to be analysed was chosen from the material described in part 2. The following subsections describe the variables considered for the selection and the organization of the resulting set of groups.

5.1.1. Variables

In this case, three variables were considered for the selection of the phonic groups to be analysed:

a) **Length of the phonic groups**:

Some studies (Maeda, 1976, among others) have revealed that the shape of the global contours can vary depending on the length of the utterance. The declination model offered in t'Hart *et al.* (1982) also considers differences in the slope of the contours depending on their duration. It seems possible, then, that the global shape of the phonic group can be affected by its length.

b) **Sentence type**:

Some analyses (Thorsen, 1980, for example) report variations in the global shape of the intonation contour due to the sentence type, as in the case of interrogative or exclamative sentences.

c) **Position of the group within the sentence**:

According to the 'supra-declination' hypothesis (Thorsen, 1985, 1986, among others), the global shape can also vary depending on the location of the phonic group in the sentence (beginning, middle or end).

5.1.2. Selection and organization of the material

As in the case of the tonic group sub-corpus, the first task was to establish the possible values allowed for each of the variables considered. For this

definition, a previous analysis of the available material was necessary in some cases. The values finally chosen were the following:

1) 'Length of the phonic group'.

Before the definition of the categories considered for this variable, an analysis of the length (in number of syllables) of the phonic groups included in the general corpus was performed. The minimum value was found to be 1 syllable, whereas the maximum value was found to be 58 syllables (see appendix 7, section 1, for a more detailed description of the results). However, for simplicity reasons, the top level length to be considered in the corpus was established in 30 syllables. Six different categories were then defined, each one covering a range of five syllables. Phonic groups were included accordingly in one of these 6 different categories:

1. 'Sil. 1': phonic groups between 1 and 5 syllables long.
2. 'Sil. 2': phonic groups between 6 and 10 syllables long.
3. 'Sil. 3': phonic groups between 11 and 15 syllables long.
4. 'Sil. 4': phonic groups between 16 and 20 syllables long.
5. 'Sil. 5': phonic groups between 21 and 25 syllables long.
6. 'Sil. 6': phonic groups between 26 and 30 syllables long.

2) 'Sentence type'.

As in the case of tonic groups, four different types have been included in the analysis: declarative, yes-no questions, wh- questions, and exclamative sentences.

3) 'Position within the sentence'.

Four different categories were used:

1. Initial: phonic groups at the beginning of a sentence.
2. Internal: phonic groups in the middle of a sentence
3. Final: phonic groups at the end of a sentence
4. Initial/Final: sentences constituting a single phonic group (the phonic group is initial and final at the same time).

The combination of these variables offered all the possible theoretical contexts to be found in the collected material, as in the case of the tonic group sub-corpus. However, also as happened with tonic groups, not all the possible 'cells' of the combination matrix were filled, due to the lack of examples in the material. When it was possible, however, two examples of the same type were selected for analysis. Two corpora, one from the 'news' material and a second from the 'commentaries' material, were built. The

'News' set contained finally 29 phonic groups, and the 'commentaries' one, 93 groups. A complete inventory of the phonic groups included in this sub-corpus, and two tables summarizing its contents can be found in appendix 4.

5.2. Definition of the framework

5.2.1. Introduction

Previous descriptions of global patterns in Spanish phonic groups have paid attention mainly to the initial and final parts of the contour. Navarro (1944), for example, proposes a model of the global shape of intonational contours within phonic groups that considers three different parts: the initial part, the 'body' of the contour, and the final part. These three parts define the typical shape for the contour. The global contour of the phonic group seems then to be defined taking into account the F0 height at the beginning, at the first stressed syllable, at the last stressed syllable and at the end of the contour. Local variations in the body of the contour, mainly due to stress influence, are not taken into account. In Garrido (1991), patterns for phonic groups where defined in a similar way.

Instead of this 'classical' approach, the 'topline-bottomline' model, already described in section 1.3.4.2.3, has been preferred here for the description of the phonic group patterns in the collected material. This approach, used in other intonational models ('declination lines' of the IPO; 'intonational grid' of the Lund model) for other languages, assumes that the relative height of the peaks and valleys of a contour is determined by global patterns that control the maximum and minimum values that a speaker can reach at any given point in the group. These patterns can be represented as lines that link the different maxima - or 'peaks' - of the contour, in the case of the **topline**, and the different minima - or 'valleys' - in the case of the **bottomline**. This approach has already been applied to Spanish contours in Garrido *et al.* (1993), as can be seen in the example of figure 5.1.
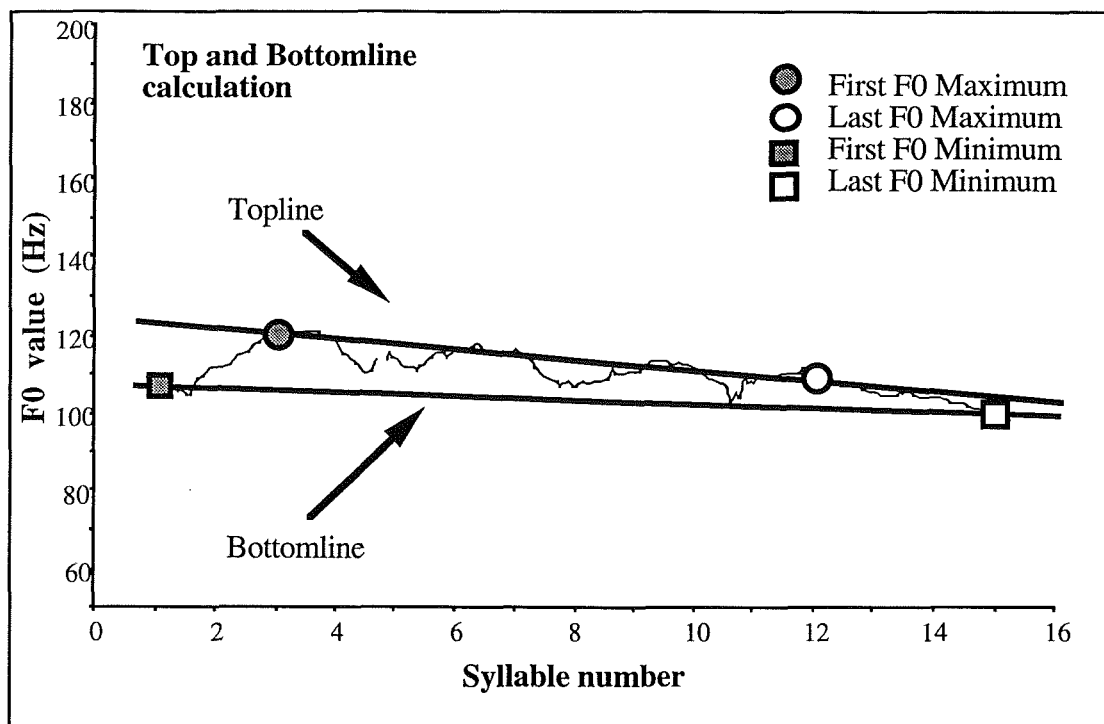
Figure 5.1. Intonation contour corresponding to the Spanish sentence "*La reina del baile bailaba la rumba de moda.*" (male speaker), described using top and bottom lines. The example has been taken from the speech material analysed in Garrido *et al.* (1993).

According to this, and following the descriptive framework proposed in chapter 4, it can be hypothesized that the height of the points labeled with P, M and V in the analysed stylized contours is defined by three different reference lines, top, mid and bottom. These lines would have a similar evolution along the phonic group, falling, and more or less parallel - according to the IPO description -, or converging, as the results of Garrido *et al.* (1993) seem to indicate.

As outlined in chapter 1, top and bottomlines have been represented in several ways in previous descriptions of intonation. In this study, the representation by means of a single straight line has been attempted. The goal of this first study has been to establish the validity of the 'straight-line' framework for the description of the intonation contours selected as sub-corpus. An experimental analysis has been carried out in order to check the hypothesis that the location of the P, M, V points along a phonic group can be accurately predicted by theoretical top, mid and bottom straight lines.

5.2.2. Procedure

The top, mid and bottom lines of the selected set of phonic groups were approximated by calculating simple regression lines from the F0 values of the P, M and V points found in each case, by means of the Statview™ data analysis program. Each line was then defined by the following equation:

$$y = ax + b$$

where y is the F0 value at time x along the group, a is the slope of the line, and b is the F0 value at the beginning of the line.

a and b values for each line were stored for further processing. The regression line was not calculated in those cases where less than two P, M or V points appeared along the group.

Figure 5.2 presents an example of the obtained top, mid and bottom lines by means of this method.
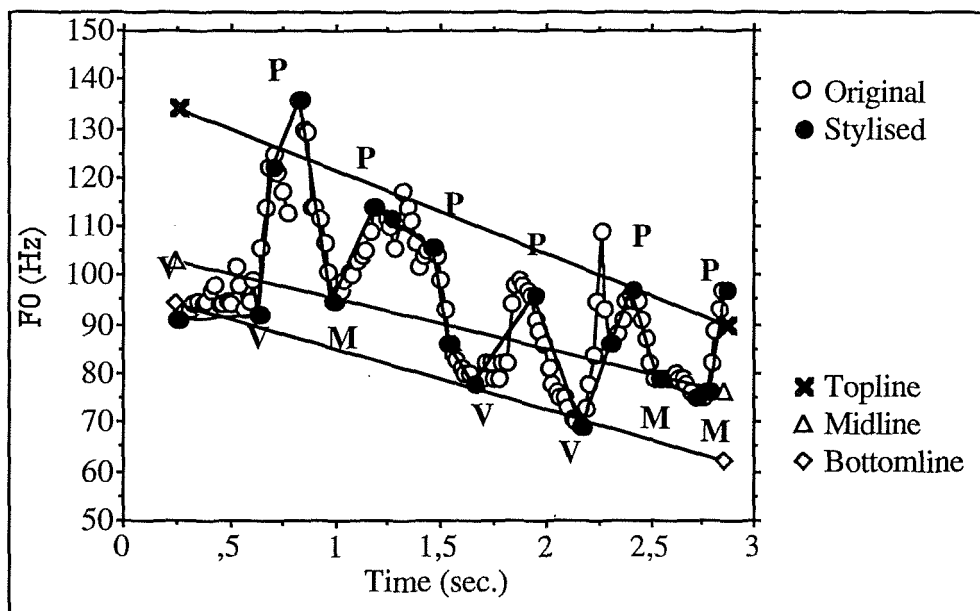
Figure 5.2. A representation of the calculated top, mid and bottom lines for the same intonation contour of figures 4.1 and 4.2.

5.3. Using top, mid and bottom lines to define global patterns at phonic group level

Using these top, mid and bottom lines, a first general pattern has been obtained by calculating the mean values of the initial and final points of each line in all the analysed phonic groups. The obtained results are presented in table 5.1, considered separately for each speaker.

	Speaker A.R.	Speaker M.E.
Initial Topline	121.15	242.71
Final Topline	95.7	205.92
Initial Mid line	103.02	205.04
Final Mid line	84.26	170.72
Initial Bottomline	88.2	177.24
Final Bottomline	73.31	153.54

Table 5.1. Mean F0 values of the initial and final points of each line considered by speaker

Using these data, a graphical representation of the lines has been obtained, by linking mean initial and final values for each line. Separate representations were drawn for each speaker, presented in figures 5.3 and 5.4:
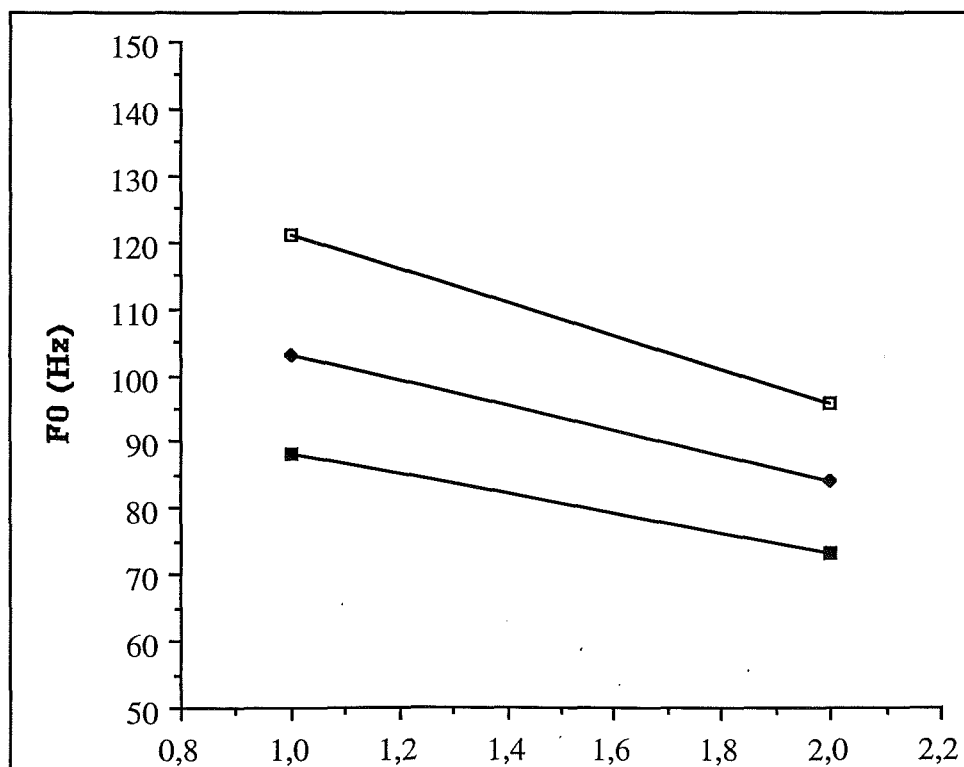
Figure 5.3. Representation of the average top, mid and bottom lines of the speaker A.R.
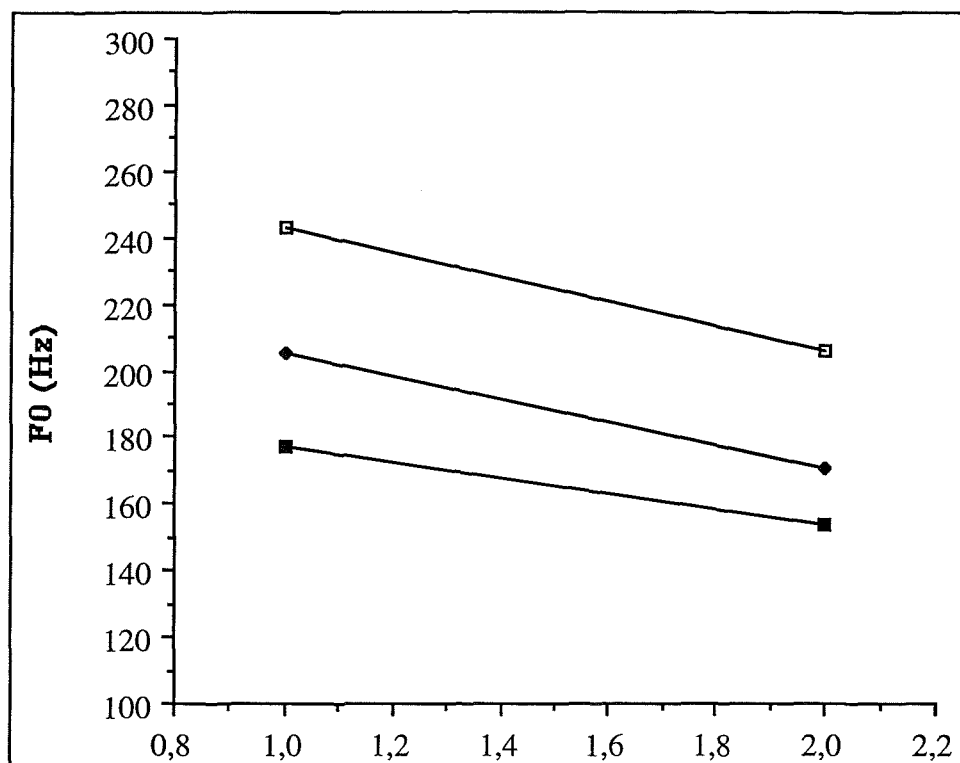
Figure 5.4. Representation of the average top, mid and bottom lines of the speaker M.E.

Some general characteristics can be pointed out from the obtained representations:

a) As far as slope is concerned, the general tendency of contours to fall, at least in reading intonation, that was assumed in chapter 4, is confirmed here with this data. The obtained representations indicate that there is a tendency in the three lines to fall along the group, both for speaker AR and for speaker ME. In addition, as can be checked in the corresponding tables of appendix 5 (sections 1.2.1, 2.1 and 3.1.1), this tendency is general in all the obtained lines: 90% of the top lines, 81.36% of the mid lines and 89.26% of the bottom lines showed a negative slope.

b) The range of the lines in both speakers shows a tendency to be wider at the beginning of the group than at the end. According to this feature, lines tend to converge from the beginning to end of the group. This tendency was already observed for Spanish in Garrido *et al.* (1993). It could be considered that these results run against the IPO description, that considers the three lines to be parallel, and not convergent. However, it has to be pointed out that the IPO model uses a logarithmic scale (semitones) to represent the contours, whereas this description has been made using a linear scale (Hertz). If the lines obtained for both speakers are represented using a logarithmic scale (figure 5.5), it can be observed that they appear to be parallel instead of converging lines.

c) Related to the range of the lines, it seems important to note the differences in the location of the mid line in both speakers. The analysed male speaker (A.R.) shows a mid line placed half way between the top and bottom line. However, in the case of the female speaker (M.E.), the mid line is located closer to the bottomline than to the topline. This finding could lead to the definition of two different patterns for male and female speakers. In addition, these results apparently differ again from the IPO model, which considers that the mid line is always half way between the top and the bottom lines. However, again the use of a logarithmic scale to represent both patterns seems to avoid these differences, as observed in figure 5.5.
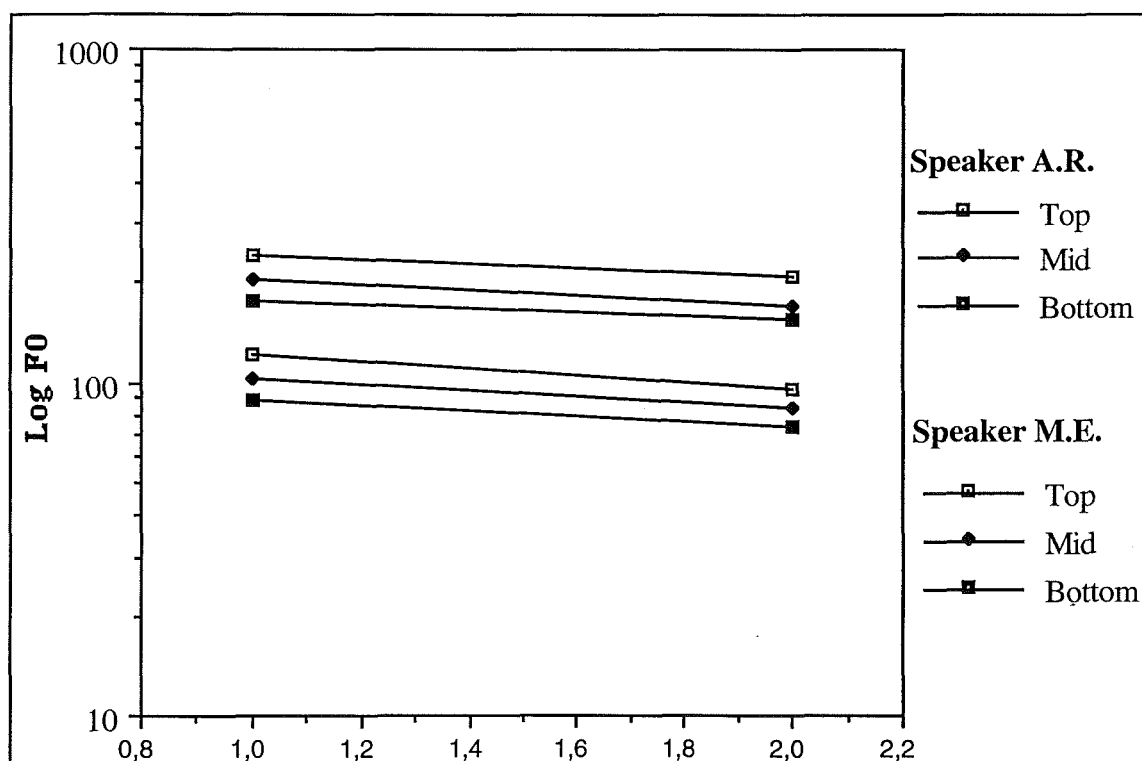
Figure 5.5. Representation of the average top, mid and bottom lines for speakers A.R. and M.E. by means of a logarithmic scale

The global pattern proposed here can be described in terms of a series of parameters, which determine the shape of each line, and the relation existing among them:

a) the **initial** and **final values** of each line;
b) the **slope** of each line;
c) the **initial range**, or difference in Hz between the top and bottom lines at the beginning of the group;
d) the **final range,** or difference in Hz between the top and bottom lines at the end of the group.

In the following sections, the results of an analysis of the variations of some of these parameters according to several factors is presented. First the influence of phonetic factors is reviewed. The analysis of the influence of sentence type, as the only linguistic factor considered in this case, is presented later.

5.4. Variations of top, mid and bottom lines according to phonetic factors

5.4.1. Duration of the phonic group

As has been pointed out in chapter 1, the duration of the utterance is one of the factors that have been previously considered to determine the slope of the top and bottom lines. Maeda (1976), for example, concludes that the slope of the contours is dependent on the length of the utterance, whereas initial and final values tend to keep constant irrespective of the length. t'Hart *et al.* (1982) define two different formulae which take into account these differences in slope according to the length of the utterance

$$D_1 = -8,5/t \qquad \text{for } t > 5 \text{ sec.}$$
$$D_2 = -11 \ (t+1,5) \quad \text{for } t \leq 5 \text{ sec.}$$

where

D = slope of declination (in semitones/sec.)
t = time (in seconds)

Bruce (1982) arrives at a similar conclusion in his analysis of declination in Swedish. According to his data, initial and final values of the contours tend to keep constant, and consequently, slope tends to change with duration. He notes, however, that other factors can influence the initial and values of the contours, specially the location of the contour within the textual unit.

Finally, Thorsen (1986) also found an effect of the length on the slope of the contour. Thorsen's data showed a slight influence on the initial and final values as well, but, as in the case of the previously reported studies, they kept more constant than the slope.

It can be hypothesized then, according to previous studies, that the utterance duration affects mainly the slope of the top, mid and bottom lines, but not the corresponding initial and final values. This hypothesis is explored in the following sections. The influence of phonic group duration has been analysed considering five different variation parameters: slope (section 5.4.1.1), initial (section 5.4.1.2) and final values (section 5.4.1.3) of the

lines, and finally, initial (section 5.4.1.4) and final range (section 5.4.1.5) between top and bottom lines. For each parameter, the data have been considered in three different ways: first, a correlation analysis between slope and duration (in seconds) of the phonic groups has been carried out; second, the data have been submitted to a regression analysis between slope and duration in number of syllables; finally, mean values for each length category established in section 5.1.2 have been calculated. The results of the last two analyses are presented in a series of figures that can be found in appendix 5 (section 1). The tables containing the results of the correlation analyses have been included in the following sections.

5.4.1.1. Slope and duration of the phonic group

The analysis of the slope of the calculated top, mid and bottom lines in relation to the duration of the phonic group seems to indicate that some relationship can be established between these two factors.

The results of the correlation analysis are summarized in table 5.2. The correlation coefficients obtained for the three lines indicate that, taking into account the number of analysed cases, a very slight correlation between the two factors seems to exist: the p value is below the significance threshold ($p=0.05$) in two of the three lines.

	Count	Correlation	R-squared	p
Top line	90	0.135	0.018	0.204
Mid line	59	0.266	0.071	0.041
Bottom line	121	0.242	0.059	0.007

Table 5.2. Correlation, R-squared and p values for the top, mid and bottom lines in the analysis of the correlation between duration of the sentence and the slope of the lines.

This tendency seems to be supported by the observation of the results of the other two analyses. The observation of the calculated mean values for each length category indicates that, despite the large variations in the means of the short groups, the slope tends to be less steep in longer phonic groups. The same results have been obtained in the regression analysis: positive regression lines have been obtained in 5 out of 6 conditions, which means that slope tends to decrease when phonic group length increases.

The results of these three analysis seem then to show a very slight correlation between slope and group length: the longer the phonic group is, the less steep is the slope. However, these results are not clear enough to claim a clear relationship between these two factors.

5.4.1.2. Initial values and duration of the group

The analysis of the F0 value at the initial point of the different lines shows no relationship between this factor and group length. The results of the correlation analysis, presented in table 5.3, can be interpreted in this way. The obtained p values for the three lines are below the significance level (p=0.05) in this case. This seems to indicate that no relationship (or at least less relationship than in the case of the slope) can be established between these two variables.

	Count	Correlation	R-squared	p
Top line	90	0.033	0.001	0.759
Mid line	59	-0.147	0.022	0.265
Bottom line	121	-0.111	0.012	0.227

Table 5.3. Correlation, R-squared and p values for the top, mid and bottom lines in the analysis of the correlation between duration of the sentence and the initial value of the lines.

This idea is confirmed by the observation of the figure presenting the mean F0 values for each length category (included in appendix 5, section 1.2.2): small variations are found from one group to another, but no tendencies can be established. Finally, the regression analysis relating the F0 value at the beginning of each line and number of syllables of the group offers similar results: the values are widely spread out, and no clear correlation, positive or negative, is observed in the different lines.

According to the data obtained here, then, no evidence of relationship between duration of the groups and height of the initial values of the lines is observed.

5.4.1.3. Final values and duration of the group

The results obtained for the F0 value at the end of the top, mid and bottom lines are quite similar to the ones obtained in the previous section. The data presented in table 5.4 indicate that there is no correlation between final F0 values and the duration in seconds of the groups in the case of the top and mid lines, but that some correlation seems to exist in the case of the bottomlines. The p value is under the significance threshold (p=0.05) in the case of the top and mid lines, but it is below the threshold in the case of the bottomline. Slight negative correlations have been obtained in the three cases.

	Count	Correlation	R-squared	p
Top line	90	-0.061	0.004	0.569
Mid line	59	-0.113	0.013	0.395
Bottom line	121	-0.190	0.036	0.003

Table 5.4. Correlation, R-squared and p values for the top, mid and bottom lines in the analysis of the correlation between duration of the sentence and the final value of the line.

The figures representing the mean values obtained for the final points in the different categories do not change this hypothesis. These data seem to show different tendencies in both speakers: speaker ME seems to present a small tendency to decrease the final values, at least in the case of top and bottom lines, while speaker AR is more constant.

These results seem then to indicate that, as in the case of the initial values, no significant correlation exists between these two parameters, although a slight tendency for the values to decrease has been observed in some cases.

5.4.1.4. Initial range and duration of the group

The initial range does not seem to be related to the duration of the phonic group according to the data obtained here. Table 5.5 presents the results obtained in the correlation analysis, which do not indicate any significant correlation between this factor and duration of the group ($p > 0.05$).

Count	Correlation	R-squared	p
89	0.02	0	0.854

Table 5.5. Correlation, R-squared and p values in the analysis of the correlation between duration of the sentence and the initial range.

The analysis of the mean values obtained for each length category and the regression analysis lead to similar conclusions. The values are quite widespread, and no consistent tendency can be recognized in the figures.

5.4.1.5. Final range and duration of the group

As in the previous case, the analysis of the final range does not offer any evidence of relationship between this factor and the duration of the group. The results presented in table 5.6 can be interpreted in this way, since the p value lies under the significance threshold ($p = 0.05$).

Count	Correlation	R-squared	p
89	-0.076	0.006	0.477

Table 5.6. Correlation, R-squared and p values in the analysis of the correlation between duration of the sentence and the final range of the groups.

The results of the other two analyses included in appendix 5 (sections 1.1.5 and 1.2.5) indicate that, as in the case of initial range, the values are quite spread and no tendency can be recognized.

5.4.1.6. Summary

According to these results, it can be concluded that the slope of the lines is the parameter more clearly related to the duration of the phonic groups, although the data obtained does not fully confirm this idea. This tendency is in agreement with the results obtained previously for other languages, as Danish or Swedish, reported at the beginning of section 5.4.1.

As expected, initial and final values of the lines do not seem to be positively correlated related with duration of the group. Further analyses described below indicate that these factors seem to be dependent on variables such as the position in the sentence.

Finally, the analysis of the initial and final range, not considered in previous analyses, has not offered evidence of relationship between this factor and duration. The results obtained in other analyses presented in the following chapters also suggest that range is rather related to factors like the syntactic structure of the sentence.

5.4.2. Location of the phonic group in the sentence

The 'supra-declination' hypothesis states that declination phenomena can be found in levels higher than the clause or phonic group. Thorsen (1985, 1986) reported this phenomenon at the paragraph level and the sentence level, and her findings where confirmed by Ladd (1988). According to this hypothesis, the values of the global patterns at phonic group level would be determined by higher level units (sentences or paragraphs, for example).

The following analysis is aimed at testing this hypothesis with the data handled here. The values of the slope, initial and final points of the top, mid and bottom lines, and initial and final range of the groups have been analysed separately according to their location in initial, medial, final or initial/final phonic groups. A detailed presentation of the results of this analysis can be found in appendix 5 (section 2).

The analysis of the obtained results shows a clear influence of the position of the phonic group within the sentence on the relative height of initial and final values of the three lines. Figures 5.6 and 5.7, representing mean top, mid and bottom lines for the phonic groups of the declarative sentences of each analysed speaker, illustrate this fact:
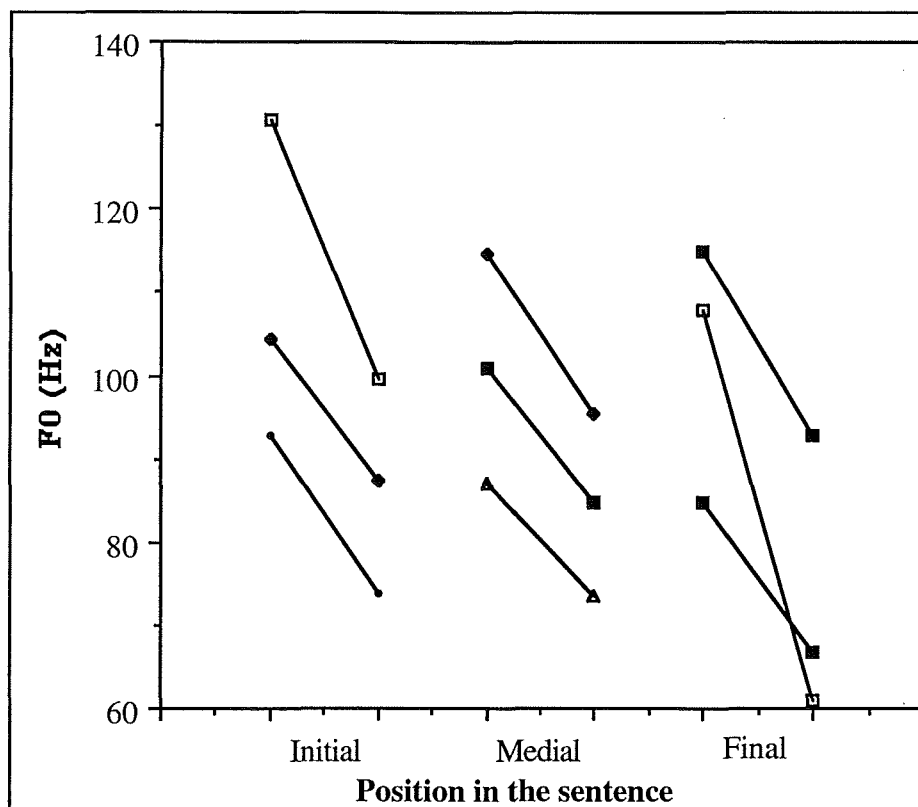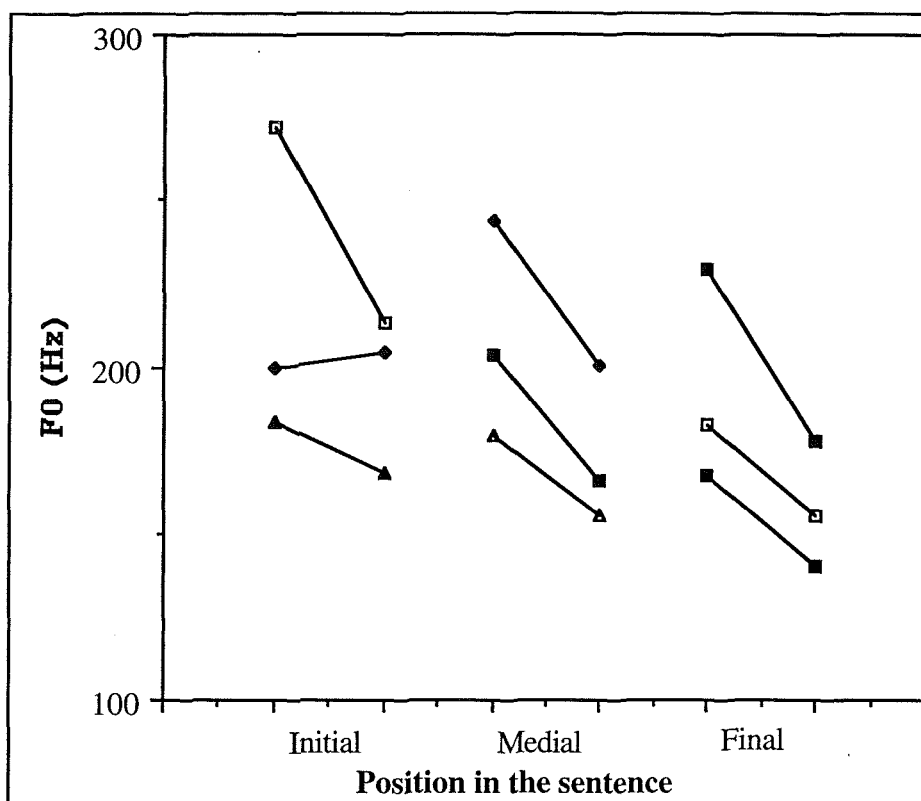

Figure 5.6. Representation of the top, mid and bottom lines in initial, medial and final position for the declarative sentences of the speaker A.R. Duration of the groups has not been considered in this representation.

Figure 5.7. Representation of the top, mid and bottom lines in initial, medial and final position for the declarative sentences of the speaker M.E. Duration of the groups has not been considered in this representation.

According to these results, it seems that the relative height of the initial and final values of the phonic groups is highly dependent on the position in the sentence.

The data presented in appendix 5 (section 2.4) also seem to indicate some relationship between initial range and position in the sentence, both for speaker AR and for speaker ME. The influence on the final range is less evident according to the collected data. This can also be observed in figures 5.6 and 5.7.

Finally, the analysis of the slope of the lines as a function of the location of the group in the sentence needs a more detailed comment. Initial groups show a tendency to have a steeper slope than the rest, specially in the case of top lines. In the case of final groups of speaker AR, the three lines seem to show a steeper slope than in the medial groups. This tendency is not found in speaker ME, although it is quite possible that this fact is related to the positive slopes detected in the final groups of her interrogative sentences.

Summarizing, it can be stated that the location of a phonic group within a sentence seems to affect in different ways all of the analysed parameters. The most evident case is the one of the initial and final values, although

some effects have also been found on initial and final range, and even on the slope of the lines.

5.5. Top, mid and bottom lines and the expression of linguistic information: the case of sentence type

As was discussed in the first chapter, sentence type can modify the global shape of the phonic groups. In some cases, it has been considered that the global slope of the group can be a cue that indicates its sentence type. Thorsen (1980), for example, suggests this idea for Danish: declarative sentences present a steeper slope than interrogative ones. For Spanish, Navarro (1944) considers that declarative sentences show a steady central part, while interrogative sentences would present a continuous fall until the last stressed syllable. In this case, Navarro's predictions are completely different to the results of Thorsen for Danish.

According to some descriptions, the global height of the F0 along the contour is another cue to distinguish declarative sentences from other types, such as interrogative sentences. Canellada & Kuhlmann (1987) argue that interrogative contours in Spanish have a higher mean F0 than declarative sentences.

Finally, the range can also be considered a cue to distinguish between different sentence types. Exclamative sentences, for example, would present higher F0 range than their declarative counterparts, according to the data presented in Garrido (1991).

These three cues - slope, global height and range - have been analysed in order to determine their influence in the expression of sentence type in the considered sub-corpus. A detailed presentation of the results of this analysis can be found in the tables and figures presented in appendix 5 (section 3). In the following paragraphs, some conclusions about the gathered data are outlined and illustrated.

5.5.1. Slope and sentence type

Mean values for the slope of the top, mid and bottom lines have been calculated separately for each set of phonic groups sharing the same sentence type. A table presenting these results can be found in appendix 5 (section 3.1.1). In addition, figures presenting the calculated mean top and bottom lines separately for each sentence type in each sentence position, and for each speaker, have been also included in appendix 5 (section 3.2). The analysis of the data presented there does not indicate any clear global effect of sentence type on the slope of the lines of the analysed phonic groups.

However, some particular effects have been found, as the special behavior of the top and mid lines of speaker ME in sentence-final interrogative groups. In these cases, top and bottom lines tend to be rising, as figure 5.8 illustrates.
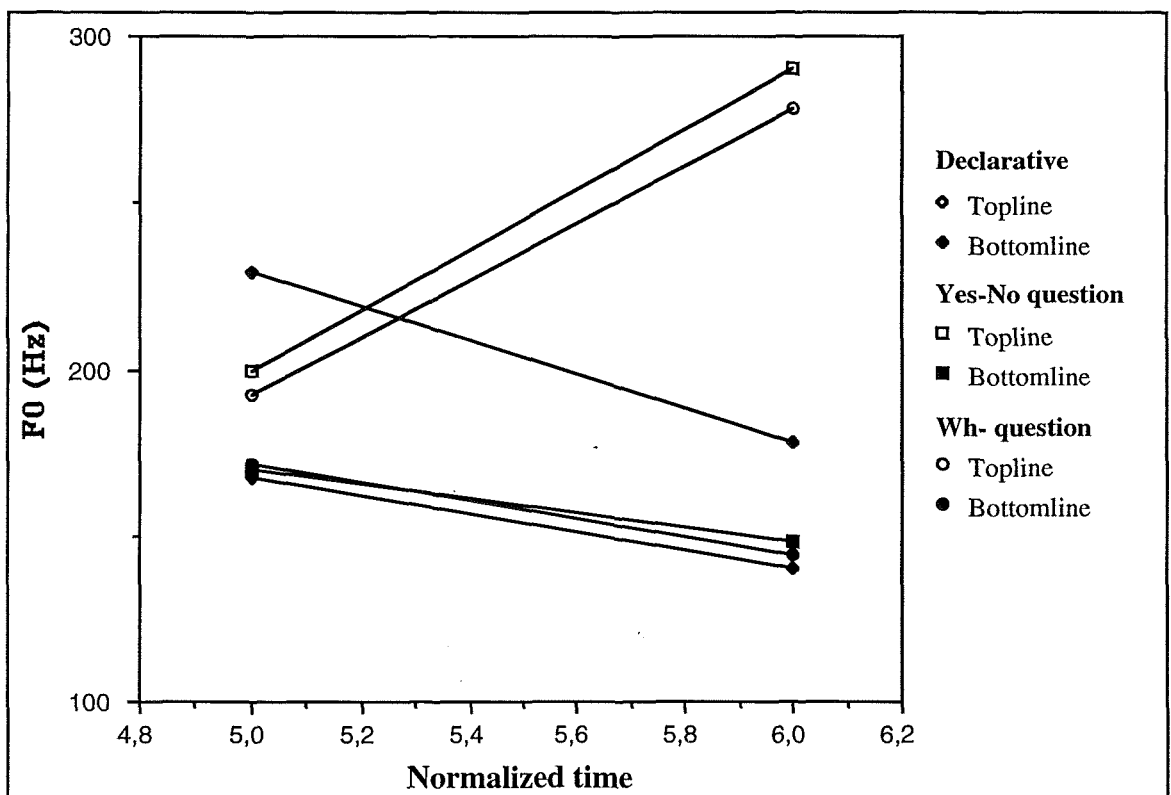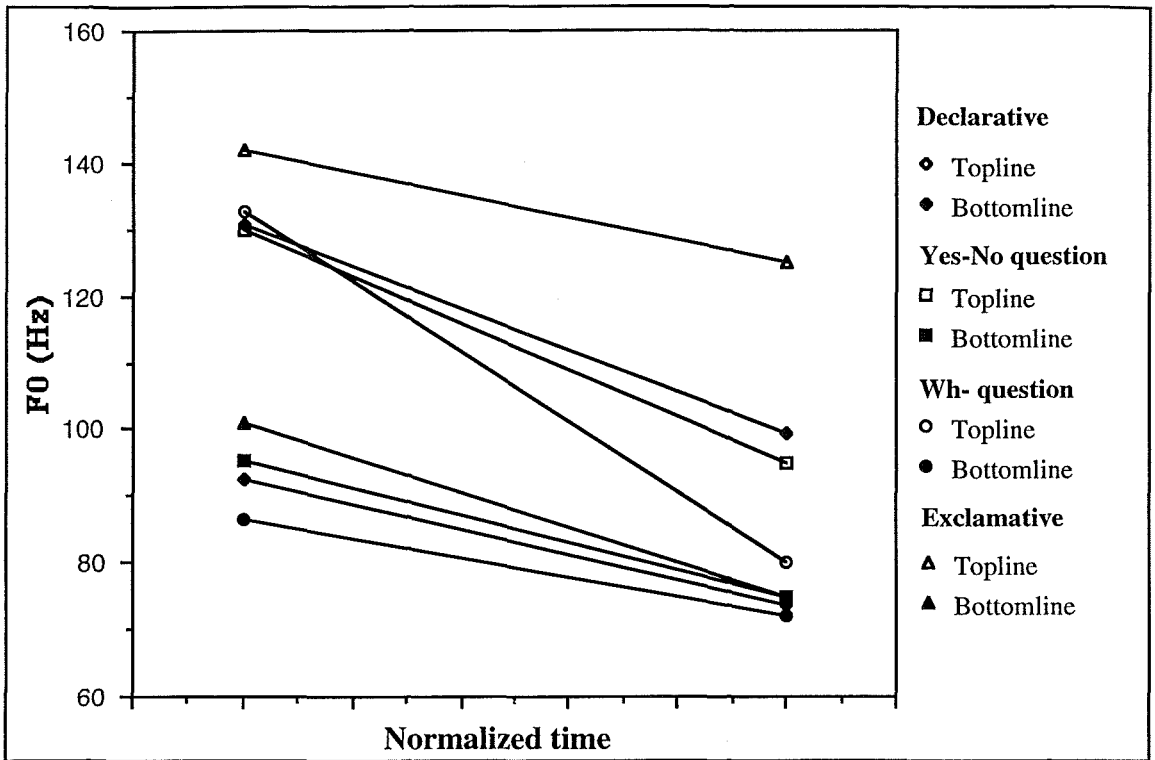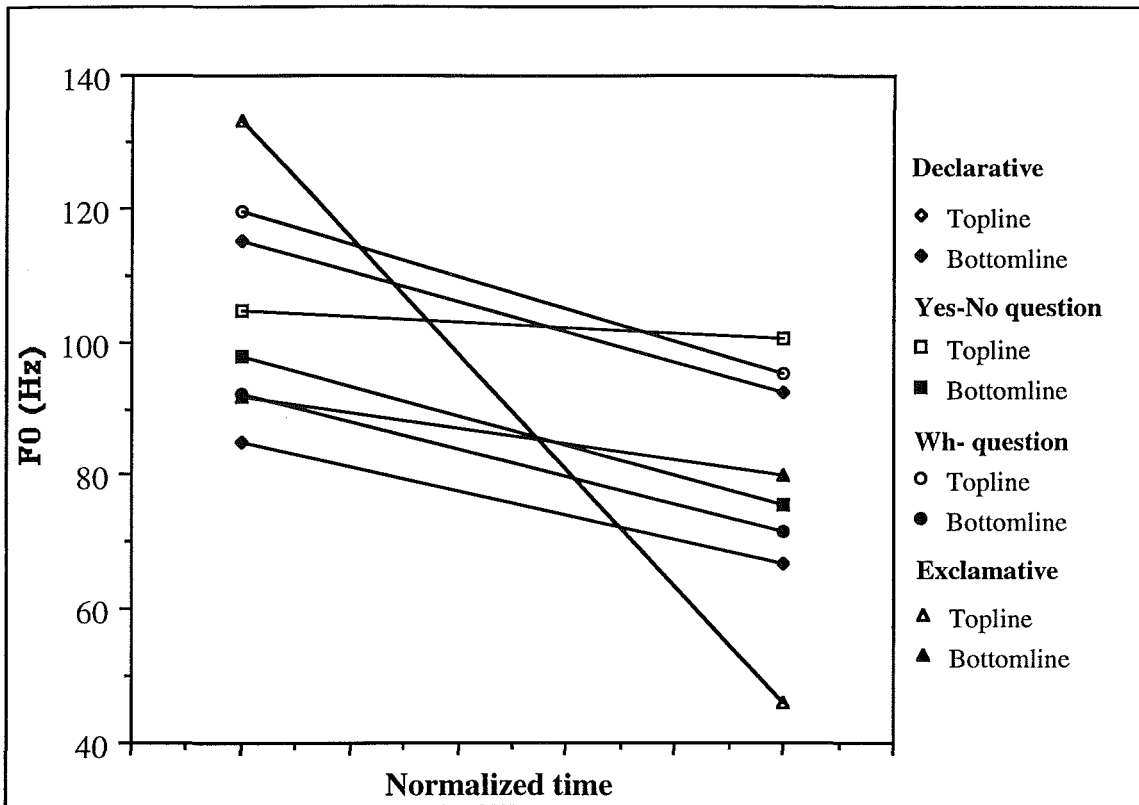

Figure 5.8. Mean values of the initial and final points of the top and bottom lines in sentence-final groups of declarative sentences, 'yes-no' questions and 'wh-' questions for speaker ME.

A more detailed analysis of this fact revealed that these rising lines are related to the high frequency values registered at the end of the final movement of the questions of this speaker, as is illustrated in figure 5.9.
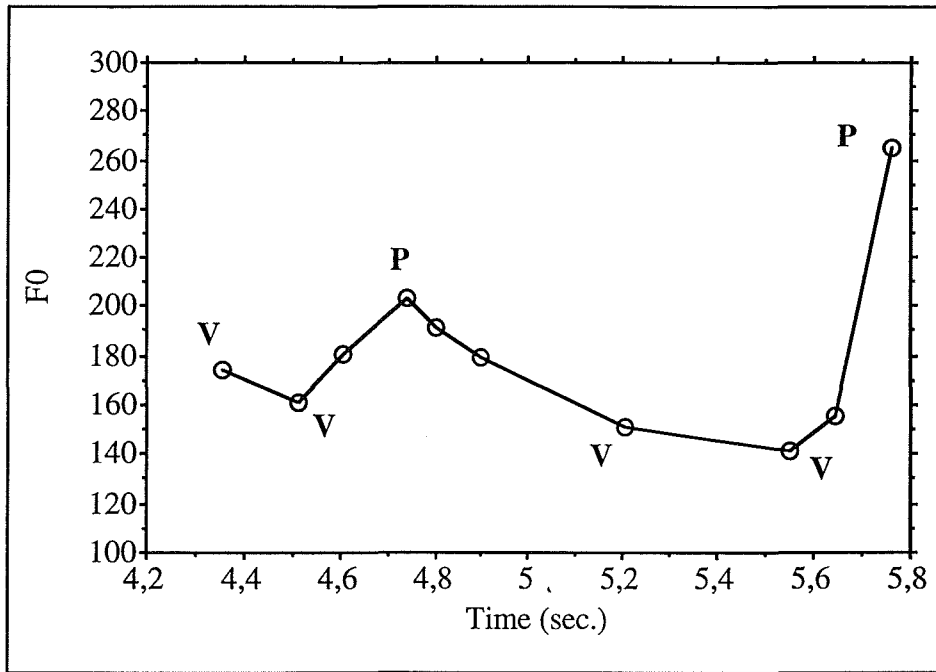
Figure 5.9. Stylized and annotated contour of the phonic group '*que disparan contra su propio bando?*', uttered by speaker ME.

The location of the 'P' point in these cases is clearly higher than the theoretical 'P' level predicted by a falling topline. Possible explanations of this fact could be the existence of a fourth level, not considered in this work, or a special behavior of the rising patterns in questions, that would not be equivalent then to the rising pattern defined in the previous chapter.

5.5.2. Global height and sentence type

To analyse the global height of the contours as a function of the sentence type, the F0 values at the initial and final points of the three lines have been considered separately for the different types of sentences. The results of this analysis are presented in appendix 5 (sections 3.1.2 and 3.1.3).

As in the case of the slope, no global effects have been observed in the obtained data. However, some particular remarks can be made. Speaker AR shows a higher mean top line and bottom lines for exclamative sentences than for the rest of types. This is specially clear in the case of the initial groups, as figure 5.10 shows.

Figure 5.10. Mean values of the initial and final points of the top and bottom lines in sentence-initial groups of declarative sentences, 'yes-no' questions, 'wh-' questions and exclamative sentences, for speaker AR.

Speaker AR also shows some differences in the height of the bottom lines of the final groups: initial and final values of the bottom line in declarative sentences present lower mean values than in the rest of sentence types, as shown in figure 5.11:

Figure 5.11. Mean values of the initial and final points of the top and bottom lines in sentence-final groups of declarative sentences, 'yes-no' questions, 'wh-' questions and exclamative sentences, for speaker AR.

These two features can be interpreted as special cues for marking, respectively, exclamative and declarative sentences.

5.5.3. Range and sentence type

Finally, the data obtained for initial and final range have been considered in order to find potential effects of sentence type. Separate mean values for the initial and final range in the phonic groups of each sentence type have been obtained and analysed. They are presented in the corresponding table of appendix 5 (section 3.1.4).

The observation of this table does not allow to establish clear correlations, but some tendencies can be outlined. The most clear effect is perhaps the large initial range that the exclamative phonic groups show for both speakers: in the case of speaker A.R., the mean initial range for exclamative groups is the highest one (49.5 Hz for exclamative groups; 32.84 Hz for declarative groups; 31.17 Hz for 'wh- question' groups; 28 Hz for 'yes-no question' groups); in the case of speaker M.E., the mean initial range for exclamative groups is not the highest one, but the second higher (63 Hz in the case of exclamative groups; 72.43 Hz for declarative group; 59.33 Hz for 'yes-no question groups'; 47.2 Hz for 'wh- question' groups). This

tendency could reinforce the hypothesis, established already in previous studies, that an increase in range can be used as a phonetic cue of exclamative sentence type.

Final range, however, tends to be more similar among the different types specially in the case of speaker A.R. (25.44 Hz in declarative groups; 22.85 in 'yes-no question' groups; 24.83 Hz in 'wh-question' groups; 11.33 Hz in exclamative groups). In speaker M.E., more variation has been found, but it seems to be related to the fact (already described in section 5.5.1) that sentence-final groups belonging to 'yes-no' and 'wh-' questions of this speaker show larger-than-usual rising movements, that have increased the obtained mean in these two categories (45.96 Hz in declarative groups; 66.83 Hz in 'yes-no question' groups; 93 Hz in 'wh- question' groups; 34.8 Hz in exclamative groups).

5.5.4. Summary

The results obtained in this analysis seem to show that sentence type does not affect in a global way the shape of the phonic groups in the different sentence positions considered here. However, some particular effects have been noticed, located at special parts of the sentence, initial and final, specially, as previous descriptions already reported. In addition, the use of these intonational cues appears to be speaker dependent, according to the data obtained here.

5.6. General summary

In this chapter, the analysis of the intonation contours in a sub-corpus of phonic groups has been attempted. The goals were:

1) the selection of a formal framework for the description of the intonation movements at this description level;
2) the definition of a pattern (or patterns) describing the shape of intonation contours of the analyzed phonic groups;
3) the analysis of the relation between the defined pattern(s) and several specific phonetic and linguistic variables: group duration, position of the group in the sentence, and sentence type.

The chosen framework for the description of the phonic group intonation contours is based on the topline-bottomline model. This model considers that the relative height of the different levels in an intonation contour can be approached by means of lines that define the F0 value of each level at any moment in time. Using this framework, a basic pattern for modelling the shape of the stylized contours of the analysed phonic groups has been

proposed, consisting of three falling and converging lines, **top, mid** and **bottom**, that define respectively the height of the different P, M and V points of the group. This basic pattern is presented again in figure 5.12.
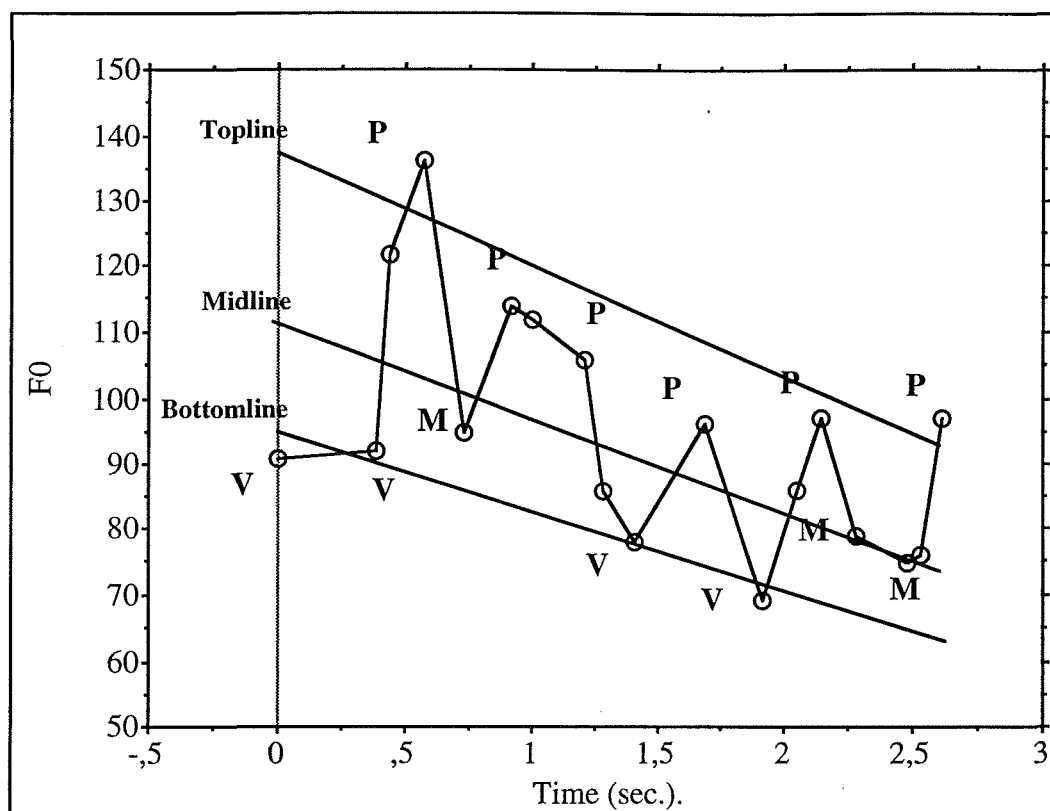

Figure 5.12. A representation of (approximated) top, mid and bottom lines approaching P, M and V points in the same stylized intonation contour of figure 5.2.

Each one of these lines can be defined by the F0 value of their initial and final points. The location of these two points defines other secondary parameters, as the slope of the line, or the range between lines.

This basic pattern has been analysed in order to check to what extent it can vary under the influence of several phonetic and linguistic factors. The results of this analysis have led to the following conclusions:

a) The slope of the lines seems to be determined mainly by the duration of the phonic group: the longer is the group, the less steep is the slope.

b) The height of the initial and final values of the lines seems to the related, first of all, to the position of the phonic group in the sentence: F0 height of the initial and final points of the lines tend to decrease from initial to final position in the sentence. This fact can be interpreted as evidence for the existence of rules or patterns, having a domain larger than the phonic group, that would establish the relative height of top, mid and bottom lines. This possibility is considered again in the following

chapter. Apart from this main influence, the height of the lines can also be determined, occasionally, by sentence type: a higher global F0 value of the lines in the different phonic groups of a sentence can indicate, for example, that the sentence is exclamative.

c) In the case of the range between top and bottom lines, initial and final ranges seem to behave in a different manner: initial range tends to show more variation, while final range tends to keep more constant. Variations found in the initial range seem to be mainly related to the position of the group within the sentence: in general, it is higher at the beginning of a sentence-initial group than at the beginning of a sentence-final group. However, initial range seems to be determined by linguistic factors, as has been observed in some sentence-initial groups of the analysed exclamative sentences: in those cases, a larger range has been considered as a possible cue to indicate sentence type.

Chapter 6

SPANISH INTONATION CONTOURS
AT THE SENTENCE LEVEL

Sentence is the next level considered for analysis. As established in chapter 1, sentence has been considered here to be a portion of text beginning with a blank space, a full stop (.), a question mark (¿) or an exclamation mark (¡), and ending with a full stop, a question mark (?) or an exclamation mark (!).

The goals of this chapter can be summarized in the following way:

a) the definition of a descriptive framework for the description of intonation contours within sentences;
b) the search of intonation units and patterns at sentence level and below;
c) the analysis of the variation of the defined patterns according to several factors, linguistic in this case.

As was outlined in chapter 1, Spanish intonation at the sentence level has been traditionally described using the 'tension part' - 'distension part' approach. According to this hypothesis, sentences can be divided in two different parts, the 'tension' and the 'distension' parts. This scheme does not determine the shape of the contour at sentence level, but only the final movement at the end of each part. This approach has been illustrated in Navarro (1944) and Canellada & Kuhlmann (1987) with sentences showing a simple syntactic structure. Nothing is said, however, about sentences with a more complex structure, or about non-declarative sentences.

In this chapter, the 'supra-declination' approach, also presented in chapter 1, has been preferred for the description of sentence intonation in the collected material. The main advantage of this approach is that intonation

phenomena which occur at phonic group level, on the one hand, and at higher description levels, on the other, can be described using a similar framework.

Using this framework, the possibility of defining global patterns at the sentence level is analysed. This analysis has led to propose a hierarchical structuring of sentence intonation, with a series of intermediate levels of description between the phonic group and the sentence, and the existence of an intonational structure within sentences. The validity of the sentence as an intonational unit of Spanish, with its own intonational pattern, is also discussed.

Finally, the building process of this proposed intonational structure for each sentence is briefly analysed. The influence of several linguistic factors on the intonational structure of a sentence has been considered.

The organization of this chapter is similar to previous ones: first, the analysed sub-corpus is described (section 6.1), and the analysis method is summarized (section 6.2); the descriptive framework is presented in the following section (6.3), and the use of this framework to define patterns at sentence level (6.4) and below (6.5) is discussed; finally, section 6.6 deals with the analysis of the factors which affect the definition of the intonational structure at this level.

6.1. Definition of the sentences sub-corpus

A sub-corpus of sentences was selected from the collected material for this analysis. The following subsections describe the variables considered for the selection of the sentences and the selection procedure itself.

6.1.1. Variables

The variables considered for the selection of tokens of this sentence sub-corpus were the following:

a) **Length of the sentence**, in number of syllables.

The results presented in Thorsen (1986) for example, show how length can determine the shape of the intonational patterns of one-phonic-group sentences. It was considered that this effect could also be present in sentences containing more than one phonic group.

b) **Sentence type**.

As was discussed already in the case of phonic groups, sentence type can be one of the variables determining the global shape of intonation contours. It has also been considered in the case of the sentence sub-corpus.

Syntactic structure has not been controlled for the selection of the sub-corpus, although it has been considered in the analysis procedure.

6.1.2. Selection and organization of the material

The values for each factor were established as in the case of the preceding sub-corpora.

1) 'Sentence length'.

An analysis of the duration of the sentences included in the speech material was carried out. The results of this analysis indicated that sentences ranged from 3 to 195 syllables long. Then 10 different categories of sentences were established, each one including a 18-syllable interval approximately, and covering the whole range of possible lengths:

1. 'Sil. 1': sentences between 3 and 22 syllables.
2. 'Sil. 2': sentences between 23 and 41 syllables.
3. 'Sil. 3': sentences between 42 and 60 syllables.
4. 'Sil. 4': sentences between 61 and 79 syllables.
5. 'Sil. 5': sentences between 80 and 99 syllables.
6. 'Sil. 6': sentences between 100 and 118 syllables.
7. 'Sil. 7': sentences between 119 and 137 syllables.
8. 'Sil. 8': sentences between 138 and 156 syllables.
9. 'Sil. 9': sentences between 157 and 175 syllables.
10. 'Sil. 10': sentences between 176 and 195 syllables.

b) 'Sentence type'.

Four different categories have been considered, the same as for the tonic group and phonic group corpora:

1. 'Mod. 1': declarative sentences
2. 'Mod. 2': yes-no questions
3. 'Mod. 3': wh- questions
4. 'Mod. 4': exclamative sentences

The combination of these two sets of categories determined the 'feature grid' of the sentences to be found in the analysed material. Only one example of each 'feature combination' was chosen, although some combinations were not found within the collected material. The realizations of both speakers, AR and ME, were considered for each selected sentence. As in the previous sub-corpora, two different subsets, one for the 'News' material and a second one for the 'Commentaries' material, were built. According to this, the total number of sentences was 10 x 2 speakers = 20 in the case of the 'News' subset, and 23 x 2 speakers = 46 in the case of the 'Commentaries' subset.

The complete inventory of selected sentences, and two tables explaining the organization of the sub-corpus, can be found in appendix 6.

6.2. Corpus analysis

The intonation contours of the selected sub-corpus were stylized and annotated as in previous analyses. Using this annotated version, top, mid and bottom lines for each of the phonic groups found in these sentences were calculated by applying the same method described in section 5.2.2. Initial and final F0 values for each line were accordingly obtained by means of this procedure. The obtained values were used to draw hypothetical top, mid and bottom lines as the ones presented in figure 6.1 for each of the sentences of the sub-corpus.
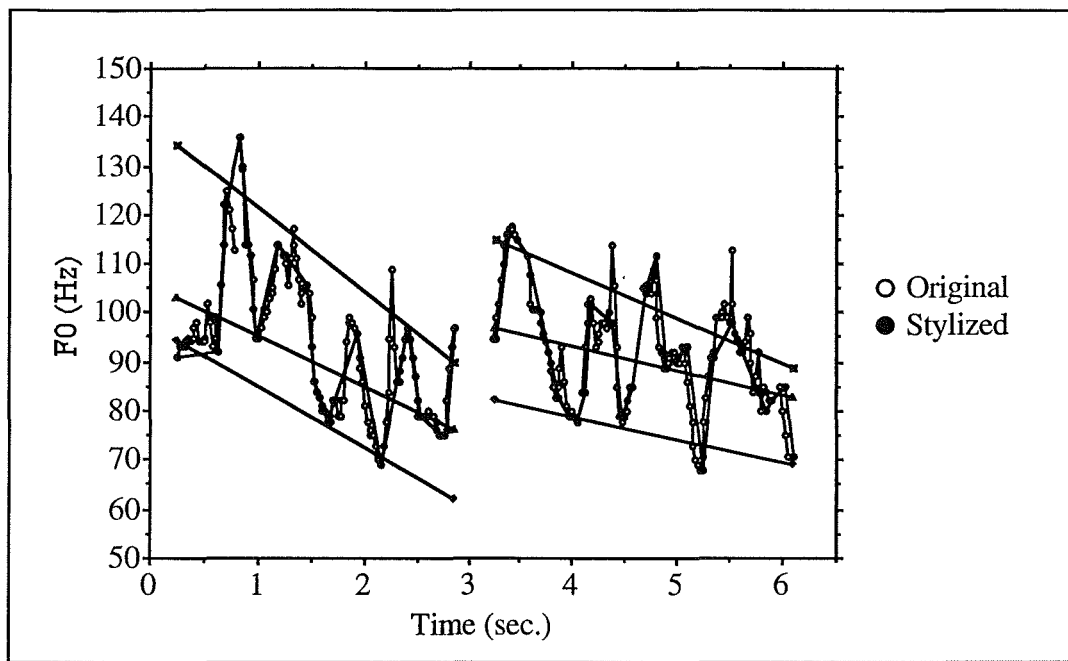
Figure 6.1. Original and stylized contours of the sentence '*La organización terrorista ha protagonizado en lo que va de año una escalada de atentados en los que han perdido la vida quince personas*', uttered by speaker AR. Calculated top, mid and bottom lines of the two phonic groups of the sentence have been superimposed to the contours.

The corresponding graphic representations including the top, mid and bottom lines for each sentence can be found in appendix 7 (section 5). They have been used as the basic material for the analyses presented in the following sections.

6.3. Definition of the framework

The descriptive framework presented here is based on the 'supra-declination' approach, already introduced in chapter 1. It can be considered an extension of the 'topline-bottomline' approach used for the description of phonic group patterns in the previous chapter.

The results of several studies (Thorsen, 1980, 1985, 1986; Ladd, 1988, among others) have shown that the organization of the intonation groups along utterance seems to be controlled by some kind of effect. Thorsen's and Ladd's works indicate that the mean F0 height of the different sentences of a paragraph tends to decrease with time: initial sentences tend to have a higher F0 level than internal sentences, and internal sentences tend to show a higher F0 level than final sentences. This effect has been called **'supra-declination'** to indicate the relationship with the declination phenomena previously reported for intonation groups.

The presence of 'supra-declination' phenomena has also been reported for Spanish in Garrido *et al.* (1993), for sentences contained in different positions of a paragraph. Figure 6.2. illustrates the results of this study.
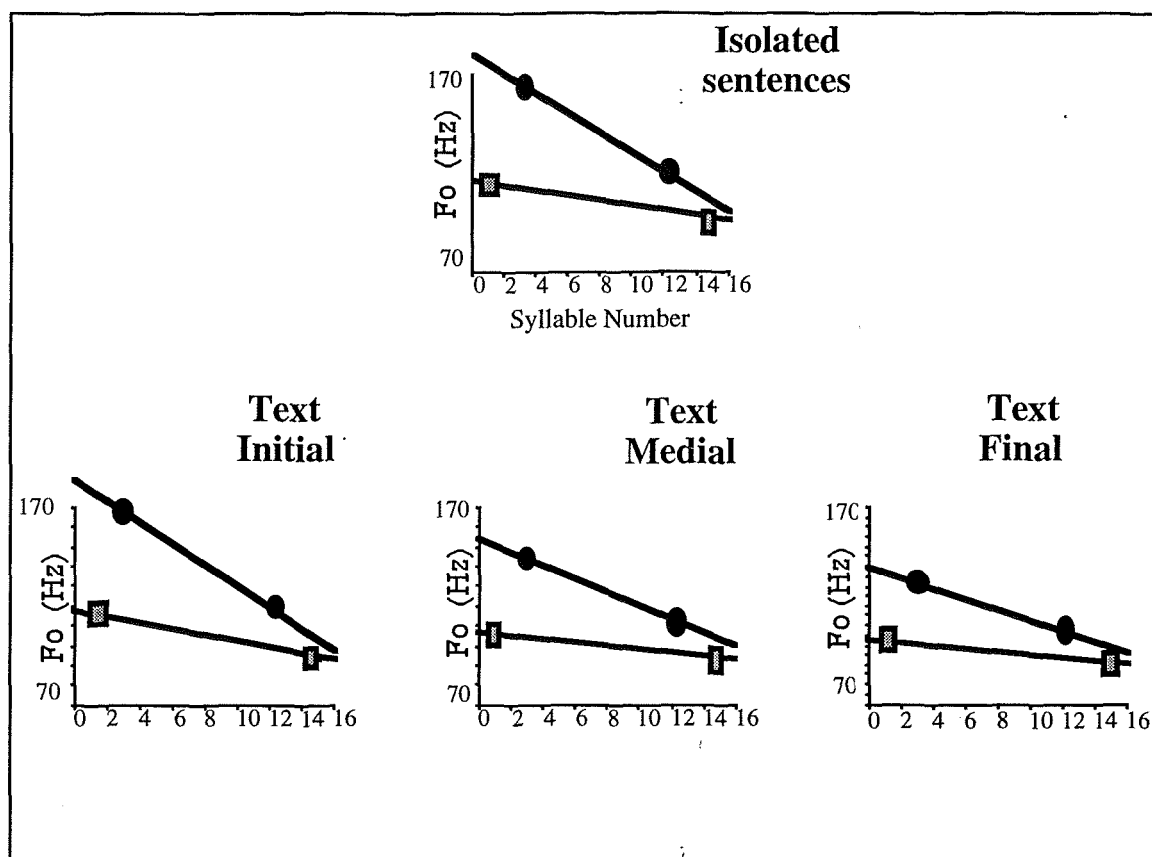
Figure 6.2. Mean top and bottom lines for isolated sentences (top), and for sentences in initial, medial and final position of a paragraph (bottom), obtained from the speech material analysed in Garrido *et al.* (1993).

The results obtained in the previous chapter (section 5.4.2) seem to suggest that these phenomena can also be found at levels lower than the paragraph, such as the sentence. For this reason, the 'supra-declination' approach is applied to describe the intonational phenomena occurring in the analysed sentence sub-corpus.

The hypothesis proposed in this work is that these phenomena can be modelled by means of top, mid and bottom lines, similar to the ones used in the case of phonic groups. These lines are called here **'supra-lines'**. According to this hypothesis, a first set of top, mid and bottom 'supra-lines' determine the height of the initial values of the three lines of each phonic group along a sentence, as represented in figure 6.3. They are called **high 'supra-lines'**.
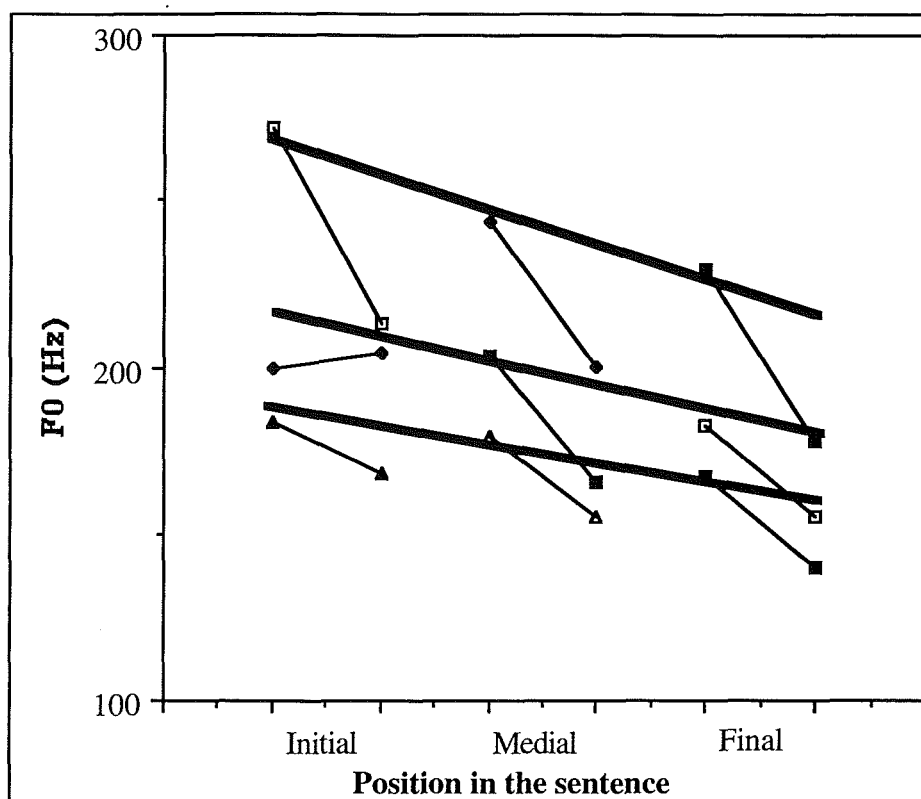
Figure 6.3. Representation of the top, mid and bottom 'supra-lines' approaching the initial values of the top, mid and bottom lines presented in figure 5.6 for declarative phonic groups of speaker ME.

Similar 'supra-lines' define the height of the final points of the lines along a sentence, as indicated in figure 6.4. They are called here **low 'supra-lines'**.
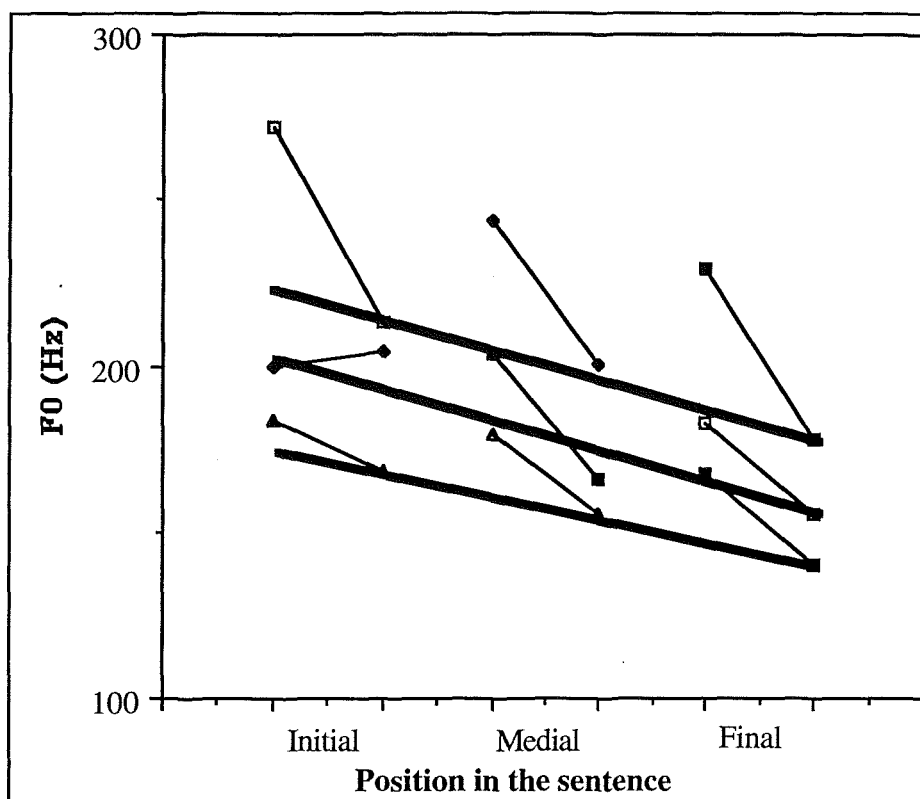
Figure 6.4. Representation of the top, mid and bottom 'supra-lines' approaching the final values of the top, mid and bottom lines presented in figure 5.6 for declarative phonic groups of speaker ME.

Six different 'supra-lines' should be then necessary to determine the relative height of a phonic group in a sentence: three high 'supra-lines' for the initial values, and three low 'supra-lines' for the final values.

The shape of these 'supra-lines' has been investigated in more detail in the sentence sub-corpus. The results are presented in the following sections.

6.4. Applying the 'supra-lines' approach to sentences

6.4.1. Procedure

Using the data obtained in the corpus analysis described in section 6.2, global high and low 'supra-lines' were calculated for the sentences of the sub-corpus. Six different regression lines were computed:

1) a high supra-line for toplines, approaching the initial points of the toplines of all the phonic groups of the analysed sentences;
2) a high supra-line for midlines, approaching the initial points of the midlines;

3) a high supra-line for bottomlines, approaching the initial points of the bottomlines

4) a low supra-line for toplines, approaching the final points of the toplines of all the phonic groups of the analysed sentences;
5) a low supra-line for midlines, approaching the final points of the midlines;
6) a low supra-line for bottomlines, approaching the final points of the bottomlines;

The calculation procedure was the same as the one described in section 5.2.2 for phonic groups. By means of this calculation, the F0 value at the initial point and the slope of these high and low 'supra-lines' have been obtained, as well as a set of R values indicating the degree of fitness of the model to the considered data. The obtained results have been analysed separately for each speaker. The following sections present the results of this analysis.

6.4.2. The shape of the high 'supra-lines' at the sentence level

Data about the F0 initial value, slope and R value for the calculated high 'supra-lines' of each speaker can be found in appendix 7 (section 4.1). Graphic representations of these high top, mid and bottom 'supra-lines' are presented separately for each speaker in figures 6.5 and 6.6.
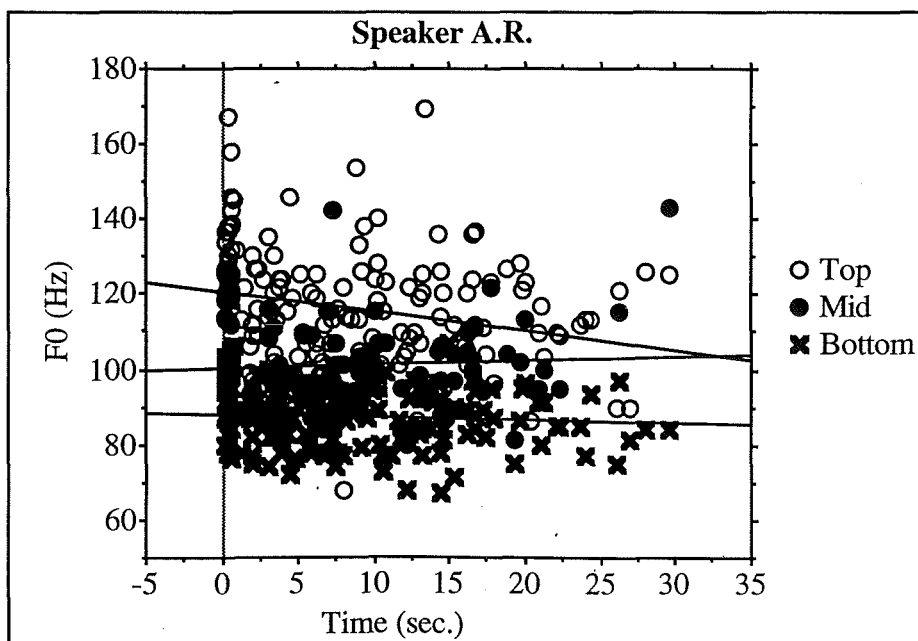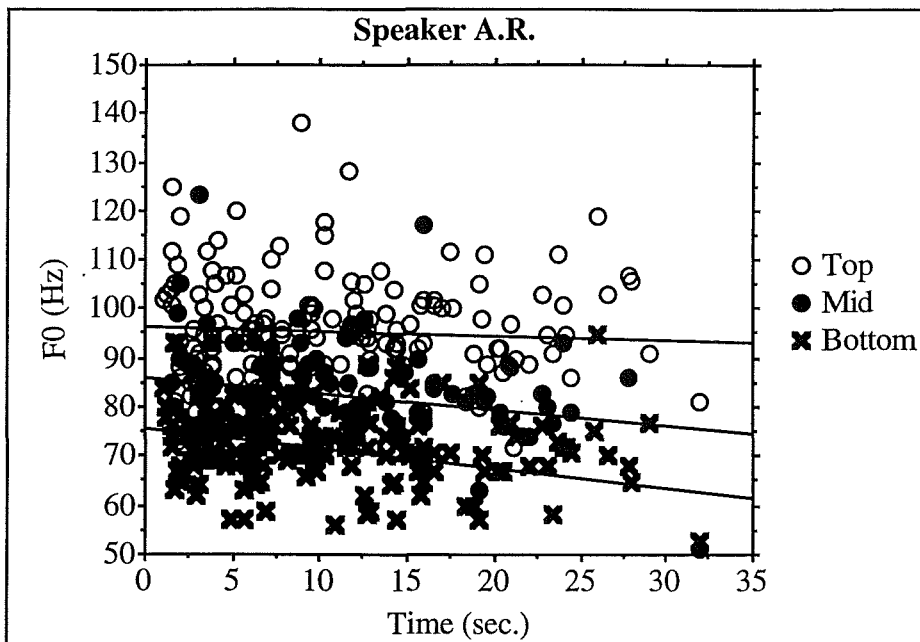

Figure 6.5. High 'supra-lines' obtained for the sentences of speaker A.R.
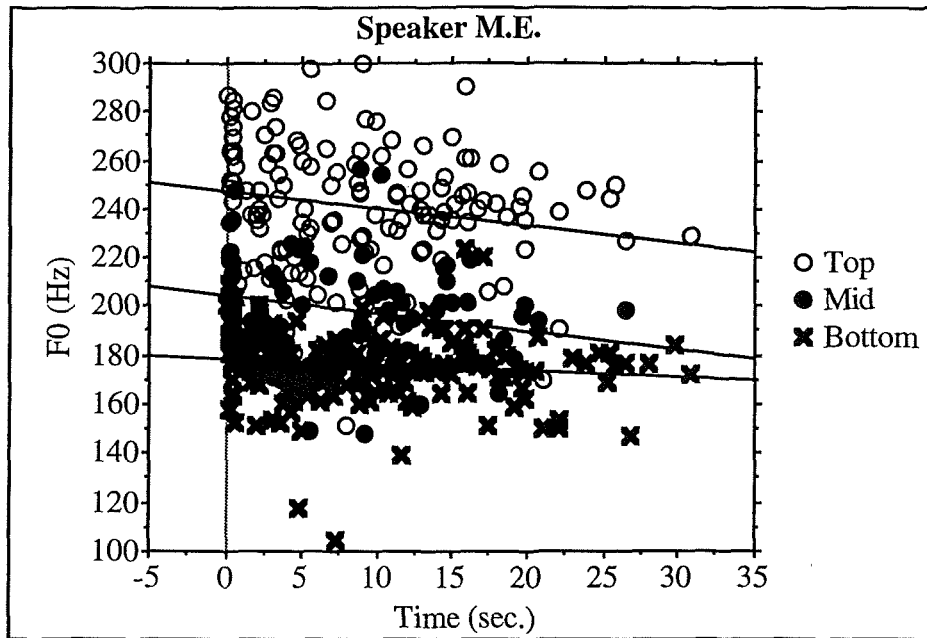
Figure 6.6. High 'supra-lines' obtained for the sentences of speaker M.E.

The shape of these resulting lines is quite similar to those of the ones obtained for the phonic groups of each speaker, that is, they show a tendency to fall along the sentence, steeper in the case of the top lines, and less steep in the case of the bottom lines, and a tendency to converge towards the end of the sentence.

The analysis of the table corresponding to the R values included in appendix 7 (section 4.1.3) shows that the p values corresponding to toplines are below the significance threshold (p=0.05) both for speaker A.R. (p=0.002) and for speaker M.E. (p=0.039). However, p values corresponding to mid and bottom lines are under the significance threshold in both speakers. These results seem to indicate that the model of 'supra-lines' does not fit very well the analysed data when it is applied directly to the sentence as a whole, although some regularity does seem to be present.

6.4.3. The shape of the low 'supra-lines' at the sentence level

Data about the F0 initial value, slope and R value for the calculated low 'supra-lines' of each speaker can be found in appendix 7 (section 4.2). Figures 6.7 and 6.8 present graphic representations of the obtained low 'supra-lines' separately for each speaker.

Figure 6.7. Low 'supra-lines' obtained for the sentences of speaker A.R.
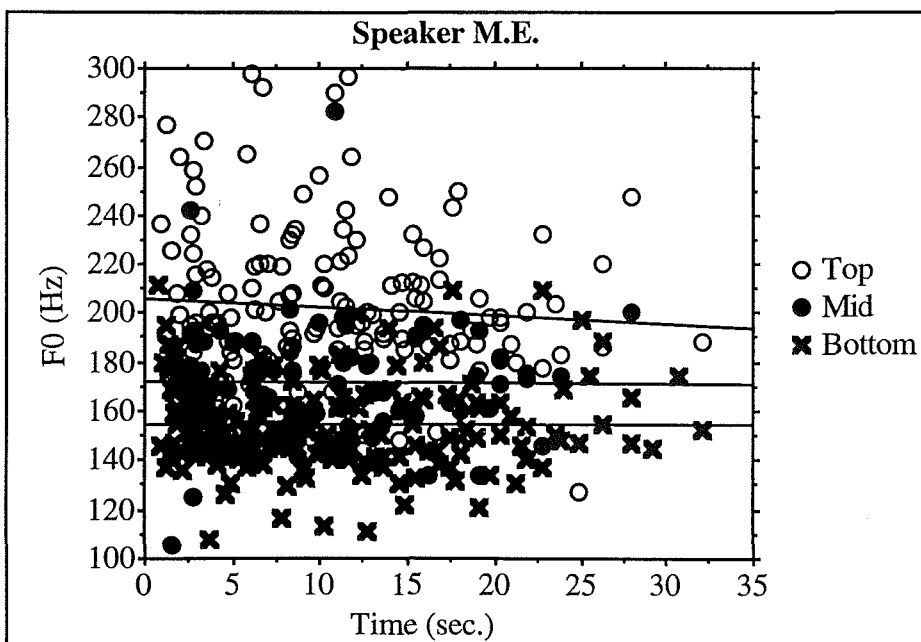
Figure 6.8. Low 'supra-lines' obtained for the sentences of speaker M.E.

The obtained low 'supra-lines' also show a general tendency to fall, but less evident than in the case of the high 'supra-lines'. Midlines show different tendencies depending on the speaker.

The analysis of the R correlation values presented in appendix 7 (section 4.2.3) shows that the degree of fitness of the calculated lines to the data is significant only in the case of the final points of the bottomlines of speaker A.R. (p=0.033). In the rest of cases, the obtained p values are always greater than the significance threshold (p=0.05). These results can be

interpreted as an indication that the description of the intonational shape of the sentences analysed here can not be properly carried out with a single 'supra-lines' model.

6.4.4. Summary

The analysis of the shape of these 'supra-lines' along sentences seems to indicate that, although a general tendency to fall is found for sentences, the patterns included in a sentence can be more complicated that a single declination line. Other factors seem to be also involved in the definition of the global intonational shape of the analysed sentences. This possibility is explored in the next section.

6.5. Defining intonation patterns and units within sentences

This section explores the possibility of defining new intermediate intonation units between the intonation group and the sentence, as a possible explanation for the inaccuracy of the 'supra-lines' model to the description of sentence intonation in the analysed material.

First, the reset phenomenon is analysed in the sentence sub-corpus (section 6.5.1), and the presence of two different types of reset is suggested (section 6.5.2). In section 6.5.3, these two types of reset are used as an argument to propose the existence of intonation units covering several phonic group. These intonation units seem to have their own 'supra-lines' pattern, as argued in section 6.5.4. Finally, the question of the existence of a global pattern for sentences is reviewed in section 6.5.5, in the light of the proposed hypothesis.

6.5.1. F0 reset

F0 reset has been previously reported by Sorensen & Cooper (1977, 1980) for American English, or Collier (1985, 1987) for Dutch, among many others. The concept of reset is closely related to the declination hypothesis. According to this hypothesis, declination lines finish at some specific F0 level in a utterance, and they restart higher than the end of the preceding declination line. Resets indicate then the start of a new declination line.

An analysis has been performed in order to establish the number of phonic groups in which a topline or bottomline reset is present in the sentence sub-corpus material. For the detection of resets, the final and initial values of the calculated top and bottom lines in consecutive phonic groups have been compared. These points are indicated in figure 6.9 as E1 ('end of the top

line of the first group'), B2 ('beginning of the top line of the second group'), E1' ('end of the bottom line of the first group') and B2' ('beginning of the bottom line of the second group').
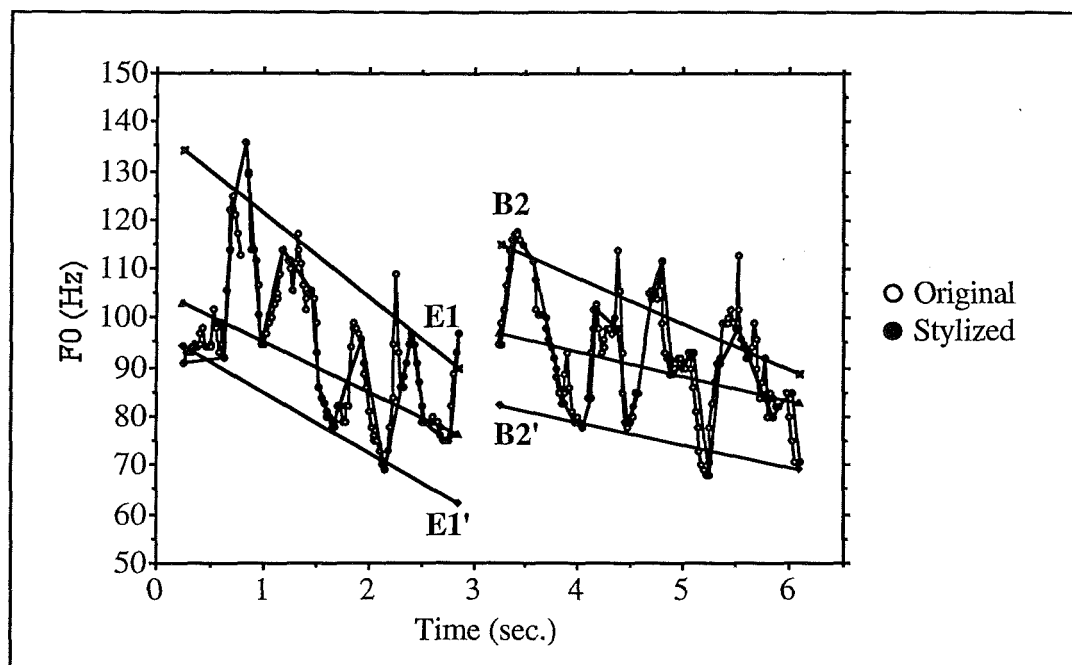

Figure 6.9. Location of the E1, E1', B2 and B2' points in the top and bottom lines of the sentence presented in figure 6.1.

The difference B2-E1 and B2'-B1' (illustrated in figure 6.10) was calculated for each pair of consecutive phonic groups, and the obtained values were recorded and analysed.
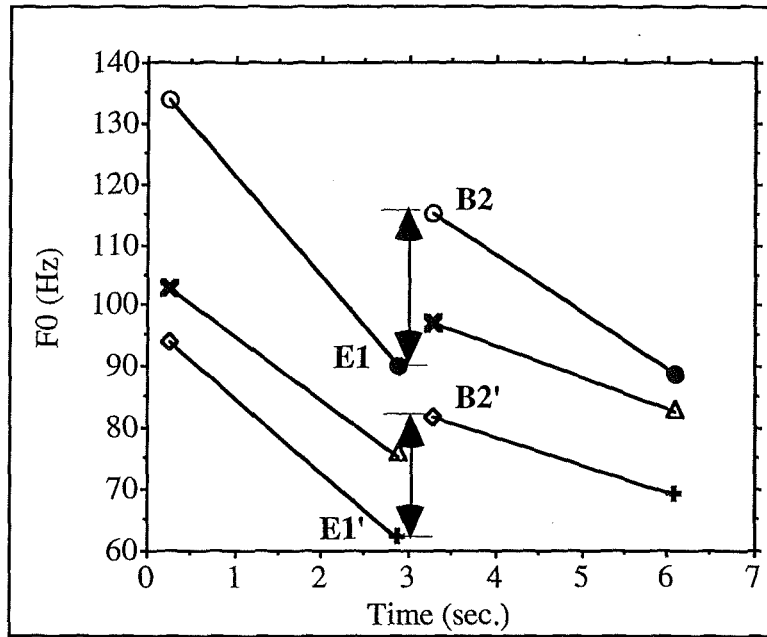
Figure 6.10. Representation of the differences B2-E1 and B2'-E1' in the sentence presented in figure 6.10.

The histograms included in figures 6.11 and 6.12 show the distribution of the obtained values for B2-E1 and B2'-E1' respectively.
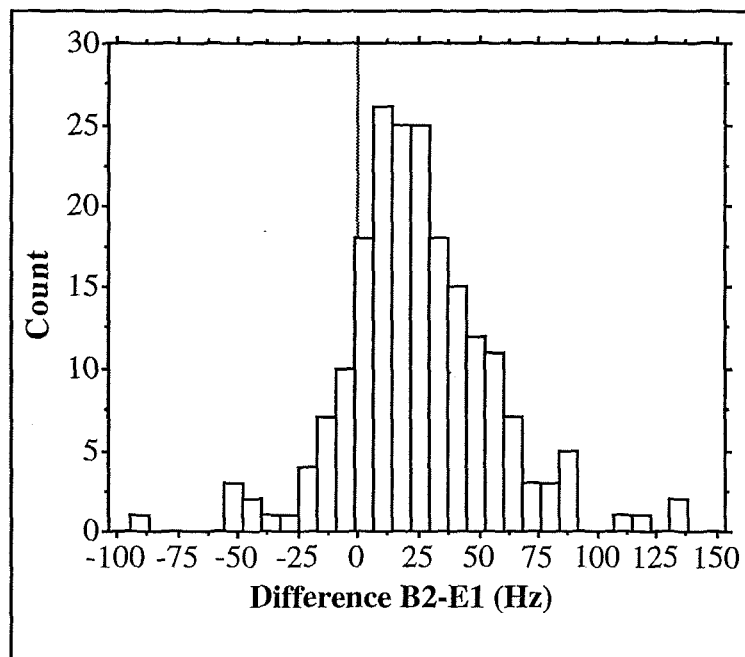
Figure 6.11. Distribution of the difference between F0 values of B2 and E1 points in the analysed sub-corpus.
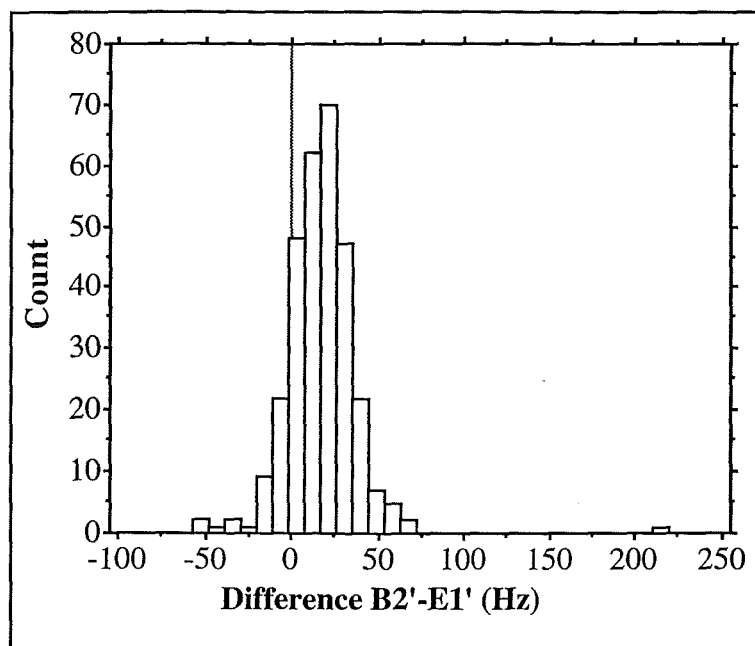
Figure 6.12. Distribution of the difference between F0 values of B2' and E1' points in the analysed sub-corpus.

In the case of toplines, when the F0 value at E1 was lower than the initial F0 value at B2, a reset was found. The same procedure was applied for the detection of 'bottomline resets': when E1' was found to be lower than B2', a reset was detected. According to this criterion, the data corresponding to boundaries showing a reset are found in both figures to the right of the 0 reference line. These histograms show that a reset was found in a high number of phonic group boundaries, both for top (77.5% of the analysed phonic groups) and bottom lines (79.78% of the cases).

The reset phenomenon can also be analysed in terms of **'amount of reset'**. The amount of reset can be defined as the difference between the F0 value at the beginning of a declination line and the F0 value at end of the following declination line. It can be then identified with the results obtained for the differences B2-E1 and B2' and E1' in the previous analysis. Analysing the results of the histograms presented in figures 6.12 and 6.13 in terms of amount of reset, it can be observed that this amount seems to be higher in the top line than in the bottom line: 24.46 Hz in average for the top line, and only 16.91 Hz for the bottom line.

The results obtained here indicate that reset is a phenomenon which takes place in a large number of the phonic groups boundaries of the analysed material. The obtained data also shows that reset occurs both in top and bottom lines, and that it is usually larger in top than in bottom lines.

According to these results, a clear relationship between resets and pauses can be established. This relationship can be interpreted as an evidence of the

status of resets as phonetic cues indicating the beginning of a new intonation unit, in addition to other traditional cues, as pauses, energy lowering, glottalization, or boundary tones.

6.5.2. 'Total' and 'partial' reset

Reset can show different 'levels', depending on its amount. Following this idea, Sorensen & Cooper (1977, 1980) defined two types of resets: 'total' and 'partial'. According to Sorensen & Cooper's hypothesis, the presence of 'total' (or 'complete') reset is detected when the beginning of a top (B2) or bottom line (B2') is at the same level of the beginning of the preceding one (B1, B1'), as can be observed in figure 6.13.
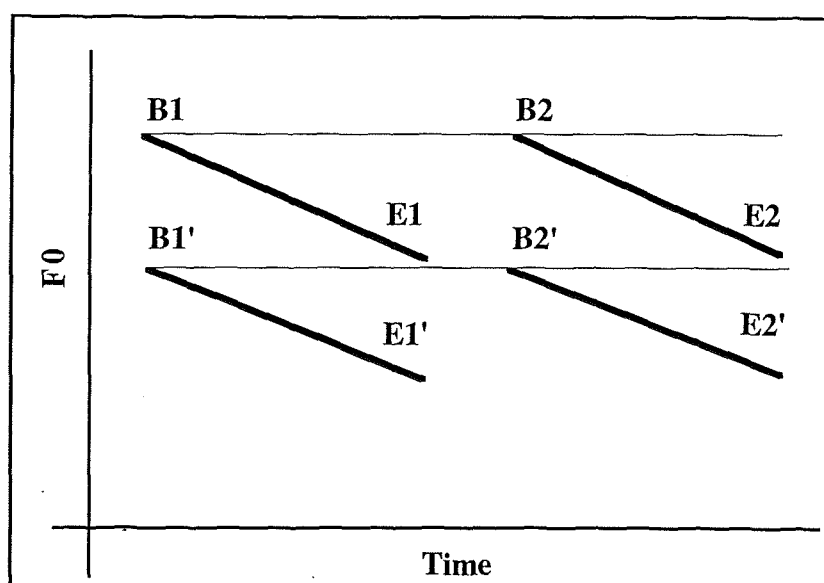
Figure 6.13. A representation of the top and bottom lines of two intonation groups showing total reset, according to the definition given by Sorensen & Cooper (1977, 1980).

A 'partial' reset appears when B2 or B2' are lower than B1 or B1' respectively. Figure 6.14 illustrates this case.
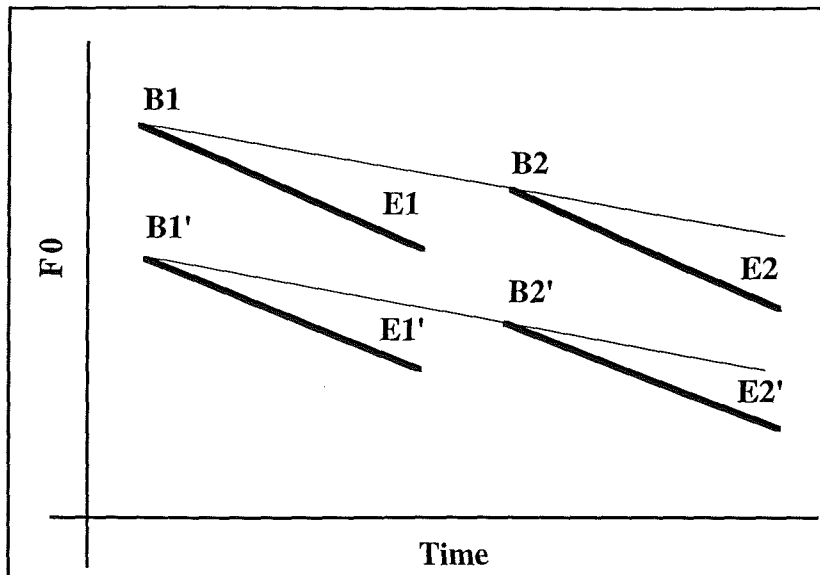
Figure 6.14. A representation of the top and bottom lines of two intonation groups showing partial reset, according to the definition given by Sorensen & Cooper (1977, 1980).

The analysis of the contours corresponding to the sub-corpus of sentences shows that there are cases where B2 or B2' are not at the same but even at a higher level than B1 or B1' ('total' reset), and cases where B2 or B2' are lower than B1 or B1' ('partial' reset). Figures 6.15 and 6.16 present examples of both types taken from the analysed sub-corpus. As in the rest of examples of this chapter, the original and the stylized contours have not been included, and only top, mid and bottom lines are plotted.

a) 'Total' reset
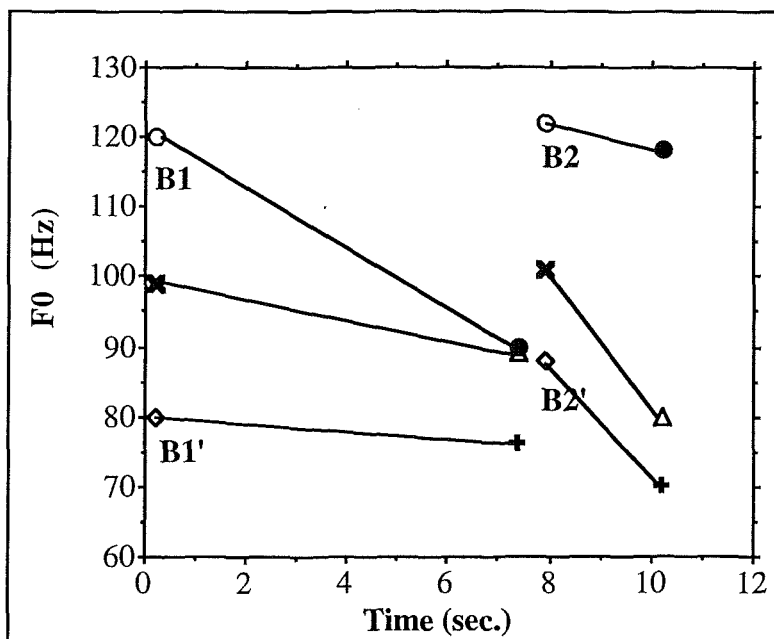
Figure 6.15. Top, mid and bottom lines of the phonic groups of sentence 9 ('News' set) ,
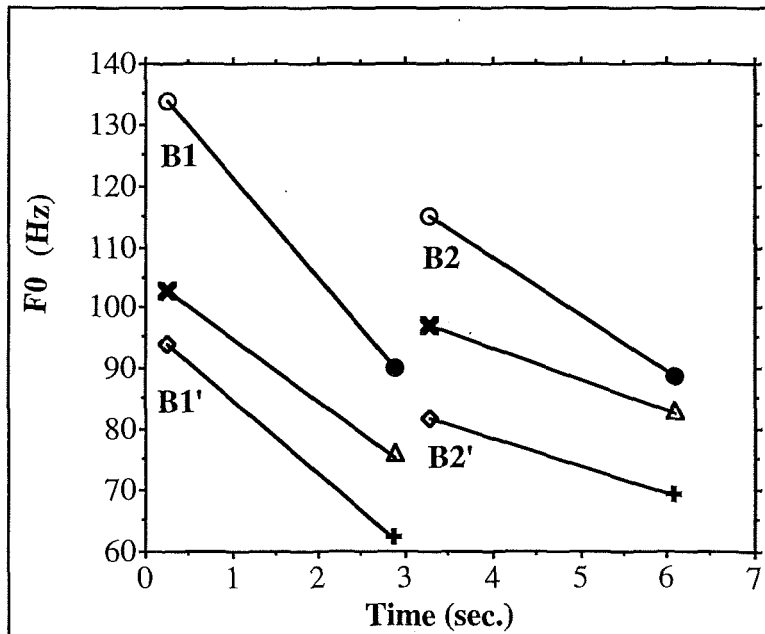uttered by speaker A.R.

b) 'Partial' reset

Figure 6.16. Top, mid and bottom lines of the phonic groups of sentence 10 ('News' set),
uttered by speaker A.R.

In the next section, an explanation for the use of these two types of reset is
proposed.

6.5.2. The 'intonational clause' hypothesis

Using the notions of total and partial reset, the existence of 'supra-declination' patterns covering only some of the phonic groups of a sentence can be explained. A series of phonic groups showing a partial reset can be seen as members of the same 'supra-declination' unit. Conversely, when a total reset is found, the beginning of a new global unit can be considered to exist. **It can be hypothesized then that the presence of a total reset is the phonetic cue to detect the presence of a new intonational unit, called here 'intonational clause'.** According to this hypothesis, this 'intonational clause' includes all the phonic groups following this total reset which show only a 'partial' reset.

Consider the intonation contour presented in figure 6.17, corresponding to a complete (and complex) sentence of the sub-corpus. The vertical lines show the places in the sentence where a total reset seems to appear, that is, those phonic group boundaries where both top and bottom lines initial points are higher than the previous initial points. According to the hypothesis suggested here, these vertical lines indicate then the limits of the 'intonational clauses' forming the sentence. The sentence presented in figure 6.17 is then built by three different 'intonational clauses', the first one including two phonic groups, the second one including three phonic groups and the third one including three phonic groups.
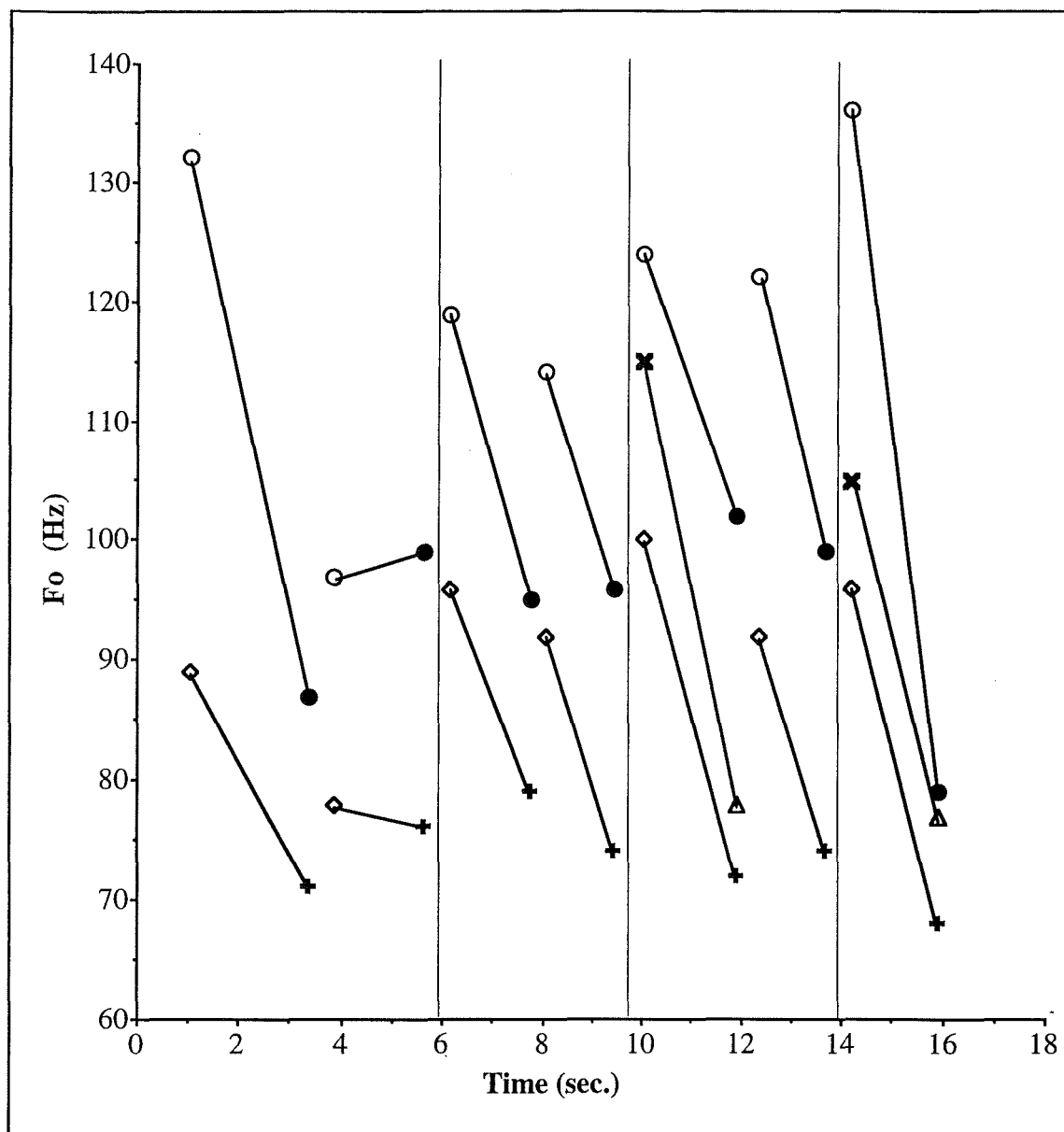
Figure 6.17. Top, mid and bottom lines of the phonic groups of sentence 103
('Commentaries' set), uttered by speaker A.R.

More examples of sentences segmented into 'intonational clauses' can be found in the analysis of the sentence sub-corpus included in appendix 7 (section 5).

Each one of the defined intonation units seems to show its own global pattern, that can be represented by means of top and bottom lines covering the different phonic groups from one total reset to the following one. Figure 6.18 presents the theoretical high 'supra-lines' corresponding to the top and bottom lines of the sentence. For the shake of simplicity, low 'supra-lines' are not considered, as well as in the rest of this chapter.
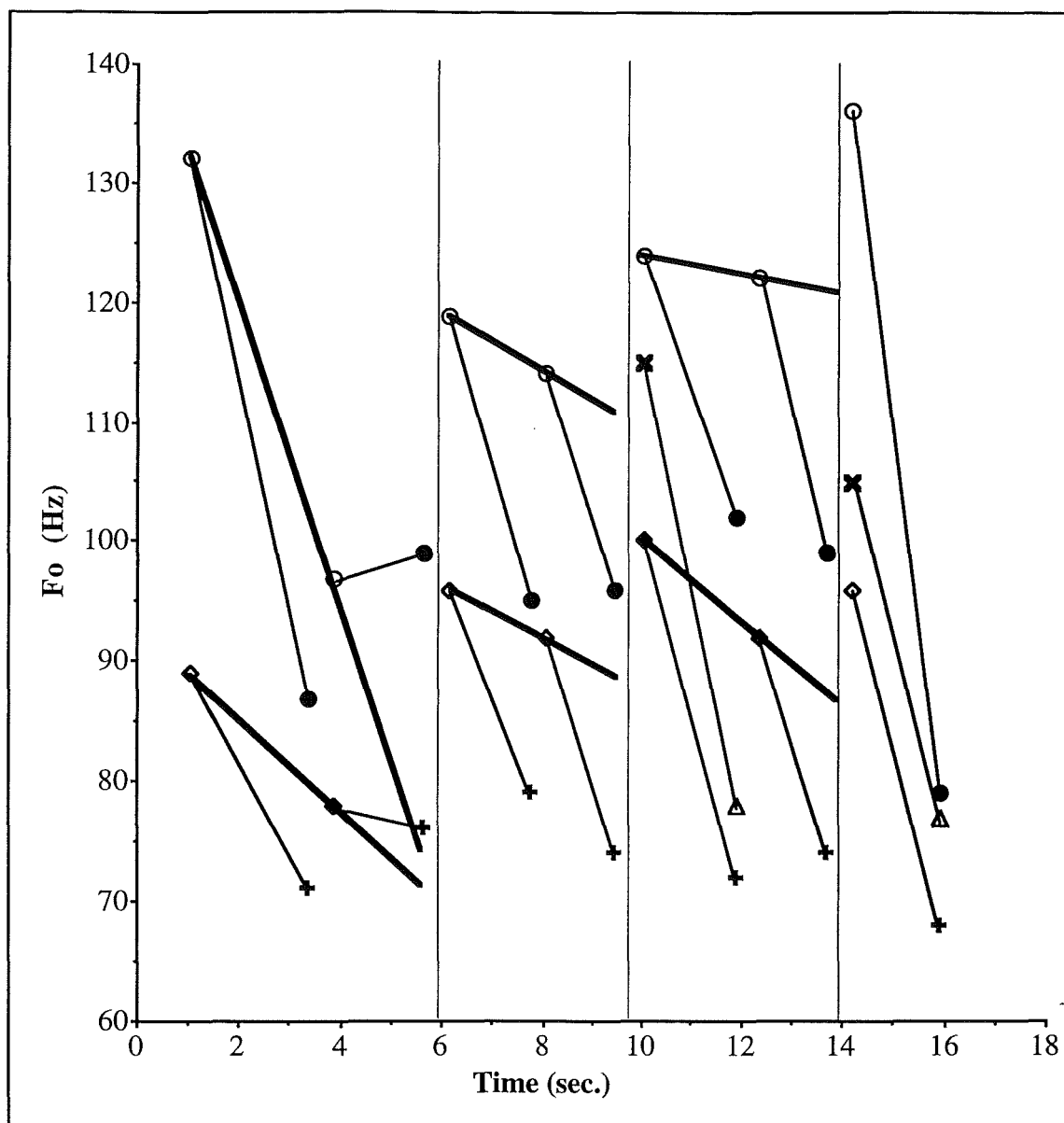
Figure 6.18. Top, mid and bottom lines of the phonic groups of sentence 103 ('Commentaries' set), uttered by speaker A.R. Bold lines represent the hypothesized top and bottom 'supra lines' for the different 'intonational clauses' of the sentence.

It has to be noted that the 'supra-lines' included in figure 6.18 (represented by thicker lines) have not been obtained by regression analysis. They have drawn by hand, as in the case of the figures presented in appendix 7 (section 5).

The grouping of intonation groups has previously been proposed in general phonological studies, such as Ladd (1986) and Nespor & Vogel (1986). Both Ladd's and Nespor & Vogel's proposals consider that intonation groups can be grouped into larger intonation groups. In addition, Nespor & Vogel (1986) propose that intonation groups are included within 'phonological units' (see section 1.1.3.2 for a review of these proposals). The results obtained here can be interpreted as a phonetic evidence

supporting these hypotheses. As far as Spanish is concerned, the 'tension' and 'distension' parts suggested by Navarro (1944) are the only reported example of intonation unit with a scope larger than the phonic group and narrower than the sentence.

6.5.3. Grouping 'intonational clauses': hierarchical structuring of the intonational units within sentences

The example presented in figure 6.19 suggests that in some cases these 'intonational clauses' appear to be grouped into larger units, forming a prosodic hierarchy of different-level units.
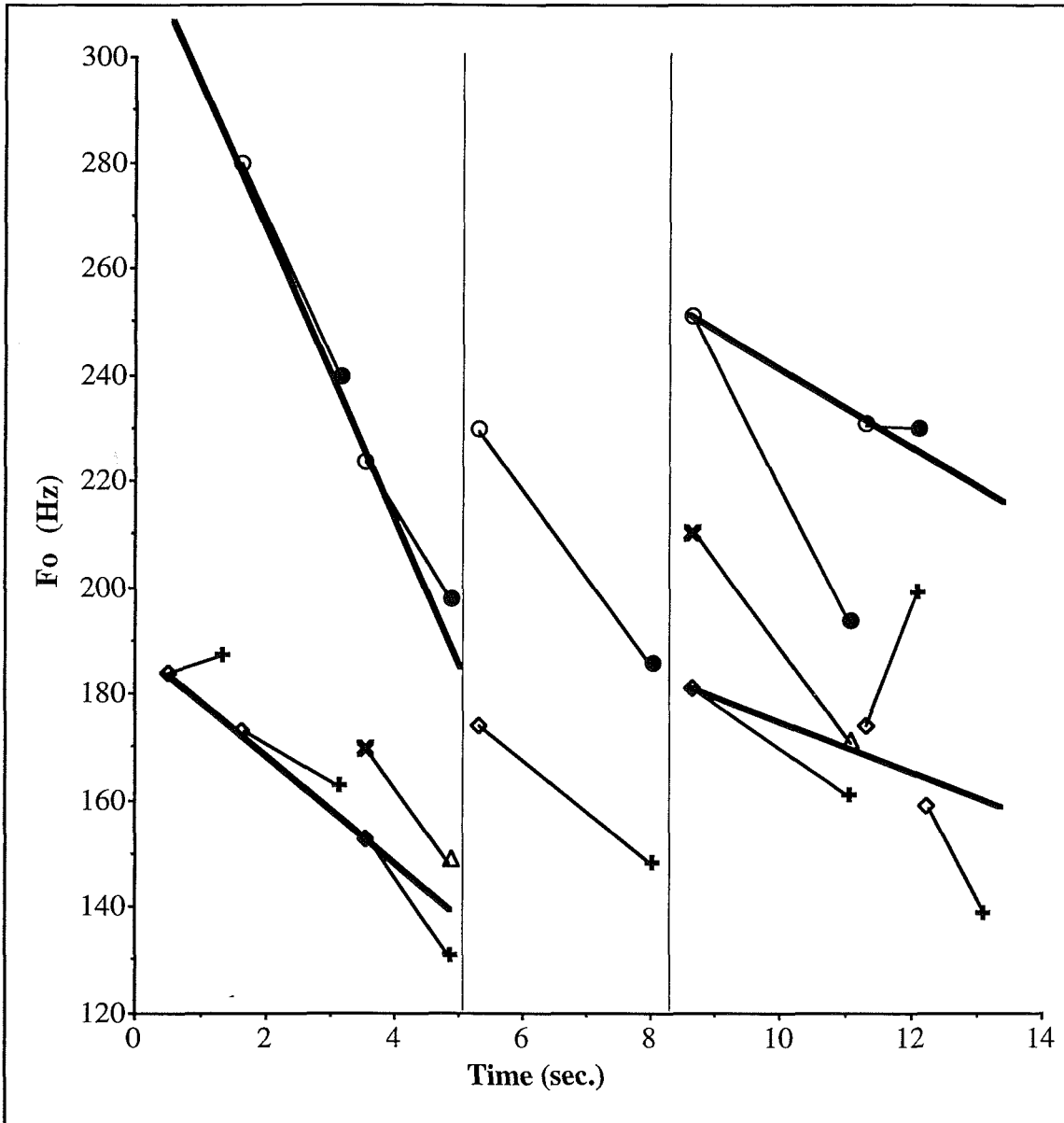
Figure 6.19. Top, mid and bottom lines of the phonic groups of sentence 106 ('Commentaries' set), uttered by speaker M.E. Bold lines represent top and bottom 'supra lines' for the different 'intonational clauses' of the sentence.

The first vertical line indicates the presence of a 'total reset', that is, an 'intonational clause' boundary. This reset places the beginning of the top and bottom lines of the third phonic group higher than the beginning of the top and bottom lines of the second one. The first and second phonic groups seem then to be grouped within the same 'intonational clause'. However, the beginning of the third phonic group is still below the initial level of the first one. For this reason, it can be hypothesized that this third phonic group and the previous 'intonational clause' are grouped in a higher-level intonation unit.

This unit also seems to show its own 'supra-lines' pattern, as illustrated in figure 6.20. Hypothetical 'supra-lines' have been drawn by hand for this intonation unit, thicker than the lines corresponding to the lower-level units.

The end of this new unit is phonetically marked by the presence of a second 'total' reset at the beginning of the fourth phonic group, which places the F0 initial level of this group higher than the initial levels of the second and third ones. The double vertical lines included in figure 6.20 indicate the hypothetical boundary of this new 'supra-unit'.
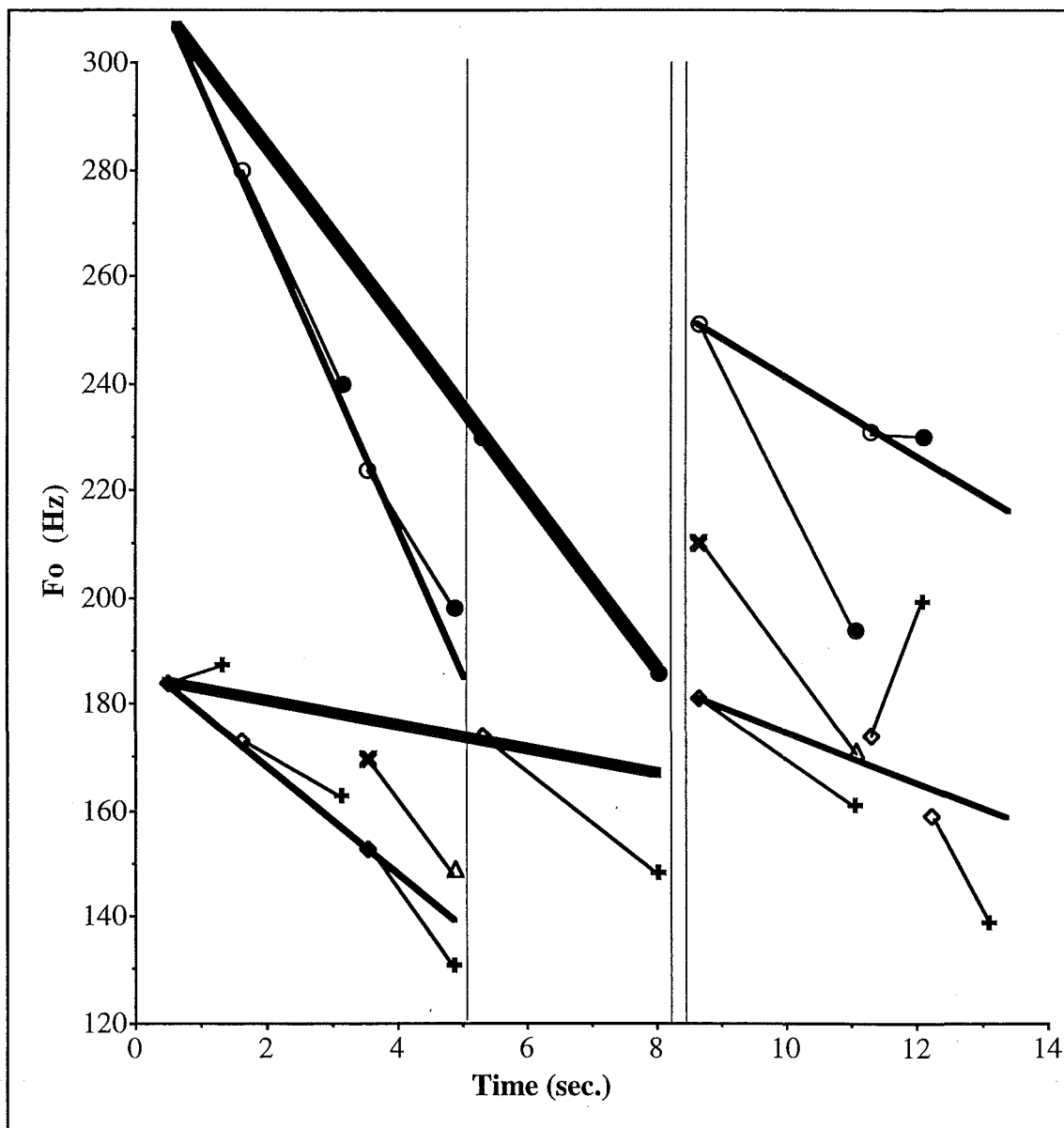

Figure 6.20. Top, mid and bottom lines of the phonic groups of sentence 106 ('Commentaries' set), uttered by speaker M.E. Bold lines represent top and bottom 'supra lines' for the different 'intonational clauses' of the sentence; thicker lines represent 'supra-lines' for the higher-level units; double lines indicate the boundary of this unit.

More examples of this 'intonational clause' grouping can be found in the analysis of the sentence sub-corpus included in appendix 7 (section 5).

6.5.4. Sentences as global intonational units

The 'intonational clause' hypothesis can be used to explain the problems reported in section 6.4 to assign a single 'supra-line' pattern to the analysed sentences. According to this hypothesis, sentences are organized into one or several layers of 'intonational clauses', each one including one or several phonic groups. Expanding this hypothesis, it can be hypothesized that the sentence represents the highest-level layer in this hierarchy of intonational units. In other words, that a single 'supra-line' pattern grouping the different 'intonational clauses' of the sentence can always be identified. This question is considered briefly in this section.

The ideas presented in the following paragraphs are the results of a visual inspection of the representations of the intonational structure of sentences which are included in appendix 7 (section 5). These tendencies have not been analysed in a systematic or experimental way in this work; they are outlined here for further investigation.

The results of this visual analysis suggest that sentences do not always show a single 'supra-line' pattern. This kind of pattern has been identified in 29 out of 66 analysed cases. Figure 6.21 presents an example of these sentences. In this example, the sentence seems to be organized in two main 'supra-units'. The double vertical line represents the boundary between these two parts, indicated by the presence of a 'total' reset. The thickest 'supra-lines' represent the global top and bottom high 'supra-lines' grouping the two main parts of the sentence.
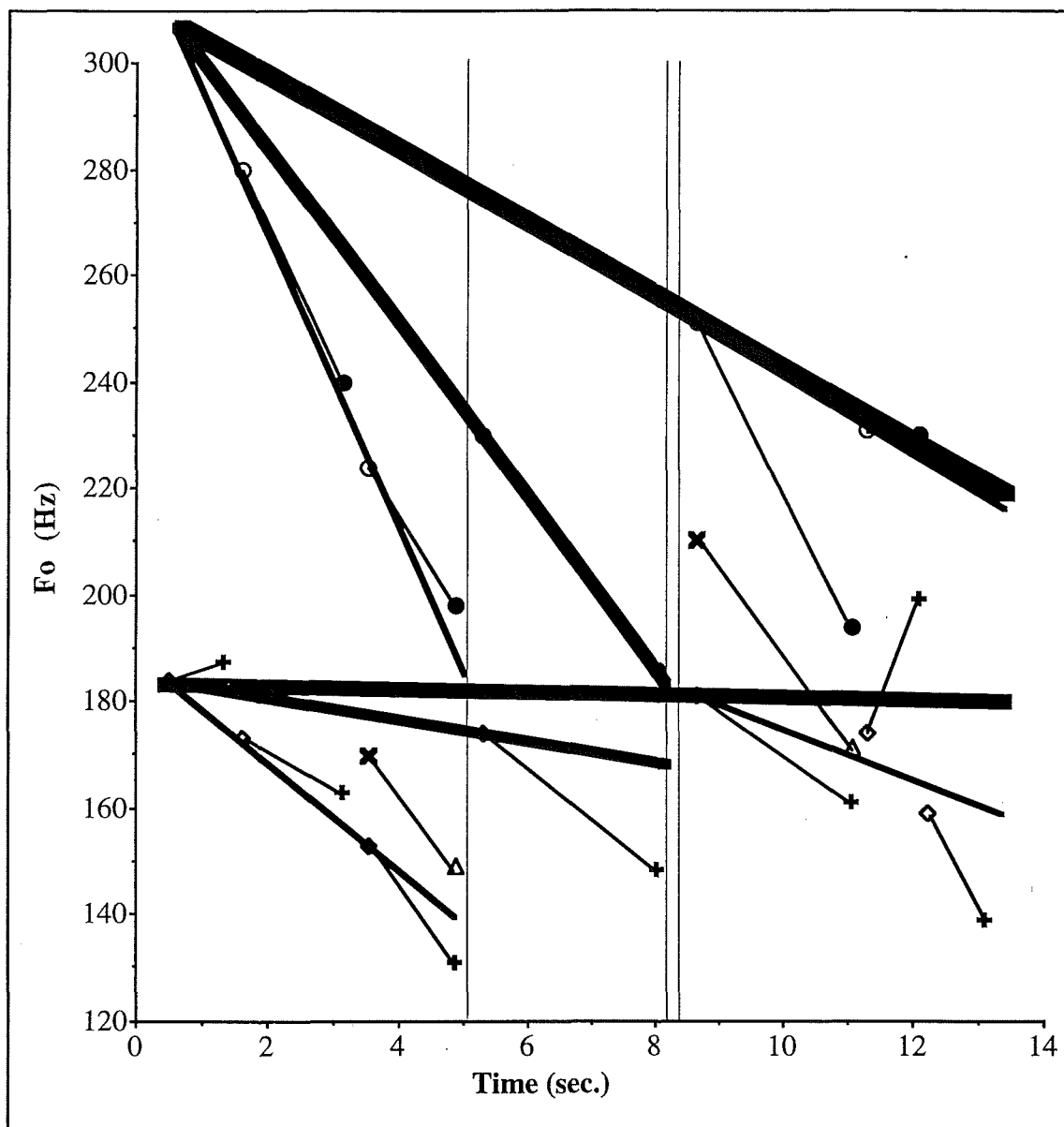
Figure 6.21. Top, mid and bottom lines of the phonic groups of sentence 106 ('Commentaries' set), uttered by speaker M.E. The thickest lines represent the theoretical top and bottom 'supra-lines' covering the whole sentence.

Other examples of sentences in which this type of global pattern has been hypothesized are sentence 10 (speaker AR), sentence 65 (speaker ME) and sentence 99 (speaker AR), in the 'News' set, and sentence 20 (speaker AR), sentence 100 (speaker ME) and sentence 116 (speaker ME), in the 'Commentaries' set. A graphic representation of their 'supra-lines' structure can be found in appendix 7 (section 5).

However, there are also cases in the sub-corpus where this global pattern does not seem to be present. In the example presented in figure 6.22, the sentence seems also to be organized in two macro-units. The boundary between these two parts is indicated in the figure by a double vertical line. However, it seems difficult to hypothesize here a single 'supra-line' pattern

covering the whole sentence, since the initial points of the second part 'supra-lines' are clearly higher than the initial points of the first part 'supra-lines'. The highest F0 value in the sentence appears then at the beginning of the second part, indicating the presence of a 'total reset' and, accordingly, the beginning of a new group of 'intonational clauses'.
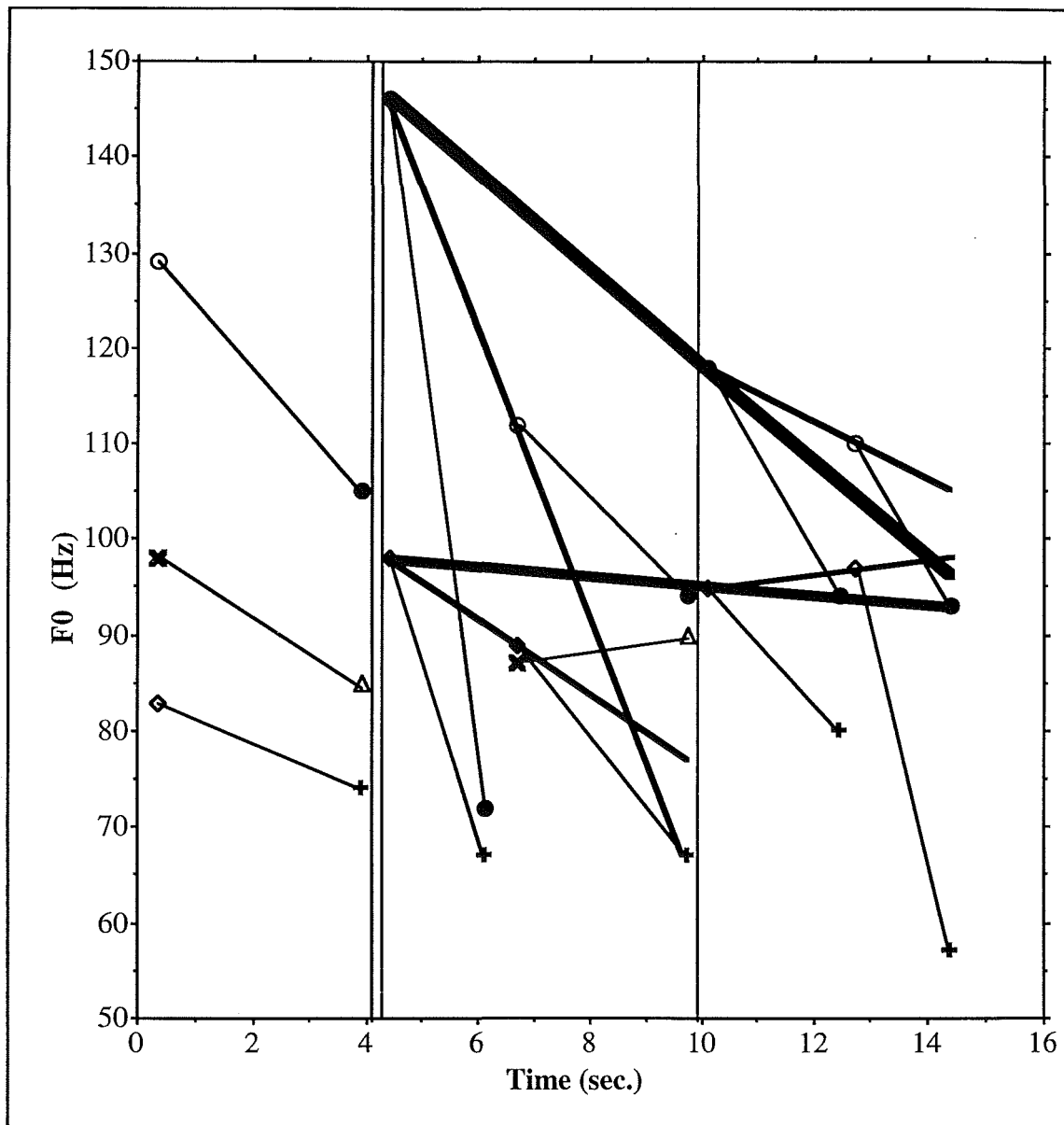

Figure 6.22. Top, mid and bottom lines of the phonic groups of sentence 24 ('News' set), uttered by speaker A.R. Thick lines indicate the different-level 'supra-line' patterns hypothesized for this sentence.

This type of structure has been found, according to the analysis carried out here, in up to 10 of the sub-corpus sentences. Some of these cases are sentence 22 (speaker ME), sentence 24 (speaker ME) and sentence 104 (speaker AR), within the 'News' set, and sentence 99 (speaker AR), within the 'Commentaries' set are other examples. See appendix 7 (section 5) for a graphic representation of their 'supra-lines' structure.

The examples presented in figures 6.21 and figure 6.22 also illustrate the tendency to organize sentences in two main parts observed in the subcorpus. Up to 37 analysed sentences clearly show this structure. Additional examples of this phenomenon, included in appendix 7 (section 5), are sentences 10 (speaker A.R.) and 24 (speaker M.E.), within the 'News' set, and sentences 55 (speaker M.E.) and 130 (speaker A.R.), within the 'Commentaries' set.

However, there are also cases in which this binary structure is not present. Short sentences, for example, usually show a single unit (see for example the realizations of sentence 25 of the 'Commentaries' set, uttered by both speakers). There are also examples of sentences showing more than two parts. Figure 6.23 illustrates this case.
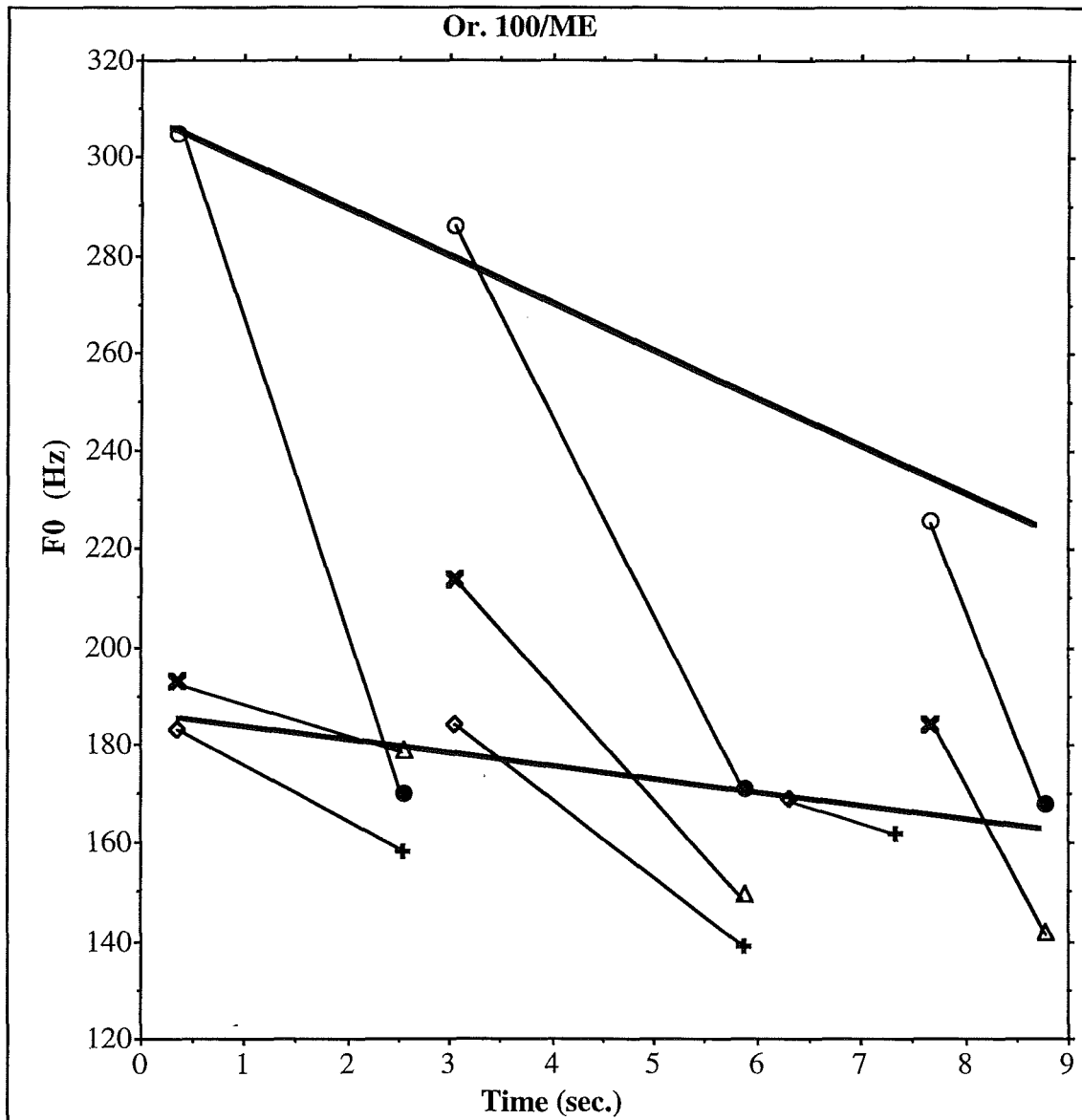
Figure 6.23. Top, mid and bottom lines of the phonic groups of sentence 100 ('Commentaries' set), uttered by speaker M.E. Thick lines indicate the hypothesized 'supra-line' patterns for the whole sentence.

Finally, there are also cases in the sub-corpus in which no clear structure can be observed, or it is more difficult to be determined. These problems are partially related to the fact that some of the top and bottom lines could not be calculated, since the corresponding phonic group did not have the necessary inflection points to carry out the regression calculation. Figure 6.23 also illustrates this fact: some of lines are missing in the third and the fourth phonic groups of the sentence, due to the lack of the necessary inflection points to calculate them.

Summarizing, the presented examples seem to indicate that the sentences of the analysed corpus can show a global 'supra-lines' pattern, but that they can also be organized in more than one 'macro-unit'. The analysis has also

revealed some tendency to organize sentences in two parts, although there are also cases in which it is not possible to identify this binary structure.

6.5.5. The representation of the hierarchical structure of intonational units

The intonational organization of the phonic groups within sentences hypothesized by this 'intonational clause' approach can be viewed as the phonetic realization of a hierarchical prosodic structure, with several layers of different-level units. Consider for example the case presented in figure 6.24.
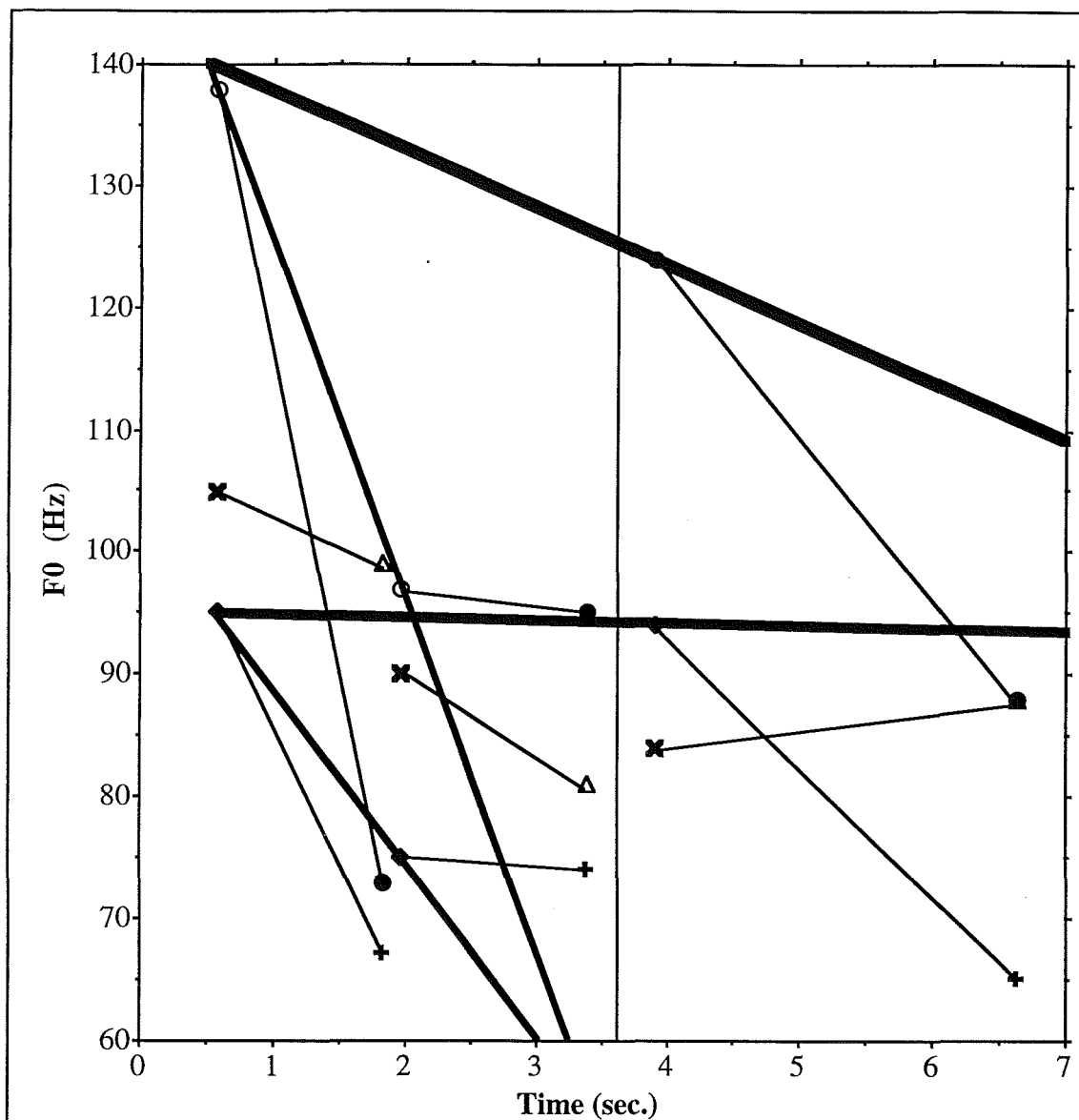
Figure 6.24. Top, mid and bottom lines of the three phonic groups of the sentence '¿*Qué*
garantías hay de que, / *además de aportar un nuevo estilo,* / *nuestros ministros no tuvieran*
que tragarse algún sapo envenenado?' (sentence 143, 'Commentaries' set), uttered by
speaker A.R. The vertical line indicates an 'intonational clause' boundary. Thick lines
represent the different-level 'supra-lines' hypothesized for the sentence. The width of these
lines indicates the level.

The intonational structure of this sentence can be described in terms of two
main units or 'intonational clauses', the first one being composed of two
lower-level units, phonic groups. This multi-layer structure can be
represented in a **prosodic tree** such as the one proposed in figure 6.25.