

Intonational Structures of Mandarin Discourse

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Intonational Structures of Mandarin Discourse*

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Introduction

Natural discourse is a very diverse and complex process. In discourse, we not only communicate ideas and feelings about events, people, and concepts, but we also accommodate and interact with other participants to mutually work out development of the conversation. To ensure the success of the communication, speakers often use various discourse strategies to maintain interest and to probe the state of the other participant. Relationships among participants and emotions and attitudes toward subject matter are intertwined with hierarchical organization of topic development and discourse flow. Intonation plays a crucial role in communicating these complex layers of meaning.

Data and Methodology

The goal of my research is to investigate the prosodic system of Mandarin Chinese by analyzing natural discourse data to bring out the essential rules and principles governing prosody. My research differs from previous research in that it takes an integrated and multidisciplinary approach of analyzing intonation within a broader theoretical framework of discourse structure and cognitive elements. By doing this, I hope to provide a more unified account of prosodic functions as they interact within natural discourse.

For this research, I recorded four spontaneous conversations, two dialogues and two multi-party conversations in a mixed group in home settings. I was a participant (speaker B) in all of the conversations. The informants are all native speakers of Chinese. To ensure that the conversation would occur naturally, no topics were provided or suggested, and no elicitation nor control was attempted.

All the conversations were recorded on high quality Maxell XL cassette tapes using a Marantz 430 professional tape recorder with a Sony ECM-909 directional microphone attached. Each conversation typically lasted about 3 hours over the dinner table, and altogether the corpus consists of about 12 hours of speech.

From the total corpus two types of data were selected. The first type consists of speech utterance samples selected in different situations from the total corpus to obtain a wide and more varied sampling of the data. By taking slices of the conversation at many different points we can encounter many different contexts and obtain multiple comparisons. The second type consists of complete and continuous extended subsections of the dialogues, so that every utterance within a continuous extended section of the conversation could be examined with respect to development, continuity and the interconnectedness of the discourses.

The speech utterances from both types of data were acoustically and perceptually analyzed. I used both perceptual and acoustic analysis, because these two methods complement each other very well. Acoustic analysis gives a more objective record, and speech events can be examined in great detail. Perceptual analysis is also critical, since it is through human perception that meaningful

distinctions are made. This dual approach is especially suited for this study because my goal is to relate the acoustic signals with their functions in language by a detailed analysis of a large discourse corpus.

For the perceptual analysis, the data were analyzed to identify the cognitive and emotional states present, as well as the discourse processes at work, and these were correlated with the specific intonational forms. The results of the perceptual analysis were confirmed through both an independent perceptual experiment and by the original participants (see Yang, 1995b). For the acoustic analysis, approximately 90 minutes of the speech data, including both sample utterances from various parts of the conversations and a 20-minute continuous subsection, were digitized at a 16 kHz sampling rate using the ESPS Waves+ program at the Phonetics Lab of Stanford University. Measurements of pitch and duration were calculated automatically, and pitch tracks were made for all of the digitized speech data. This process resulted in approximately 1,500 pitch tracks.

Cognitive-Affective States and Shapes of Intonation

The variations of intonational shapes in discourse are a forceful expression of the continual changes in the cognitive and emotional states of speakers. These shapes are of key significance in communicating the emotional, relational, and judgmental meaning which accompanies the presentation of semantic content. Intonational shapes are comprised of variations in pitch level, pitch range, pitch slope, pitch movement, as well as amplitude, duration, rhythm, and voice quality. Each of these plays a part in communicating the specific state, and work together to present an ongoing representation of the complex meaning which intonation conveys. The variability of intonational forms reflects the great capability of intonation in expressing the critical distinctions among finely differentiated meanings.

The intensity of a particular state forms an integral part of its expressive meaning. In Chinese, the need to express emotional and attitudinal meaning through intonation occurs in the presence of the lexical tones. The intensity of intonational expression is a principal element in the mutual realization of tonal and intonational contour.

In Figures 1 to 6, we can see how variations in pitch shape and intensity of the same expression can give rise to different perceptions of cognitive state. In Figure 1, speaker B expresses her opinion, *ti2mu4 ding4 le0 zui4 hao3 bu2 yao4 zai4 gai3* 'Once the topic is decided, it's best not to change it', and this expression is characterized by a clear downdrifting pattern. Upon hearing speaker B's remark, speaker A immediately responds with a strong expression of agreement *dui4* 'right', signalled by the large pitch range of *dui* of about 120 Hz. The combination of the steep drop in both amplitude and pitch contributes to a more definite and emphatic impression. By contrast, the following echoing and supportive *dui* of speaker B is much softer. The gentle soft agreement is reflected in a much smaller pitch range of only about 20 Hz and a much lighter amplitude.

Concavity and convexity of pitch slope are very important features in distinguishing the perceived harshness or softness of an utterance. In Figure 2, speaker B is describing the shopping situation, *dian4 shen2me0 dou1 hen3 zao3*

dou1 guan1 'The shops and everything all close up very early', and speaker C responds with an eager but soft agreement. Speaker C's 4th tone *dui* here has a

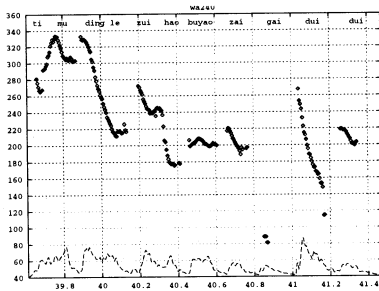


Figure 1

B: ti2mu4 ding4le0 zui4 hao3 bu2yao4
zai4 gai3
A: dui4 B: dui4

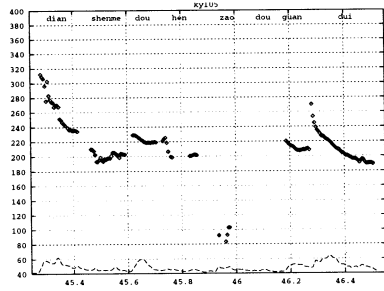


Figure 2

B: dian4shen2me0 dou1 hen3 zao3 dou1
guan1
C: dui4

gradual pitch slope with a convex shape, giving an impression of gentle, eager and prolonged agreement with the main speaker. The amplitude contour here also falls more gradually. Both the convexity of pitch shape and the more gradual decline in amplitude contour combine to give a more soothing quality in this case.

The fact that pitch range variation is often correlated with the degree of emotional intensity is further demonstrated in Figure 3:

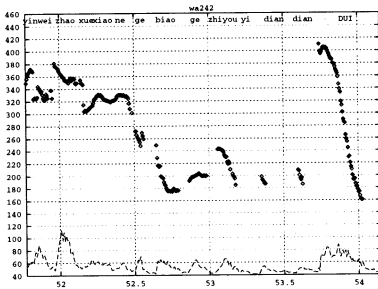


Figure 3

B: yin1wei4 zhao4 xue2xiao4 ne4 ge0
biao3ge2 zhi3 you3 yi1dian3dian3
A: dui4

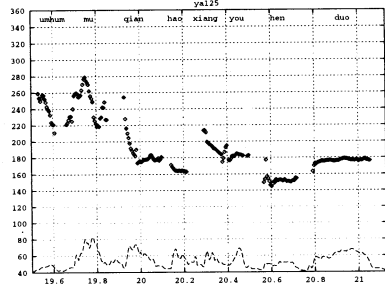


Figure 4

A: mu4qian2 hao3xiang4 you3 hen3 dou1

In this example, speaker B continues the topic by saying, *yin1wei4 zhao4 xue2xiao4 ne4ge0 biao3ge2 zhi3 you3 yi1 dian3 dian3* 'Because according to the form they have at the school, you only have a little bit of space', and speaker A responds with an exaggerated and emphatic expression of agreement, *DUI!* The dramatic drop in pitch from a very high 410 Hz to a low point of 160 Hz, a change of 240 Hz, forcefully signals the intensity of agreement.

In Chinese, there is an intricate ongoing interplay between the lexical tone shapes and the shape associated with cognitive and emotional intonation. Adherence or conformity to the tonal shape plays an intonationally significant role, and is not merely something that occurs in the absence of an emotional state. In spontaneous speech the nature of the specific state and the strength of the emotion are critical elements of the realized intonational form.

In Figure 4, speaker A is saying *mu4qian2 hao3xiang4 you3 hen3 duo1* - 'Right now there seems to be a lot -' with an emphasis on *duo*. Both the fall-rise 3rd tone *hen* 'very' and 1st tone *duo* 'many' have a level shape here, but they differ in that *hen* is lower and shorter, while *duo* is higher and longer. The focus on *duo* is accomplished by both the lengthened duration of about .35 seconds, and by the sustained sound quality, and is enhanced greatly by keeping the shape at an unusually uniform pitch level. By emphasizing and exaggerating the specific distinguishing characteristics of the tones, prominence is achieved.

Figure 5 *you3 o0 hao3 duo1 o0* 'There are! A whole lot!' shows how the intonational manifestation of a dramatic exaggerated expression can differ from a more identification or informational type of emphasis. Comparing with the previous example, it is evident that speaker A here is undergoing an emotionally excited and involved state. This excited state is most clearly indicated by the large curved pitch movements seen on this chart.

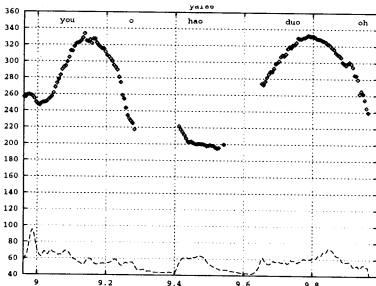


Figure 5

A: you3 o0 hao3 duo1 o0

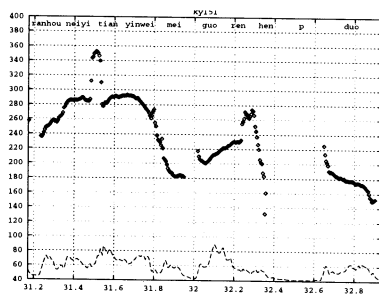


Figure 6

C: ran2hou4 nei4yi4tian1 yin1wei4 mei3guo2 ren2 hen3 duo1

In this example, 3rd tone *hao* is still mostly level and low, but 1st level tone *duo* is greatly modified and has a dramatic rise-fall arch shape instead, due to the exaggerated and persuading emphasis of the speaker, which is also signalled by the emphatic marker *o*. This example illustrates how tones can accommodate to the intonation forces, even to the extent of greatly distorting the defined tone shape.

Figure 6 shows how tones can take a drastically different pitch direction in the presence of a strong intonational force. In the utterance *ran2hou4 nei4 yi4 tian1 yin1wei4 mei3 quo2 ren2 hen3 duo1* 'Then that day because there were many Americans', speaker C is emphasizing *hen duo* with a negative emotion, expressing her disapproval of 'too many'. The fact that *hen* here is emphasized is evidenced in the sharp pitch drop, as well as in the large pitch range it has. The perceptible pause of .19 sec between *hen* and *duo* is an effective way to convey

deliberate emphasis, and this enhances considerably the expression of disapproval present in this example.

The next two examples show how a speaker's different levels of intensity can lead to significant differences in pitch shape. In Figure 7 *Mei2you3 mei2you3 bi3 zhe4 geng4 pian2yi2 de0 a0* 'There wasn't there wasn't anything cheaper than this?!' we can see the expression of surprise, expressed by the high pitch level and sharp pitch rise of F0 in both *meiyou*s. Speaker B starts at a moderately high pitch level of about 280 Hz, but immediately rises to a very dramatic high peak at 495 Hz, at the upper extreme of her range, and then descends to the bottom of her pitch range at 170 Hz. The extreme high pitch level gives the expression a very intense and forceful character, and the large pitch movement from very high to very low contributes greatly to the impression of disbelief and astonishment.

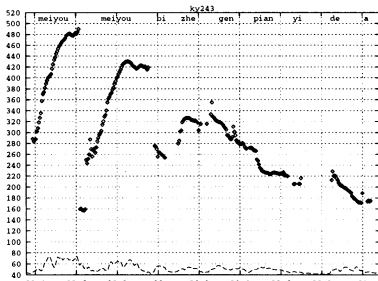


Figure 7

B: mei2you3 mei2you3 bi3 zhe4 geng4
pian2yi2 de0 a0

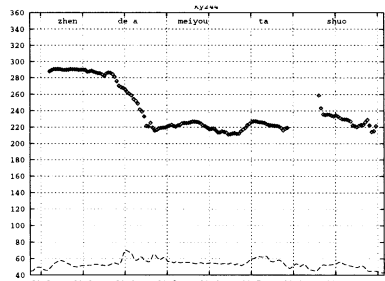


Figure 8

B: zhen1de0 a0
C: mei2you3 ta1 shuo1

The high degree of surprise is not only indicated by the unusually high pitch level, but is also present in the steep rising slope of the two *meiyou*s. The extent of the rise is highly expressive and reflects the high degree of the abrupt, urgent, unexpected doubt present. By contrast, the same *meiyou* in Figure 8 *zhen1de0 a0 ? mei2you3 ta1 shuo1...* 'Really? There wasn't, she said...' is much milder, and this less intensified state is expressed in the much lower pitch level and the flatter pitch contour of this utterance.

Intonation and the Coherence of Topic Organization

In the above examples we have seen how significantly cognitive and affective states can affect intonational contours. Such expressive changes in intonation are very important as they constitute a fundamental level of intonational composition at the local syllable and phrase levels, and contribute greatly to the overall discourse interpretation. However, discourse is a dynamic and continuous process, and in order to understand intonation in discourse fully, it is crucial to look at discourse as a sequence. That is, we need to broaden the scope of analysis to a more global level, investigating the nature of intonation in bringing about overall discourse coherence through examination of the pitch level structuring of phrases.

The hierarchical topic organization and the dynamics of participant interaction are interrelated in discourse. To capture the nature of these relationships, a complete subsection of 600 utterances, about 20 minutes of continuous conversation, was digitized and analyzed for the highest pitch points for both speakers in the conversation, and the peak pitch points for the initial section of discourse are plotted in the following chart (see Figure 9). Peak pitch points are widely regarded as being more salient and carrying more information by researchers in intonation because of their prominence and contrastive capabilities. They also function as an indicator of the general pitch level for each phrase.

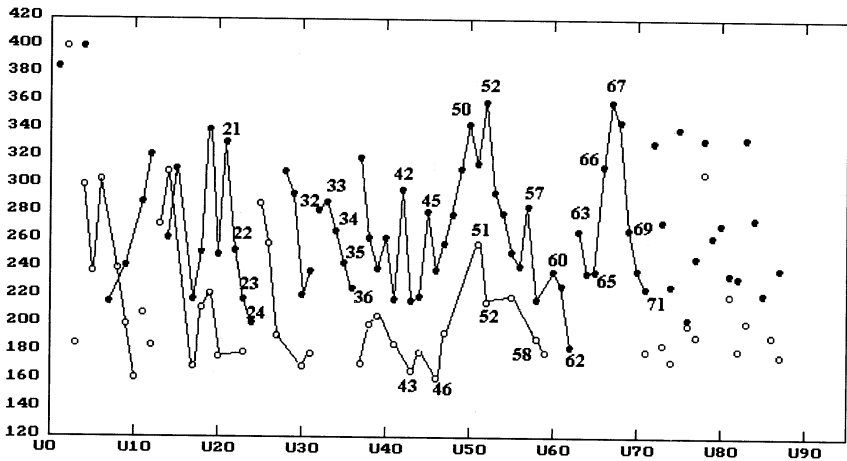


Figure 9. Plot of Pitch Peaks of 90 Utterances
 * Speaker A: ○ Speaker B: ●

Encapsulating the relative pitch heights of entire phrases as single points allows us to visualize important discourse phenomena over an extended period of time. On this chart, the general hierarchical structure, discourse development, and changing participant relationships are represented. The connected sequences of points represent utterances within topics and subtopics, and we can see the pattern of a generally high start and low pitch ending for topics.

Discourse seems to go through different phases, sometimes more fragmented, sometimes more structured. For example, we can see the initial negotiation period to settle on a topic from Utterances 1 (U1) to 31 (U31). This period is characterized by higher pitch levels, and frequent turn-taking and interruptions. This is indicated by the roughly equal numbers of dots that both speakers have at both high and low points. By contrast, from U31 on, speaker B has many dots at high, low and intermediate levels, while speaker A's relatively fewer dots are mostly at low pitch levels. This indicates that speaker B is the main speaker and has entered a narration phase, and her narration is supported by the series of low pitch level utterances of speaker A, which are mostly feedback words.

Downstepping and Topic Development

The hierarchical intonational structure of discourse frequently appears as downstepping in pitch between phrases. Downstepping in pitch commonly parallels movement from a more uncertain or unresolved start that works towards a gradual resolution over a series of phrases, as seen in (1) (Intonational phrases are marked by || and intermediate phrases by | in the transcripts. 's' means soft, 'f' means fast):

- (1)
- | | | | |
|----|---|----|--|
| 21 | B: Oh women haoxiang sibai wushi
kuai ho? (soft) | 21 | B: Oh wasn't ours around four fifty
or so? (soft) |
| 22 | (s) hai yao jia shui, | 22 | (s) then you have to add tax, |
| 23 | (s) ranhou jia qilai | 23 | (s) then altogether |
| | (s) jiangjin wubai. | | (s) it was close to five hundred. |
| 24 | B: Umhum. | 24 | B: Umhum. |

In the sequence of utterances U21-U24 (see Figure 9), there is a progressive downstepping as speaker B works from a position of initial uncertainty over the price towards a satisfactory resolution of what the price actually had been. This progression from high pitch to low pitch during elaboration is associated with the growing level of confidence and certainty.

Regular Stepping in More Uniform Development

The specific size and uniformity of step size also reflect the stability of cognitive state. More uniform step sizes may be associated with more stable cognitive progression:

- (2)
- | | | | |
|----|---|----|--|
| 32 | B: Na wo cengjing | 32 | B: Then - I once before |
| 33 | yongguo biede xuexiao de nage jiqi
de shihou ho, | 33 | Used the facilities of another school - |
| 34 | (f) Nage shihou wo ye bu zhidao shi
zenme nong de. | 34 | (f) At that time I didn't know how
they did it, |
| 35 | (f) Fanzheng tamen dou shi yiqie dou
computerized, | 35 | (f) anyway everything there was
computerized, |
| 36 | (f) tamen bang women nong le. | 36 | (f) they did it for us. |
| | A: Um. | | A: Um. |

In this section, speaker B first introduces the topic in U32. But then a cognitive shift occurs because the information is not immediately retrievable, and therefore the speaker adds on successive qualifying expressions in U34-U36; each qualifying expression drops by about 15 to 20 Hz, as seen in the smaller step sizes. The proportional downstepping here contrasts significantly with the larger and variable step sizes in the previous example. In this example, the sequence is more

narrative and descriptive, and the smaller and uniform step sizes reflect the relative stability and constancy of the speaker's state during this short segment.

Upstepping as Cognitive Uncertainty

Although topics often start high, this does not always have to be the case. When discourse enters a more structured or narrative phase, topic initiation phrases often start at a more intermediate level and develop in an upstepping pattern.

(3)				
62	B: jiu shi nayang.	62	B: It's just like that.	
63	Ranhou women jiu	63	Then we just asked people	
	qing ren lai luyin ma.		to come in to record.	
64	ranhou lu yin le yihou	64	Then after the recording	
65	ranhou jiu ba nege luyindai --	65	then we just took that tape	
66	Oh,	66	Oh,	
	wo xiangxiang kan		let me think	
	ta shi shi zenmeyang?		what happened then?	
67	Fanzheng fangzheng ---	67	In any case, in any case ---	
68	wo wang le zenmeyang,	68	I forget what happened,	
	fanzheng jiu shi		anyway it's just	
69	tamen jiu ba nage luyin	69	they just took that tape,	
70	nage yin ho,	70	that sound, huh,	
71	ba ta shusong dao diannaolimian qu.	71	and put it into the computer.	
	A: umhum umhum		A: umhum umhum	

Language often reveals the cognitive process. In U63, the speaker has just finished the previous topic, and is starting another topic. This topic completion is signalled lexically by the concluding phrase in U62. The speaker starts low at U63, but then becomes uncertain and steps out of the topic to recall some information at U66, and this results in an upstepping pattern. At U67, the speaker reaches a cognitive turning point and decides to move on and return to the main topic, as signalled by the phrase *fanzheng* 'in any case'. From this point on, the speaker becomes more certain, and this more certain state is reflected in the downstepping pattern in U68-U71.

Topic, Planning and Cognitive States

The complexity of topic structure increases as discourse gets more involved and more complicated. One characteristic of discourse is that speakers may have a general idea of where they are going in the conversation, but often do not have a definite plan or have all the details of the topic worked out ahead of time. In this type of situation, the topic will be constructed one step at a time, and the main topic may not be identifiable until that section of the conversation is complete. Throughout this process, interactional elements communicating the current understanding and interests of participants can cause topics to move in and out of

the conversation, or turn in a different direction. Moreover, a speaker may try to follow a general plan for topic, but then unexpectedly finds that relevant information cannot be readily recalled from memory, and thereby is forced to modify the direction of the topic or turn to a new topic completely. Speakers may also change their minds in the middle of developing a topic to elaborate on a particular point, or may be reluctant to continue the current line of development. The fact that conversation is dynamic and the topic direction is often dynamically determined in this fuzzy way is a reflection of the cognitive process. The cognitive state is revealed and signalled in the intonational patterns.

Let's examine an extended section of the discourse in the light of these considerations:

(4)				
	1st account		1st account	
42	B: (fast) tamen youge luyinji, dui bu dui.	42	B: (fast) They've got a tape recorder, right?	
43	[A: M.] dou you shebei hai hen hao ho.	43	[A: M.] B: Everything. Their facilities are really good.	
44	[A: umhum] ranhou nage	44	[A: umhum] B: Then that	
45	jiu shi - yuyin shiyanshi ma	45	it's just a phonetics lab, right?	
46	[A: um] ranhou hai you yige	46	[A: um] B: then they also got	
47	nezhong boli men, (fast) jiu shuo ni zai waimian keyi kandao limian ren zai zuo sheme a,	47	that type of glass door, (fast) it's just like from outside you can see what the people inside are doing,	
	[A: Umhum] deng deng de		[A: Umhum] things like that	
48	jiu shi shuo bijiao zhengshi,	48	it's just more formal	
49	buxiang women xuexiao nege jiushi ----	49	not like the one at our school it's - just ----	
	[both laugh]		[both laugh]	
50	Tui men jinqu	50	When you open the door	
51	renjia zai zuo shiyan de hua, yijing chao dao renjia le.	51	if people are in there doing experiments you've already disturbed them	
	A: Shi ah!		A: Exactly!	
	2nd account		2nd account	
52	B: Tamen jiu shi hen da ho.[A:Mm]	52	B: Theirs is really big [A: Mm]	
53	Ranhou zhebian nabian, ranhou biru shuo	53	Then here there, then for example	
54	xiang zheyang	54	it's like this	
55	zhebian shi yige boli de,	55	here's a glass door	
	[A: Umhum]		[A: Umhum]	
56	ranhou limian de ren	56	then the people inside	

57	zai limian luyin,		are recording in there,
58	jiushi xiang yige luyinpeng,	57	it's just like a recording studio,
	dui bu dui?	58	right?
	nayangzi ho. [A: Mm]		Just like that. [A: Mm]
59	[A: Mm]	59	[A: Mm]
	ranhou ni qita de ren zai waimian		Then the other people outside
60	hai keyi caozong a,	60	can also monitor,
61	gei ni tiao zhege,	61	adjust this,
	tiao nage,		adjust that,
	dengdeng de,		things like that,
62	jiu shi nayang.	62	It's just like that.

From this segment of the discourse we can see that the speaker made two attempts at describing her previous experience. In both cases, the speaker was trying to provide an adequate description of this experience from her memory. In each attempt, the key elements stay the same, because both versions revolve around the same salient point, i.e. bolimen and its usefulness. However, the specific phrasing and strategy differ, and the intonational topic development also differs. As can be seen in the chart, the general intonational structure in the first account (U43-U50) is a well-organized series of upsteps, whereas in the second account (U52-U62) the intonational structure is generally a series of downsteps. What are the factors that can account for this marked difference in intonational development? and how does this relate to the discourse topic structure?

Comparing these two versions, it is obvious that the 2nd account is more well-organized, and that the 1st account is building up step-by-step cognitively. In the first version (version 1), the topic is being developed spontaneously; each step is triggered by the previous step and the ideas brought up in these phrases often act as insertions to the main idea. This step-by-step development is a consequence of the constraints of memory which often operate when a large amount of information has to be activated or evoked in the mind. In situations like this, speakers often have difficulty evoking the whole schema of the experience in a short period of time. Instead, ideas and images come back to mind piece by piece and scene by scene, and often are dictated by the salience order or temporal order existing in the speaker's mind.

Furthermore, in discourse the speaker is often motivated to accommodate the hearer's cognitive state and informational needs. Speakers often adjust to the discourse situation and monitor the hearer's reactions to ensure that the points made are interesting and well-understood. This motivation to make the conversation relevant to both speaker and hearer is often accomplished by building a common or mutually shared background. The ultimate goal of relevance, understanding and establishing a common background is to call up or evoke a matching cognitive picture in the hearer's mind of the images and ideas that are the current focus of interest of the speaker.

The two issues of memory and interactiveness both are part of the cognitive state of the speaker, and come together intonationally in the issue of planning. The

degree of cognitive planning appears as one of the most significant determinants of phrase to phrase intonational structure. Planning comes from organized knowledge and a confidence in what is going to come up next in the topic development. When a speaker has one simple idea, and can express it in a short sequence of phrases, or has a well-organized idea in his or her head, then the speaker can have a well-integrated plan to produce the utterances in a unified manner. When there is a more extended topic idea or experience, it is more difficult to plan everything out. When discourse is more interactively oriented, there often will be less of a complete plan, and there will tend to be more disruptions of the initial plan through side interests and being lead astray. Unexpected events also destroy the nice organization and planning the speaker may have. Under constraints of unexpected events and problems with recalling, it is difficult to plan very far ahead and we have to move step by step. The way topic is intonationally organized really reflects the cognitive judgement on the relations between phrases.

How do these issues of memory, interaction and planning affect the intonational manifestation here? In the beginning part of this segment, the speaker is building up the topic, and at the same time has to struggle with all these cognitive and discourse elements to keep the conversation going. Each phrase functions to add new information as a way to overcome the previous phrase, therefore each step is higher than the other, until the speaker finally comes to the climax - a high point - in the story. The upstepping pattern is just such an expression and representation of these elements in the speaker's mind. In the subsequent section, the speaker has already organized the essential points in her head, has also established the appropriate common background, so is free of disruptions, and can concentrate more on the topic structure, i.e. the elements of the story, itself. Therefore her account here is smoother and more certain, as signalled by the gradually descending anti-climactic downslope. The essential point is that the planning in these two versions differs: the upstepping section, the 1st version, is less planned, whereas the downstepping section, the 2nd version, is more planned. This example is evidence that discourse is *not* always pre-planned, and the intonational structure and topic development reflect the degree of planning involved.

Intonation and Discourse Interaction

My data also show that discourse is interactionally and cooperatively organized. In discourse, participants accommodate and interact frequently to mutually work out development and resolution of the conversation. The cooperative nature of discourse is manifested in intonation.

If we look at the hearer's responses in U41-U62, we can see that, on the whole, speaker A's pitch movements are mirroring exactly the pitch movements of speaker B, and the two speakers are moving together in an emotionally synchronized manner. At phrases in which speaker B continues the further elaboration of topic, the two speakers' step movements are parallel, i.e. they

converge, and this convergence signals that both speakers are in agreement on the topic development.

Conclusion

Based on my analysis of the data, I propose that intonation in discourse includes three concurrent and interrelated determinants: topic organization, discourse interactional organization, and cognitive-emotional organization, each of which entails specific intonational patterns and scope of influence. Topic organization generally affects the relative pitch height of phrases, while emotion and cognitive relationships often affect both the pitch height and the shape of syllables, words and phrases. Interactional elements also systematically affect the overall intonational structure. Intonation is a critical element in the expression of cognitive states, and discourse structure is inseparably linked to intonation through emotion, planning, and the sympathetic accommodation of the states of discourse participants.

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