

Contour Patterns of Chinese Intonational Phrases

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Abstract

Intonational phrases with 2, 3, and 4 intermediate phrases constitute the majority of all Chinese IPs. The contour patterns of Chinese IPs indicate that the near-bottom D_{\min} value of the last intermediate phrase serves as the primary indicator of the statement intonation in Chinese, while the falling trend of the last part of the top-line can serve as a compensatory auxiliary indicator when the primary indicator is not typical.

Index Terms: contour patterns, Chinese intonational phrase, the AM approach

1. Introduction

The intonation of Chinese, a typical tone language, has long been an intriguing subject for prosodic study. Among others, the interaction between lexical tones and discourse intonation lies at the core of the question. To observe the actual resultant contour patterns of Chinese intonational phrases in connected speech, this paper makes a data-based survey of CCTV news in the Autosegmental-Metrical (AM) approach.

2. Research method

According to the AM approach, intonational features of tune and relative prominence are distributed in utterances in ways allowed by the prosodic structure. As the basic unit of intonational pitch contours, an intonational phrase (IP), which is often demarcated by boundary markers like pauses, anacrusis, boundary-final lengthening, pitch reset, etc., comprises one or more intermediate phrases (ip). An ip in turn consists of one or more pitch accents and ends with a phrase tone. At the end of the last ip of an IP, there is a boundary tone. [1, 3]

2.1. Materials

The research materials are twenty-two complete news stories selected from the recording of the half-hour CCTV news program *Xinwenlianbo* aired on Jan. 1, 2008. *Xinwenlianbo* remains China's most authoritative official news program and a live model of *Putonghua* (i.e., Standard Chinese).

2.2. Processing and annotation

The software Praat (ver. 5112) is used for the processing, annotation, and pitch data extraction of the target materials.

For the purpose of this research, five tiers are annotated for the selected news stories: PY (pinyin), PW (prosodic words), GS (grammatical structure), ip, and IP.

2.3. Data normalization

Given that the pitch register and pitch range of an IP vary a lot as its announcer or discourse location or function changes, in order to make the observation of the pitch contours of different IPs comparable, the 5-degree pitch scale is adopted for the normalization of the pitch data extracted from Praat in the unit of Hertz.

Here is the formula: [4]

$$D = 5 \times (F_0 - F_{0\min}) \div (F_{0\max} - F_{0\min}) \quad (1)$$

In the formula, F_0 refers to the target pitch value to be normalized from Hz to D, while $F_{0\max}$ and $F_{0\min}$ refer to the maximum and minimum pitch values of an IP respectively.

All the survey of intonational contour patterns in this paper is made on the basis of the 5-degree D values.

2.4. Representation of contour patterns

As mentioned before, Chinese is a typical tone language, whose pitch contours reflect the combination of lexical tones and intonational modification. For a clear and holistic description of the contour patterns of Chinese IPs, we follow the method of observing the respective movement trends of the top-line and bottom-line of the component intermediate phrases within an IP. [5]

Specifically, to describe the contour pattern of an IP, the maximum and minimum D values of each of its component intermediate phrase are first calculated based on extracted pitch values; the contour patterns, then, are represented by the series of R's (Rise) and F's (Fall) obtained by successively deducting the D_{\max} or D_{\min} value of a former intermediate phrase with that of the next one, where a positive result or zero is recorded as a R while a negative result a F. And the final representation of the contour pattern of each IP is put down as a serial code consisting of two hyphenated parts, each reflecting the overall pitch trend of the top-line and the bottom-line of the IP pitch contour. For instance, the contour pattern RF-FF indicates that the IP consists of three intermediate phrases, and that its top-line (i.e., the connected line between the D_{\max} values of each pair of neighboring intermediate phrases) first rises and then falls (RF); meanwhile, its bottom-line forms a consecutive falling trend (FF).

2.5. Results

2.5.1. General description

Among the twenty-two target news stories, there are altogether 156 intonational phrases, 452 intermediate phrase, 1,389 prosodic words and 3,164 syllables.

On average, each news story is made up of 7.1 intonational phrases; each intonational phrase comprises 2.9 intermediate phrases; each intermediate phrase contains 3.1 prosodic words; and each prosodic word consists of 2.3 syllables.

Intonational phrases are classified into 7 groups (as shown in Table 1) according to the number of intermediate phrases they contain. From Table 1, we can see that the intonational phrases with 2, 3, and 4 intermediate phrases constitute the overwhelming majority (a total of over 90 percent in our data) of all IPs. Due to space limit, only the survey of the contour patterns of the 2-ip and 3-ip intonational phrases is presented.

Table 1. *Distribution of IP groups.*

Group of IP	Number	Percentage
IP with 1 ip	5	3.2
IP with 2 ip	62	39.7
IP with 3 ip	59	37.8
IP with 4 ip	21	13.5
IP with 5 ip	6	3.9
IP with 6 ip	2	1.3
IP with 7 ip	1	0.6
Total	156	100%

2.5.2. *Phrasing*

Grammatically, among the total of 156 intonational phrases, 81 (51.9%) are predicative verb phrases without a subject; 69 (44.2%) are complete clauses with both subject and predicate; the remaining 6 (3.9%) belong to others such as stranded adverbial phrases, subject phrases, etc., which all involve relatively complicated internal structures. The majority of the verb phrases as IPs is not unexpected given that Chinese, as a parataxis language, is well-known for its rich use of run-on sentences.

Within the intonational phrases, the phrasing of intermediate phrases is of much greater variety. In Table 2 below is the list of the top 10 most frequently recurrent intermediate phrases.

On the whole, despite occasional exceptions, either the phrasing of the IPs or the intermediate phrases demonstrates high agreement with grammatical boundaries.

Table 2. *Distribution of the top 10 intermediate phrases.*

Intermediate phrase	Frequency	Percentage
AV	25	5.5
V	19	4.2
DS	17	3.8
VO	16	3.5
DO	15	3.3
VDO	15	3.3
O	14	3.1
A	9	2.0
DDS	9	2.0
DDO	8	1.8
Total	147	32.5%

In Table 2 (and elsewhere of this study), the letters A, V, D, S, O refer to Adverbial, Verb, Determiner (i.e., modifier of a noun), Subject, and Object respectively.

2.5.3. *Relative prominence*

Previous studies have long indicated that in Chinese intonation, prosodic prominence is highly related, among other factors, to the relative prominence in the realization of the target pitch value (H for Tone 1, 2 and 4; L for Tone 3) and pitch range of the stressed syllables; meanwhile, grammatical structure has a bearing on the distribution of the so-called “logical stress” in Chinese. [6]

Table 3 below shows the average values of the D_{max} and D_{min} of the corresponding prosodic words of the six major Chinese grammatical constituents in our data:

Table 3. *Feature D values of the major Chinese grammatical constituents.*

Grammatical constituent	D_{max}	D_{min}
Subject (S)	3.5	0.8
Verb (V)	3.0	0.9
Object (O)	2.8	0.3
Determiner (D)	3.8	1.3
Adverbial (A)	3.8	1.7
Complement (C)	3.1	0.4

From Table 3, it is clear that the average Determiner has a higher H value and a lower L value than the average Subject or Object, which conforms to the existing observation that in an unmarked Determiner-Head structure, the relative prominence goes to the Determiner (as indicated by its higher D_{max} value) whereas the structure as a whole tend to form a single prosodic unit (as indicated by its higher D_{min} value).[5] The same is true with the Adverbial-Verb structure, in which the Adverbial enjoys relative prominence while the two still form a single prosodic unit.

It is also noteworthy that the Object and the Complement, whose unmarked positions are IP-final, both have the lowest average D_{min} values approaching the bottom-line of the 5-degree scale space, a clear indicator of the existence of the statement boundary tone. [1]

2.5.4. *Contour patterns of IPs with 2 intermediate phrases*

Table 4 shows the frequency and percentage of all the contour patterns of 2-ip intonational phrases in our data.

The overall pitch trend of each contour pattern is graphically demonstrated in Figures 1 to 4, in each of which the upper T-Line and the lower B-Line reflect the pitch trend of the top-line and the bottom-line of each contour pattern respectively. The D values marked on the figures show the average D_{max} and D_{min} values of the component intermediate phrases of each contour pattern in a left-to-right order.

Table 4. *Contour patterns of 2-ip IPs.*

Contour pattern	Frequency	Percentage
F-F	36	58.1
R-F	12	19.3
F-R	10	16.1
R-R	4	6.5
Total	62	100%

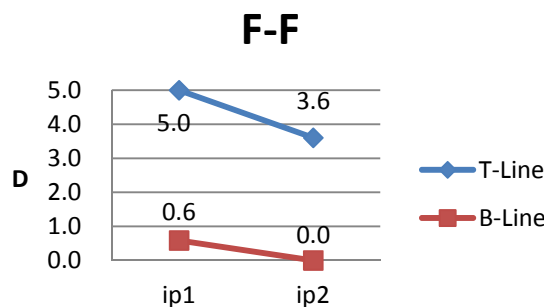


Figure 1: *Contour pattern of F-F.*

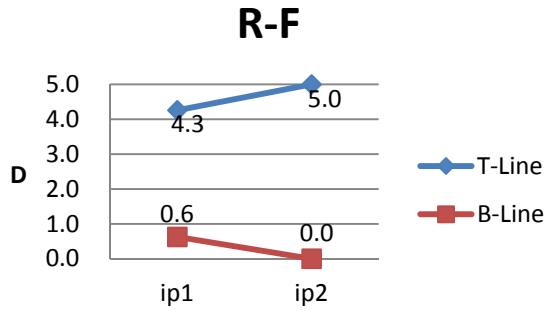


Figure 2: Contour pattern of R-F.

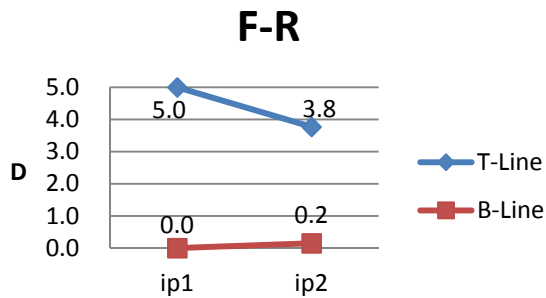


Figure 3: Contour pattern of F-R.

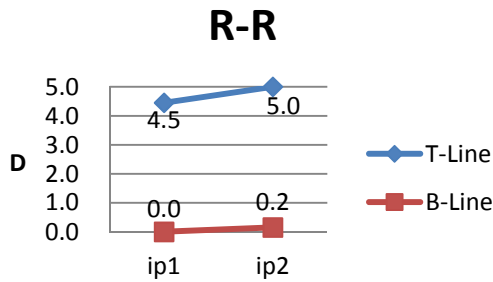


Figure 4: Contour pattern of R-R.

2.5.5. Contour patterns of IPs with 3 intermediate phrases

Table 6 shows the frequency and percentage of all the contour patterns of 3-ip intonational phrases in our data. The overall pitch trends of the top 6 most frequent contour patterns are graphically demonstrated in Figures 5 to 10.

Table 5. Contour patterns of 3-ip IPs.

Contour pattern	Frequency	Percentage
RF-RF	16	27.1
RF-FF	12	20.3
RF-FR	5	8.5
FF-FR	5	8.5
RR-RF	4	6.8
FR-RF	4	6.8
FR-FR	3	5.1

FF-RF	3	5.1
RR-FR	2	3.4
FR-FF	2	3.4
RR-FF	1	1.7
FF-RR	1	1.7
FF-FF	1	1.7
Total	59	100.0%

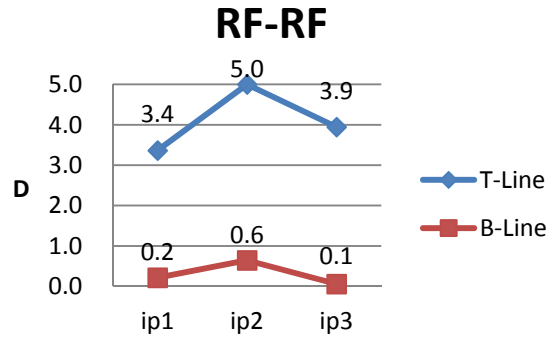


Figure 5: Contour pattern of RF-RF.

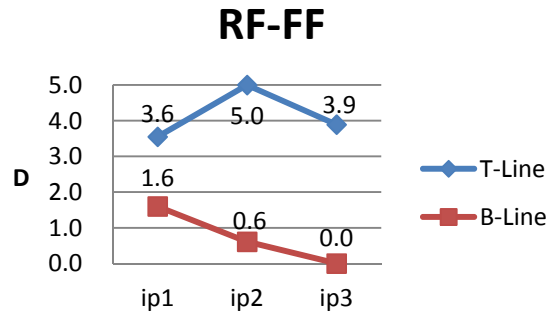


Figure 6: Contour pattern of RF-FF.

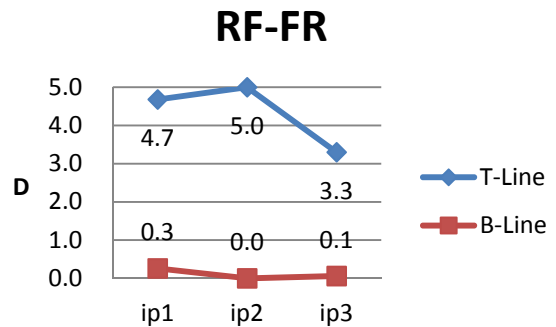


Figure 7: Contour pattern of RF-FR.

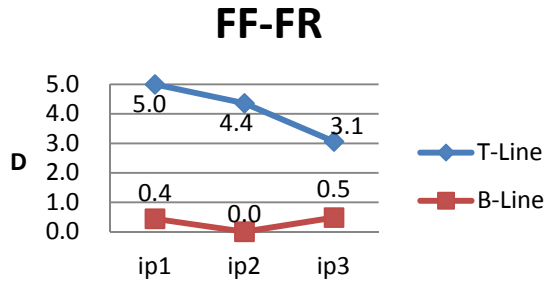


Figure 8: Contour pattern of FF-FR.

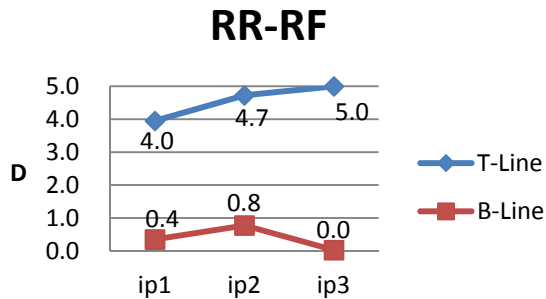


Figure 9: Contour pattern of RR-RF.

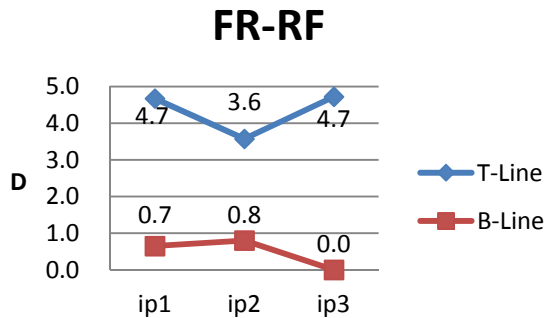


Figure 10: Contour pattern of FR-RF.

3. Discussion

As is shown in Table 4, all the four logically possible contour patterns of 2-ip intonational phrases are observed in our data. However, their frequency distribution is quite uneven, with the F-F pattern, which features both a falling top-line and a falling bottom-line, accounting for more than a half of the total. If the pitch trends of the top-line and the bottom-line are observed separately, the total frequencies of a falling top-line and a falling bottom-line get even higher. Such observations are in a way quite expected given the existence of declination and downstep and the fact that the intonational phrases in our survey are either statements or parts of statements.

Furthermore, from Figures 1 to 4, it is clear that in both the F-R and R-R patterns the rising in the bottom-line is very slight, and the D_{\min} values of the ending intermediate phrases are both quite near the bottom-line of the 5-degree scale. These help to ensure the statement function of the relevant pitch contours.

Things get more complicated in the 3-ip intonational phrases. From Table 5, we can see that as the number of intermediate phrases grows from two to three, the diversity and variety of contour patterns boom a lot. What adds to the complication is that when observed separately all the four possible patterns can be observed for both the top-line and the bottom-line. Apparently, as shown in Figures 5 to 10, there seems to be no evident regularity in the performance of the different contour patterns. However, through a careful observation and comparison of the second halves of the top-line and bottom-line of each pitch contour in Figures 5 to 10, a certain regularity can be found indeed: When the ending point of the bottom-line is low (i.e., 0 or near 0), the ending point of the top-line can be either high (Figure 9, 10), mid (Figure 5, 6) or low (Figure 7); however, when the ending point of the bottom-line is relatively non-low, the ending point of the top-line must then be relatively low and form a clear falling trend from the former D_{\max} value so as to ensure the perception of the statement boundary tone. The same observation also applies to the contour patterns of 2-ip intonational phrases in Figures 1 to 4. Therefore, we can come to the tentative conclusion that the near-bottom D_{\min} value of the last intermediate phrase serves as the primary indicator of the statement intonation in Chinese, while the falling trend of the last part of the top-line can serve as a compensatory auxiliary indicator when the primary indicator is not typical.

4. Conclusions

In standard Chinese news materials, on the whole, the phrasing of the IPs and the intermediate phrases demonstrates high agreement with grammatical boundaries. Among the six major Chinese grammatical constituents, the Determiner and the Adverbial enjoy relative prominence in comparison with the Subject, the Object and the Verb while the Object and the Complement both have near-bottom average D_{\min} values.

The intonational phrases with 2, 3, and 4 intermediate phrases constitute the majority of all IPs. The contour patterns of all IPs indicate that the near-bottom D_{\min} value of the last intermediate phrase serves as the primary indicator of the statement intonation in Chinese, while the falling trend of the last part of the top-line can serve as a compensatory auxiliary indicator when the primary indicator is not typical.

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6. References

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