AN ANALYSIS OF PROSODIC SYSTEMS IN THE CLASSROOM DISCOURSE
OF NATIVE SPEAKER AND NONNATIVE SPEAKER TEACHING ASSISTANTS

By
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A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
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# TABLE OF CONTENTS

**ABSTRACT** ...................................................... iv

**CHAPTERS**

1 **INTRODUCTION** ........................................... 1
   Overview ..................................................... 1
   L1 and L2 Discourse. ...................................... 10

2 **INTONATION IN DISCOURSE** ............................... 16
   Models of Discourse Prosody ............................. 16
   A Model of Intonation in Discourse ..................... 18
   Comparison with Two Models of Intonation .......... 37
   Additions to Brazil's Model ............................ 47
   Conclusion ................................................ 53

3 **METHODOLOGY** ............................................. 55
   Database .................................................... 55
   Data Collection and Analysis ........................... 57
   Transcription Conventions .............................. 64

4 **ANALYSIS OF NS DATA** ..................................... 65
   Introduction .............................................. 65
   Sequence Structure Structure .......................... 67
   Pitch Sequences and Discourse Markers ............. 80
   Tone Choice and Orientation ........................... 94
   Conclusion ................................................ 104

5 **ANALYSIS OF NNS DATA** .................................. 107
   Introduction .............................................. 107
   Sequence Chain Structure .............................. 109
   Pitch Sequences and Discourse Markers ............. 135
   Tone Choice and Orientation ........................... 153
   Conclusion ................................................ 168
## 6 ANALYSES OF IVE DATA

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>172</td>
</tr>
<tr>
<td>Sequence Chain Structure</td>
<td>172</td>
</tr>
<tr>
<td>Pitch Sequences and Discourse Markers</td>
<td>185</td>
</tr>
<tr>
<td>Tone Choice and Orientation</td>
<td>198</td>
</tr>
<tr>
<td>Conclusion</td>
<td>212</td>
</tr>
</tbody>
</table>

## 7 CONCLUSION

<table>
<thead>
<tr>
<th>Topic</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summary of Analyses</td>
<td>242</td>
</tr>
<tr>
<td>The Role of Prosodic Structure in Discourse</td>
<td>253</td>
</tr>
<tr>
<td>Suggestions for Future Research</td>
<td>258</td>
</tr>
</tbody>
</table>

## APPENDICES

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>A SAMPLE MATHEMATICS TRANSCRIPTS</td>
<td>265</td>
</tr>
<tr>
<td>B SAMPLE ENGINEERING TRANSCRIPTS</td>
<td>270</td>
</tr>
<tr>
<td>C SAMPLE PHYSICS TRANSCRIPTS</td>
<td>283</td>
</tr>
<tr>
<td>D SAMPLE CHEMISTRY TRANSCRIPTS</td>
<td>296</td>
</tr>
<tr>
<td>REFERENCE LIST</td>
<td>305</td>
</tr>
<tr>
<td>BIOGRAPHICAL SKETCH</td>
<td>315</td>
</tr>
</tbody>
</table>
Abstract of Dissertation Presented to the Graduate School of the University of Florida in Partial Fulfillment of the Requirements for the Degree of Doctor of Philosophy

AN ANALYSIS OF PROSODIC SYSTEMS IN THE CLASSROOM DISCOURSE OF NATIVE SPEAKER AND NONNATIVE SPEAKER TEACHING ASSISTANTS

By

Lucy Pickering

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Chairperson: Diana Boxer
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This dissertation investigates the role of prosodic structure in the classroom discourse of native and nonnative speaker teaching assistants in one American university. Video and audiotaped data of naturally occurring teaching presentations given by male North American, Chinese, and Indian English speakers were collected in the classroom. Fundamental frequency contours and pause structure were calculated using a Kay Elemetrics computerized Speech Laboratory. Patterns of intonation, stress, and pausing were then interpreted using a model of intonation in discourse.

The results of the native speaker analysis show that intonation and pause structure are organized systematically by these speakers both to structure information (for example, to mark topic boundaries and establish contrasts), and interactively to establish a rapport between discourse participants. The results of the two nonnative speaker analyses show that both groups could be characterized by a typical prosodic profile which marked speakers as deviating from a native speaker standard. Typical
pitch and pause patterns found in these data show little indication that teachers are directing their presentation towards assisting the students in their comprehension of the material. Conflicts between prosodic cues and organization at other levels of the discourse (for example, topic organization or syntactic structure) make the informational structure of the discourse more difficult to interpret for the native speaker hearer. In addition, intonation choices are shown to contribute to a distancing between teachers and students. At an interpersonal level, they frequently characterize teachers as uninvolved and unsympathetic from the perspective of native speaker participants in the discourse.

The study concludes that prosodic structure forms a natural link between grammatical and sociolinguistic competence and bears a high communicative load in terms of both structuring information and expressing relationships between participants. Therefore, prosodic miscues in nonnative discourse will negatively effect undergraduate perceptions of the nonnative teachers' competence and personality and are one underlying cause of cross-cultural communication failure between international teaching assistants and their students.
CHAPTER 1
INTRODUCTION

Overview

Over the last decade, both university faculties and graduate programs have become increasingly diverse. The numbers of international teaching assistants and lecturers in scientific and technical fields such as engineering, mathematics, and laboratory sciences have increased dramatically (Mooney, 1990). The majority of U.S. undergraduates are now more likely to have important contact with international staff in their introductory courses, and nonnative speakers are required to be "professional communicators" on a daily basis in their classrooms (Scollon & Scollon, 1995). As with many other workplaces, cross-cultural communication has become an integral part of academic life in universities across the country. However, communication failure between nonnative teachers and their students is not uncommon, and concern regarding the competence of international staff remains acute (Cresswell, 1990). Increasingly, screening programs developed to assess the linguistic ability of international teachers have recognized that successful communication between language groups requires a sophisticated communicative competence on the part of the nonnative speaker. This includes the ability to use language appropriate to a given situational context, and to recognize the expectations of native speaker discourse participants. One area of linguistic competence which is frequently overlooked in this discussion is the prosodic structure of nonnative discourse.
This dissertation investigates the contribution of prosodic structure to possible cross-cultural communication failure by analyzing the systematic use of two prosodic variables, pitch variation and pause structure, in the naturally occurring discourse of native and nonnative teaching assistants. Using native speaker presentations as baseline data, the analysis focuses on the role of discourse prosodics in typical classroom presentations and in rapport-building between teachers and students.

In comparison with analyses of the syntactic and lexical features of text, the contribution of the prosodic characteristics of longer stretches of speech has remained largely understudied (Levinson, 1983). Systematic investigation of the role of intonation, in particular, has also been hampered by its traditional representation as a "half-tamed savage" (from Bolinger, 1978, cited in Vaissiere, 1995), lying on the edge of language and more appropriate for paralinguistic investigation. More recently, however, improvements in the instrumental techniques available to researchers in speech perception and new approaches to discourse analysis have resulted in a revised conception of the role of prosody in the production and interpretation of spoken discourse. Prosodic features such as stress, intonation, rhythm, and pause structure have been shown to form a natural link between linguistic and sociolinguistic aspects of language, as they bear a high communicative load in terms of both structuring information and expressing relationships between discourse participants (Brazil, 1997; Gumperz, 1982). In light of this research, prosodic features become measurable as a critical component of
the communicative ability of nonnative speakers, as they directly impact linguistic, sociolinguistic and discourse competence.

The role of discourse prosodics in information structuring has been investigated in a number of experimental studies which propose that prosodic features such as pitch (as measured by fundamental frequency) and pause structure are used in the production and processing of local (utterance level) and global (discourse level) information structure (Grosz & Sidner, 1986). Production studies in English and Dutch show that a speaker's use of pitch and pausing can be directly linked to the topic structure of the discourse (Grosz & Sidner, 1986; Nakajima & Allen, 1993; Swerts & Geluykens, 1993, 1994; Cutler, Dahan & Donselaar, 1997). Speakers tend to use a high pitch level, or fundamental frequency (Fo), at the initiation of a new topic, a mid level at points of continuation, and a low Fo accompanied by longer pauses at topic final boundaries. Nakajima & Allen (1993) also found that topic elaborations or 'asides' were produced with lower Fo onsets and finals and were characterized by a restricted pitch range. Swerts & Geluykens (1994) conclude that "this points to a very sophisticated use of global Fo features by the speaker, and shows that we should look beyond the local level when studying the discourse function of Fo variation" (p. 31).

Listener perceptions of the role of prosodic cues in information processing are typically tested using response times to manipulated or synthesized speech (Kreiman, 1982; Grosz & Sidner, 1986; Grosjan, 1983; Swerts & Geluykens, 1994; Cutler, Dahan & Donselaar, 1997). In these studies, listeners were able to identify major discourse boundaries and
predict when an utterance was likely to end using only prosodic features such as pause length and Fo variation. When syntactic and prosodic cues were manipulated so that utterances were syntactically complete but prosodically incomplete, listener response times increased, suggesting that this mismatch of linguistic signals required listeners to reanalyze the information (Berkovits, 1984; Sanderman & Collier, 1997). Swerts & Geluykens (1994) conclude that "listeners are able to deduce discourse structure from prosody. Both pause duration and pitch variation appear to be important perceptual cues" (p. 38). Collectively, this research suggests that speakers employ prosodic structure to organize information at a global level and that listeners use prosodic cues to parse incoming information and predict upcoming discourse structure.

In addition to these informational functions, discourse analysts have proposed that pitch variation and pause structure form part of a systematic use of prosodic features for indexical, or non-referential, functions (Gumperz, 1982; Couper-Kuhlen & Selting, 1992). Indexical functions include the use of pitch variation to regulate turn-taking in conversation, to communicate sociolinguistic information such as status differences, solidarity, or social distance between interlocutors, or to project speaker assumptions regarding what information is 'new' or shared in the context of a specific interaction. In general terms, prosody contributes to relationship-building between participants. Both the referential and non-referential functions of prosodic structure are united in Gumperz's (1982) theory of conversational inference.
Gumperz suggests that comprehensible spoken discourse is achieved through the production and interpretation of multiple cues or signals present at all levels of the discourse, i.e., lexical, syntactic, prosodic and non-verbal. The pragmatic or communicative value of the discourse message is contained within the composite whole. For their production and interpretation of these devices, or contextualization cues, participants use "contextual presuppositions" (institutionalized linguistic and cultural knowledge), and "situated inferencing" (moment by moment inferences regarding the speaker's intent based on the context of the interaction). Gumperz proposes that over time, these cues have become tacit, conventionalized choices, and in normal interaction between members of the same speech community, discourse participants will implicitly assume a shared framework of production and interpretation.

The reliance on a shared linguistic and sociocultural background for interpretation of the discourse message has particular implications for cross-cultural communication. The way in which participants orient themselves to the interaction and to each other depends on their ongoing interpretation of conversational behaviors. Those behaviors that differ across speech communities may not be immediately evident to interlocutors, as interpretation rests on deeply rooted, culturally based presuppositions which are not easily retrieved by a native speaker on a conscious, analytical level. Participants are likely to assume a mutual understanding of discourse conventions, and infer speaker intent within their own interpretive framework (Green, 1989; Humphrey-Jones, 1986; Tannen, 1985). Prosodic cues are particularly vulnerable to misinterpretation. In Gumperz's (1982, 1983, 1992) own work
investigating interactions between Indian English speakers and British/American English speakers, he shows that Indian English prosodic conventions frequently lead American/British participants to view Indian speakers as discourteous, aggressive and misleading.\footnote{Although the models of discourse and intonation structure used in this study (Gumperz, 1982; Brazil, 1997) are based primarily on observations from standard British speakers, both researchers have also used American English examples. As the formal constructs proposed in the models and their interpretative value were found to be equally applicable to the standard American English speakers investigated in this study, I will subsume both the standard models of American and British English under the title 'English' throughout this study for ease of exposition. This term is contrasted with 'indigenized varieties of English' which is used to describe Indian English. I also note, however, that there may be differences in the interpretation of certain intonational features based on localized regional or social factors, in both American and British English (see, for example, Local, 1985; Bolinger, 1989), or in other native standard models.} In light of the double function of prosodic cues in both structuring information and rapport-building between participants, Gumperz et al. (1984) characterize intonation as "among the most important of the devices that accompany cohesion in spoken interaction" (p. 5).

This dissertation extends the current research in both speech analysis and cross-cultural communication concerning the role of prosody in discourse. The study compares two prosodic features, pitch variation and pause structure, in the teaching presentations of native and nonnative speaker (Chinese and Indian) teaching assistants in an American university. A qualitative design was chosen in order to conduct a microanalysis of the complete pitch and pause structure of each of the discourse extracts recorded for this study. Fundamental frequency contours and pause lengths were computed for each extract using a Kay Elemetrics Computerized Speech Laboratory. These data
were then analyzed using a model of intonation structure in discourse proposed by Brazil (1997). Brazil’s framework comprises a series of formal intonational categories which operate at the same level of abstraction as syntactic and lexical choices, and have independent implications for the discourse structure. Both Gumperz’s and Brazil’s proposals share the same underlying principles regarding the communicative function of intonation. Central to Brazil’s model is the principle of a state of convergence between discourse participants; that is, the continuous negotiation toward a roughly mutual state of understanding in the immediate and constantly changing world of naturally occurring spoken discourse. Intonational choices made by the speaker project both referential and non-referential information which the hearers will interpret within their understanding of the how the system operates in English.

The comparison of the native speaker (NS) and nonnative speaker (NNS) prosodic data is set within this larger framework of discourse interpretation. If it can be established that native speakers are using prosodic cues to orient their hearers to the interaction, then analysis of the nonnative data can determine whether prosody is used by these speakers to transmit the same information. In addition, the formal categories proposed by Brazil constrain the hearers’ interpretation of particular pitch movements. Therefore, we can surmise what effect specific prosodic miscues in the nonnative speaker discourse are likely to have on the comprehensibility of the discourse and rapport-building between teacher and students.
The study focuses on four principal research questions:

1. Based on a model of prosodic structure in American/British discourse, is there evidence that native speaker teaching assistants systematically pattern intonation and pause structure for informational and social functions for the benefit of their hearers?
2. Based on an analysis of parallel native speaker and nonnative speaker teaching presentations, what similarities and differences in prosodic patterning are found in the teaching discourse of Mandarin Chinese ITAs?
3. Based on an analysis of parallel American English and Indian English teaching presentations, what similarities and differences in prosodic patterning are found in the teaching discourse of Indian English ITAs?
4. Based on these analyses, is the prosodic structure of ITA discourse likely to be a cause of miscommunication at informational and social levels between ITAs and their American English hearers?

The discussion also addresses issues which evolved naturally out of the analysis, such as differences between Indian and Chinese speakers’ use of English prosodic systems, development of prosodic features in a second language, and how these results can be applied to cross-cultural communication and ESL pedagogy.

The remainder of this chapter examines recent literature concerning the prosodic structure of L2 discourse, and ITA discourse specifically. Chapter 2 describes Brazil’s model of intonation in discourse in detail. Currently, there are several models of prosodic structure in English discourse available to the researcher (Pierrehumbert & Hirschberg, 1990; Watt, 1994; Brown, Currie & Kenworthy, 1980; Halliday, 1967). Chapter 2 also includes a comparison with two similar models, and a discussion of why Brazil’s model was considered to be most appropriate for this study. Finally, Chapter 2 describes two additions that have been made to Brazil’s model for the purposes of this study. The first is a unit of intonation structure
developed by Barr (1990), which formalizes a prosodic paragraphing structure found in the lecture discourse of native speakers. The second is the inclusion of pause analysis based on previous findings regarding the prosodic features of typical NNS teaching discourse (Rounds, 1987). Chapter 3 describes the data and the procedures used in this dissertation. The chapter includes a discussion of the instrumental techniques used in the data analysis, and examples of the fundamental frequency read-outs used to illustrate pitch variation in the analyses.

Chapters 4, 5, and 6 comprise the results of the study. Chapter 4 reports the native speaker data analysis. The results verify that NS TAs make systematic use of prosodic cues to communicate the global structure of the discourse and to project their assumptions regarding the knowledge state of a particular group of hearers. In addition, these speakers use certain intonation choices to create solidarity with their hearers by acknowledging their participation in the discourse. Chapters 5 and 6 report the results from the nonnative data. The analysis of the Chinese ITA data, given in Chapter 5, shows that these speakers fail to make systematic use of prosodic cues for referential discourse functions. Furthermore, there was little evidence in these data of the use of prosodic cues to build rapport between teacher and students. Indeed, intonation patterns were typically found to exclude the hearers from the context of the interaction. The results of the Indian ITA analysis are reported in Chapter 6. There was more within-group variation in these data, possibly related to the speakers' different L1 backgrounds. However, the analysis suggests that as a group, these speakers use
certain conventionalized prosodic patterns that have been transferred from General Indian English. For the American English listener, these patterns frequently obscure the informational structure of the discourse at both a local and global level and reduce comprehensibility. There is also less evidence of the use of rapport-building strategies by this group of TAs in comparison to the NS group.

Lastly, Chapter 7 presents a summary of the three analyses, and discusses the role of prosodic structure in the comprehensibility of L2 discourse in light of the results of this study. I assert that prosodic cues are a critical component of comprehensible spoken discourse in English, and should be viewed as of central importance to the development of effective discourse competence in L2 learners. The chapter concludes with suggestions for future research, and the possible applications of this kind of analysis.

L1 and L2 Discourse Structure

Comparative studies of L1 and L2 discourse structure demonstrate crucial differences in the production of prosodic cues by L2 speakers which can negatively affect the interpretation of discourse structure by NS hearers. Current research suggests that nonnative-like prosodic structuring in NNS discourse contributes to a lack of cohesion at a global level, confusion regarding the relationships between individual propositions at a local level, and misinterpretation of speaker intent at an interpersonal level (Wennerstrom, 1997; Hewings, 1995; Anderson-Hsieh, Johnson & Koehler, 1992). In investigations of advanced and intermediate Asian and European learners, Wennerstrom (1994, 1997) found that speakers did not use pitch variation to signal new or
contrastive lexical items, and used less reduction of pitch on non-prominent words. This led to multiple prominences in an intonation unit and difficulty in distinguishing sentence accent. Japanese, Thai, and Chinese speakers also tended to use low boundary tones between related propositions where rising or mid level tones would be anticipated by NS hearers. Pirt (1990) reported similar results in a study of Italian learners. In addition to multiple prominences, she found more use of level and falling unit final tones in the NNS data, indicating that learners were 'language-oriented' rather than oriented toward their hearers. Lower proficiency learners also used inappropriate low boundary tones such as the following (capital letters indicate prominent syllables, and // indicates the boundary of an intonation unit):

// you must the FIRST RIGHT// (p. 151)
TAKE//

Hewings (1995) found a similar preference for the use of falling tones in the discourse of advanced L2 learners from Korea, Greece and Indonesia. This was particularly problematic in situations where rising tones were chosen by native speakers for "socially integrative" purposes. Hewings reports that when contradicting a previous speaker, NSs consistently used rising tones to avoid the appearance of overt disagreement implicit in a falling tone. In agreement with Gumperz, Hewings suggests that the use of falling tones by NNSs in this context can give the impression of deliberate rudeness or animosity on the part of the speaker.

Studies investigating fluency in L2 discourse (i.e. pause structure and hesitation phenomena) suggest that this can also confound listener interpretation of the discourse structure. Typical characteristics of NNS
speech such as repetition or correction of lexical items, and retrospective drafting of entire phrases (Hewings, 1990), disturb the prosodic composition of the discourse and make it more difficult for the hearer to retrieve the overall informational structure. Similar difficulties have been shown for pause structure in L2 discourse. Riggenbach (1991) and Anderson-Hsieh & Venkatagiri (1995) found that there were more nonlexical fillers and unfilled pauses in non-fluent NNS speech, and that long pauses frequently appeared within intonation units.

These characteristics affect NS perceptions of both internal cohesion and overall coherence of the discourse structure, and listener perception studies suggest that NS hearers react in a number of ways. Difficulties in processing information structure may necessitate hearers "replaying" parts of the message (Munro & Derwing, 1995). This, in turn, can lead to "listener irritation" (Eisenstein, 1983), a dual response to NNS discourse consisting of a negative cognitive reaction to reduced comprehensibility, and a negative emotional reaction due to annoyance and distraction. Problematic pause and pitch characteristics in discourse production have been directly linked to listener irritation in a number of experimental studies (Brown, Strong & Rencher, 1973, 1974; Philipson, 1978; Fayer & Krasinski, 1987; Holden & Hogan, 1993). In summary, the prosodic features of NNS discourse clearly contribute to what Bouchard-Ryan (1983) calls a "generalized negative affect", which

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2 The following is a typical example of retrospective redrafting taken from Hewings (1990):
describes the negative judgements made by NS hearers concerning the speaker's competence and personality.

Turning now to the ITA literature, although prosodic structure is directly addressed in very few studies, where observations are made, they reflect the findings in the L2 literature. Rounds (1987), Byrd & Constantinedes (1990) and Bailey (1984) show that pause structure and rate of speech can negatively affect intelligibility of the discourse and student perceptions of the ITA. In Hinofotis & Bailey (1980), undergraduate students were asked to comment on ITA presentations. The most frequent complaint was that ITAs were boring, and it was difficult for students to concentrate. The authors link this remark to the monotonic intonation patterns that characterize the presentations. The underlying problem reflected in these kinds of comments is listener perception of a "flat, undifferentiated, amorphous structure" (Tyler, Jefferies & Davies, 1988), created in part, by frequent silences and a lack of prosodic cues to signal information structure.

Many of these observations are consolidated in a group of studies conducted by Tyler and her associates (Tyler, Jefferies & Davies, 1988; Davies, Tyler & Koran, 1989; Tyler & Davies, 1990; Tyler, 1992; Tyler & Bro, 1992; Tyler & Bro, 1993; Tyler, 1995). Working within Gumperz's model of cross-cultural communication, these researchers use microanalysis of ITA presentations and teacher-student interactions to illustrate how an accumulation of miscues at all levels of the discourse structure can result in a misinterpretation of speaker intent by undergraduate students. Tyler, Jefferies & Davies (1988) show that prosodic miscues such as inappropriate falling contours, multiple
prominences and disfluency, combine with problematic syntactic structures and use of discourse marking to obscure informational structure. In Tyler & Davies (1990), both ITA production and interpretation of prosodic cues contribute to communication failure between a Korean ITA and a US undergraduate student. As the interaction progresses, it is clear from the student's agitated tone and higher pitch that he is becoming increasingly more distressed. However, during a playback session of the interaction, the ITA told researchers that "he was not confident about reading the information conveyed by prosodies and tone" (p. 404), and therefore, did not adjust his approach to the student. These studies further highlight the critical importance of situational context. Classroom interaction is an example of "binding discourse" (Goffman, 1981), i.e., talk that "supports a class of hearers who are more committed by what is being said" (1981: 140). Undergraduate students are primarily concerned with their ultimate success in the class, and may be less tolerant of communication difficulties in this environment than they would be in some other situational context. With this added consideration, the ability of ITAs to both successfully produce and interpret prosodic cues in discourse becomes a necessary component of their overall communicative competence.

The design of this dissertation study is consistent with the qualitative, interpretive investigations of ITA discourse conducted by Tyler et al., and augments these earlier studies by demonstrating how global prosodic organization of the discourse can contribute to the typical cross-cultural communication problems found in many teacher-
student interactions. This dissertation shows that if we do not address prosodic structure in ITA discourse, we are essentially disregarding an entire level of discourse organization and access to a tool used consistently by native speakers to build a positive rapport with other participants in the discourse. Through comparison with baseline native speaker data, this study demonstrates how prosodic miscues in the nonnative speaker discourse can be integrated into an overall assessment of L2 competence and the ability of L2 speakers to communicate effectively with native speaker interlocutors.
CHAPTER 2
INTONATION IN DISCOURSE

Models of Discourse Prosody

Introduction

The previous chapter argued for a discourse framework in which comprehensible spoken discourse is achieved through the interpretation of multiple cues present at all levels of discourse production. This interpretation is based on both the shared linguistic and sociocultural backgrounds of participants and the situated context of any given interaction. It was further proposed that prosodic cues contribute independently to the message contained within the discourse as a whole, serving to both structure information and establish the relationship between discourse participants. This chapter introduces a model of intonation in discourse (Brazil, 1985 and 1997) compatible with this framework of discourse production and interpretation.

The first part of the chapter gives a full description of Brazil’s model based largely on the work of Brazil (1997) and Brazil, Coulthard & Johns (1980). Where issues addressed by the model parallel discussion in the collective literature concerning prosodies, this will be indicated in order to clarify Brazil’s theoretical position within the larger framework of other important work in the field. The second section compares aspects of two other models of intonation (Halliday, 1967; Pierrehumbert & Hirschberg, 1990) to Brazil’s proposals. Halliday’s model precedes many treatments of intonation analysis that employ tone unit division
and tonal analysis of tonic syllables, including Brazil's model. However, the discussion will assert that Halliday's reliance on syntactic and information structure and attitudinal meaning to explain phonological form unnecessarily complicates the tonal inventory. The Pierrehumbert and Hirschberg model is analogous to Brazil's proposals in that it develops a system based only on phonological form and assigns an independent pragmatic function to intonation structure. However, I suggest that the interpretive model they have developed up to this point offers less insight regarding intonational effects across tone unit boundaries and, therefore, is unable to investigate the larger patterns of intonation structure in discourse suggested by Brazil and other researchers. On this basis, it is argued that Brazil's model provides the most comprehensive framework in which to investigate an independent intonational structure of discourse as opposed to sentential or clausal based units.

The final section in this chapter incorporates two additions to the model. The first is a unit of intonation structure operating in discourse proposed by Barr (1990). As Barr is working both within Brazil's model and with teaching discourse, the investigation of these units has been added to this analysis. The second is the addition of pause analysis to Brazil's original work with stress and intonation. Prior research investigating the teaching discourse of nonnative teaching assistants (Rounds, 1987) suggests that an analysis of pause structure highlights important qualitative differences between the overall prosodic structure of NNS and NS discourse that can affect comprehensibility and
relationship-building in the classroom. Finally, a summary of the revised model will be given at the end of the chapter.

A Model of Intonation in Discourse

Brazil (1997) proposes that intonation structure directly contributes to the pragmatic message of the discourse by the use of intonational cues to link the information to a world or context the hearer can make sense of. The speaker chooses from a series of formal options which operate at the same level of abstraction as syntactic and lexical choices and have independent implications for discourse structure. The speaker's choices project a context of interaction based on the on-going situated context of the discourse and her assessment of the hearer's knowledge state. As this context is constantly changing, intonation choices are relevant only at the moment of speaking, and the speaker is involved in a continuous assessment of the relationship between the message and the hearer. Within the context of any given interaction, the participants are in the process of negotiating a "common ground" or background to which "new" or unknown information is added, contributing to the structure both within and between intonation units. It is this negotiation toward a state of convergence (p. 133), a roughly mutual understanding of what is being said in the discourse, that allows for successful communication between participants. The formal options through which this negotiation is realized are described below.

In the tradition of functionally based descriptions of English intonation (Halliday, 1967; Crystal, 1969; Watt, 1994; Tench, 1996), Brazil adopts pitch defined tone units as a means of breaking up stretches of
spoken discourse. Each unit has a possible 3 part structure; however, only the tonic segment, the actual meaning-bearing element, is obligatory; therefore, a minimal tone unit consists of only a tonic segment, while an extended unit contains additional proclitic or enclitic material. Examples of minimal and extended tone units are shown on Table 2-1 below.

Table 2-1. Examples of Minimal and Extended Tone Units

<table>
<thead>
<tr>
<th>TONE UNIT</th>
<th>PROCLITIC SEGMENT (optional)</th>
<th>TONIC SEGMENT (obligatory)</th>
<th>ENCLITIC SEGMENT (optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DRAW the GRAPH</td>
<td>you can</td>
<td>DRAW the GRAPH</td>
<td>now</td>
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Tone unit boundary recognition is frequently discussed in the literature (Crystal, 1969; Brown, Currie & Kenworthy, 1980; Cutler, Dahan & Donselaar, 1997) and there is general agreement that boundaries can be detected using a number of phonetic criteria such as vowel lengthening, changes in pitch direction or short pauses. It is also recognized however, that such boundaries are not always easily identifiable (Tao, 1996; Couper-Kuhlen & Selting, 1996). While Brazil uses phonetic criteria where they are present, one of the advantages of the model is that it does not require precise recognition of unit boundaries, as no linguistically significant contrasts are made on the optional proclitic and enclitic segments. Tonic segment boundaries are identified by the feature of prominence, fundamental frequency (Fo) excursions which distinguish prominent syllables from the surrounding content and
represent the speaker's assessment of the relative information load carried by the elements in the utterance (Halliday, 1967; Crystal, 1969; Williams, 1986; Tench, 1996). Brazil suggests that at least one, but usually two, prominent syllables delimit the tonic segment. The way in which syllables are assigned prominence rests on the pragmatic intentions of the speaker and what Brazil terms an *existential paradigm*. The paradigm consists of what possible choices could appear in each of the syntagmatic slots of the tone unit based on both the constraints of the language system and on the non-linguistic situation or the situated context of the interaction. For example, given a potential tone unit such as 'a parcel of books lay on the table', at least two possible prominence selections could be made (capital letters indicate prominent syllables):

a. a parcel of BOOKS lay on the TAble  
b. a PARcel of books lay on the TAble

In (a) the speaker presents a prominent choice of 'BOOKS' as opposed to perhaps flowers or cups, and makes a similar prominence choice regarding the location, i.e., on the table as opposed to on the floor or on the chair. The choice of prominence on both syllables projects a situated context in which both these pieces of information are unrecoverable either from the prior interaction or from constraints within the language system. Equally, by choosing not to make prominent certain other words in the unit, the speaker assumes that no choice needs to be made from the existential paradigm. This may be based on non-linguistic or linguistic factors. For example, a choice of 'box' of books (another possibility in the paradigm) can be considered synonymous to the choice of 'parcel', and books can be assumed to 'lay'
on a table as opposed to 'stand up'. Constraints on the possible choices in the language system apply to the nonprominent function words such as 'of' and 'on'. In (b) the speaker chooses to make 'parcel' prominent and 'books' nonprominent. This projects a context in which other possibilities from the appropriate paradigm are unlikely as 'books' is understood as having been already negotiated:

A: Was the book there?
B: There was a PARcel of books there

The way in which these understandings are achieved can range from constraints in the language system or immediate context, to less restricted contexts such as assumed cultural knowledge, for example, the non-prominent '5th' in 'SAKS 5th AVenue' for an American English speaker and the non-prominent 'hardy' in 'FREEman, hardy and WILLis' for a British English speaker.1

Support for the function of prominence in projecting the speaker's understanding of the negotiated status of a given item comes from both mishearings and prosodic repairs. In the following example, the mishearing ('eight' instead of 'ace') causes B to project a context in which 'eight' is already determined and therefore, realized non-prominently:

A: Which ace did you play?
B: The eight of HEARTS
(Brazil, 1997: 27)

Prominent syllables are divided into two categories based on where they appear in the tone unit: the first prominent syllable in the

1 Freeman, Hardy and Willis is a national chain of shoe stores in Britain. This example comes from Brazil (1986).
tonic segment is called the *onset*, and the last is called the *tonic syllable*. It is the pitch level and pitch movement on these syllables that forms the basis for the assessment of their communicative value within the three systems that comprise the model. The systems realized on these two syllables are *key*, realized on the onset syllable; termination, realized on the tonic syllable; and tone, also realized on the tonic syllable. Key and termination will be discussed together as they are closely related, followed by tone.

Both key and termination choices are analyzed under a three term system that divides the speaker's pitch range into three levels: high (H), mid (M), and low (L). Clearly, for any given speaker, an indefinite number of absolute pitch levels may be identified, and absolute pitch level may be affected by a number of factors including individual idiosyncrasies, emotional involvement (Bolinger, 1988) or sociocultural convention (van Bezooyen, 1984). However, once we abstract away from these factors, Brazil suggests we are left with a small number of pitch contrasts used to convey purely linguistic meaning.

Both key and termination pitch choices are also glossed with the same communicative values. Choice of high pitch on the prominent syllable denotes the constituent (or the matter of the tone unit) as either 'contrastive' with something derivable from the preceding

---

2 Brazil et al. (1980) suggests that it is possible to have intermediate stressed syllables between these two if they form part of the informing content of the tone unit; however, this pattern usually occurs in particular styles of speech (see later discussion).

3 In cases where there is only one prominent syllable in the tone unit, both key and termination choice fall on the same syllable.
discourse (including both linguistic and non-linguistic factors) or 'particularized', i.e., highlighted as crucial over and above the surrounding information. (In the following examples, both key and termination are realized on the same syllable):  

\[
\begin{align*}
\text{H} & \quad \text{FAILED}// \\
\text{M} & //\text{he took the exAM}// \text{and} \\
\text{L} & \\
\text{he did not pass, as you might have expected:contrastive} \\
& \text{(Sinclair & Brazil, 1982: 144)}
\end{align*}
\]

Mid pitch choices have an additive function and denote the constituent as an 'expansion' or 'enlargement' of the information in previous units:

\[
\begin{align*}
\text{H} & \\
\text{M} & //\text{he took the exAM}// \text{and FAILED} \\
\text{L} & \\
\text{he did both: additive} \\
& \text{(Sinclair & Brazil, 1982: 144)}
\end{align*}
\]

Finally, a low pitch choice signifies an 'equative' value in relation to previous units, giving low key an additional restrictive function. It may be a reformulation of the previous unit, or some kind of recognition that no new information is added:

\[
\begin{align*}
\text{H} & \\
\text{M} & //\text{he took the exAM}// \text{and} \\
\text{L} & \quad \text{FAILED}// \\
\text{as you would expect; from what you know of him you will assume that taking it involves failing it: equative} \\
& \text{(Sinclair & Brazil, 1982: 144)}
\end{align*}
\]

Turning now to examples in which key and termination are realized on different syllables, separate choices on these systems allow

\[
\text{\footnotesize{\textsuperscript{4}} Following Brazil's conventions, in all the following examples, '//' indicates a tone unit boundary, onset syllables are given in capitals and tonic syllables are capitalized and underlined. Key/termination levels are indicated by H, M, & L.}}
\]
the projection of a finer context of interaction, and a more detailed analysis of speaker assumption and intent:

A: It's three o'clock  
B: H  
M  
L  //TIME to  
Here the message would be, 'I take three o'clock' as equivalent in meaning in this context to 'time to go' (indicated by the choice of low key), and I assume you will agree' (mid termination predicting mid key 'yes, I agree'). (Brazil et al., 1980: 77)

This interactive use of the key and termination systems allows the speaker to 'suggest' the appropriateness of certain reactions by the hearer. In the following example, Brazil suggests the speaker invites an "adjudicating response" from the hearer with a use of high termination, i.e., 'consider whether he ought or ought not be ashamed of himself', and anticipates concurrence or approval of the proposed action with the use of mid termination on 'tell him so':

H  SHAMED of himself//  
M  //he OUGHT to be a  
L  

H  
M and I'm GOing to TELL him so//  
L  
(Brazil, 1997: 59)

In terms of previous analyses of the English intonation system, there is nothing inherently new about identifying a small number of linguistically contrastive pitch levels for any given speaker (Pike, 1946; Halliday, 1967; Crystal, 1969; Tench, 1996). However, Brazil's proposal differs from these treatments in two important respects.
First, one level is not given as the 'norm', i.e., the level the speaker will deviate from for specific (and largely attitudinal) effects. In Brazil’s model, values are derived on a relative basis. Key choice is identified by its relative pitch height as compared to the pitch of the key choice in the previous unit, and termination choice is identified relative to the key choice in the same unit. As Couper-Kuhlen (1986) notes, this allows for more precise recognition of pitch height changes than a system that establishes a series of fixed levels. However, it raises a different problem: How to categorize a specific pitch level choice that may be only marginally lower or higher than a previous choice, compared to one in which the actual F0 change is much greater. These difficulties, as with those that come with a fixed level system, reflect the problem of dealing with the gradient nature of the systems measured in prosodic analysis, i.e., F0, amplitude and length. It is suggested here, in agreement with Couper-Kuhlen (1986), that these potential problems for analysis can be alleviated by analyzing key and termination choices within a minimally fixed framework, i.e., the voice range of the speaker. The first onset key is identified within this range, and subsequent levels are identified as appreciably 'higher than' or 'lower than' the preceding key or termination choice (see the sample analyses shown in Chapter 3). A certain amount of flexibility must remain within any system that attempts to describe these features, as F0 changes are conditioned by both time, which causes declination, and position in the discourse, which results in an expansion or flattening of the intonation contour near the beginning and ends of prosodic units (Vaissiere, 1983; Levelt, 1989; Beckman, 1997). Second, stemming from
the level analysis, Brazil posits a form of \textit{tonal collocation}, i.e. the extent to which adjacent tones display predictable restrictions (Crystal, 1969). Changes in pitch level are constrained by movement between adjacent levels only. Therefore, no tone unit exhibits a high key and low termination, or low key and high termination, and there is a further adjacent level constraint across tone unit boundaries. In formulating and systematically incorporating the notion of key or relative onset level into the model, Brazil's proposals differ from those made in a number of other current research models (Brown, Currie & Kenworthy, 1980; Gussenhoven, 1983; Pierrehumbert & Hirschberg, 1990). However, key choice analysis is critical in establishing pitch range interactions across tone units both in the discourse of one speaker and in interactions between speakers, and it has been recognized by a number of other researchers (Couper-Kuhlen, 1986; Tench, 1996; Wennerstrom, 1997) as a necessary construct to investigate prosodic units larger than the tone unit or intonational phrase.\footnote{Wennerstrom (1997) in fact, incorporates a form of key analysis into Pierrehumbert & Hirschberg's model for this reason.} These units, or \textit{phonological paragraphs}, are readily incorporated into Brazil's model and are discussed below.

There are two kinds of \textit{phonological paragraphing} proposed in this model: \textit{pitch concord} and \textit{pitch sequences}. Pitch concord describes pitch range interactions between speakers. Brazil proposes that in exchanges, following the consequent introduction of a new range of pitch norms, the second speaker will aim to match her initial key choice to the final termination choice of the first speaker in response to
whatever 'invitation' is projected by the first speaker. This is exemplified in the following examples:

(a) A: H
    M //Do you understand//
    L
B: H
    M //yes//
    L

(b) A: H
    M //Do you understand//
    L
B: H //yes//
    M
    L (Brazil, 1997: 54)

In (a) the use of mid termination by speaker A is not so much a request for a decision as an invitation to confirm that A's assumption ('I think you do understand') is correct. Speaker B supplies this expected concurrence with a mid key 'yes, I do'. In (b) on the other hand, the use of high termination can be glossed as: 'Tell me, do you or do you not understand?' and speaker B's response as asserting 'yes, there is no question of me not understanding'. A similar example was recently overheard on a college campus:

A: H
    M //it wasn't my fault//
    L
B: H //No// of course it wasn't//
    M
    L

In this example, speaker B responds to speaker's A request to adjudicate ('tell me, was it or wasn't it my fault') with a high key suggesting there is no question that it was not her fault. As Brazil notes, there is no absolute requirement that a speaker must obey the concord rule. However, when a second speaker does wish to refuse the
invitation offered by the speaker, she may choose to do so indirectly by realizing the expected key choice on a "dummy" item such as the mid key choice on 'well' shown below:

A: H
M //i COULdn't go// COULD i/
L

B: H
YES// COULD//
M //WELL// i think you
L

(Brazil, 1997: 56)

The second construct, the pitch sequence, is a stretch of consecutive tone units that fall between two low termination choices. It may be uttered by one speaker or shared between two participants in an exchange. It typically delimits longer sections of speech and may be related, in terms of communicative value, to the next or previous pitch sequence, or to the constituent tone units within it:

Pitch sequences resemble sentences and exchanges in that they exhibit a kind of running down of the constraints that unify them. By saying that low termination is the realization of a pitch sequence closure we are recognizing that the unit ends when the constraints that derive from a particular kind of language organization are reduced to zero.

(Brazil, 1985: 182)

The following example of a pitch sequence closure marks the boundaries of a typical teacher-student exchange with a final low key on the evaluation 'good':

T: H
M //WHAT's the final ANSwer//
L

S: H
M //sixTEEN//
L

T: H
M //sixTEEN//
L //GOOD//
In addition, the example shows the teacher beginning a new pitch sequence with the high key frame 'now'.

In longer narratives or monologues by one speaker, pitch sequences create relationships with each other of 'separateness' or 'connection'. A low termination pitch sequence closure may be followed by a high, mid or low key choice which carries the same communicative value (contrastive, additive or equative) as key choices within tone units; however, these are external key choices that reflect the speaker's projection of the relationship of one pitch sequence as a whole to the pitch sequence preceding it. A high key choice marks a point of maximal disjunction from the previous sequence and may mark major semantic or structural boundaries in the discourse. A mid key pitch sequence carries a value of enlargement, expansion, or addition to the preceding sequence, and a low key sequence closes off a prosodic unit and may be associated with reformulations or asides which typically have a reduced pitch range (Beckman, 1997; Tench, 1996).

A tendency for pitch concord between speakers has been noted by a number of other researchers, particularly those working with conversational interaction (Couper-Kuhlen & Selting, 1996). In addition, pitch sequences most closely parallel the paratone structures that have been discussed by researchers working with long stretches of narrative discourse (Yule, 1980; Brown, Currie & Kenworthy 1980; Brown & Yule, 1983; Couper-Kuhlen, 1986). Major paratones are identified by a high key onset and a low termination (or extended pause) consistent with
Brazil's high pitch sequence boundaries. Yule (1980) and Couper-Kuhlen (1986) also discuss a minor paratone structure; however, only the latter recognizes relative onset key which would make minor paratones coextensive with Brazil's mid and low key pitch sequences. The nature of the model also allows for new developments in prosodic paragraphing, and this will be discussed below. In sum, phonological paragraphing is a relatively new area of discourse analysis that can be fully investigated using the key and termination options proposed in this model.

The third and final system posited in the model is that of tone. This is concerned with pitch movement rather than pitch level and appears in addition to the termination choice on the tonic syllable. Tone denotes the status of the content of the tone unit, i.e., whether it is 'new' or 'given' within the context of the interaction. Brazil recognizes five tonal contours:

\[ \text{fall (p); rise-fall (p+)} \]
\[ \text{fall-rise (r); rise (r+)} \]
\[ \text{neutral tone (o)} \]

Excluding for the moment the neutral tone choice, the four possibilities can be divided into two opposing pairs: rising and falling. Tones that end in a falling movement are termed *proclaiming* tones. The use of these tones signifies the content is new, i.e., not recoverable from the preceding discourse, or is asserted, i.e., as necessary or incontrovertible truth or fact. Tones with a rising movement are termed

---

6 In fact, these are more likely to be coextensive with the sequence chain boundaries proposed by Barr (1990) and discussed below.
referring tones and signify that this information is already "conversationally in play" i.e., assumed to be known or recoverable from the preceding discourse or non-linguistic context. In the following examples, a teacher is providing examples of commonplace 'rubbing movements' in order to demonstrate the concept of friction to her students:

(1) //p when you strike a match//
//r it's a rubbing movement//

(2) //r when we rub our hands together
//p we are causing friction//

(Brazil et al., 1980: 14)

(1) can be glossed as 'talking of rubbing movements, another (new) kind is striking a match'. (2) reverses the organization of 'new' and 'given' and can be glossed as 'all these examples of rubbing movements (such as rubbing our hands together) are causing something new I will introduce to you called friction'. Thus, tone choice summarizes the 'common ground' between speakers at any particular moment in a given interaction.

As with choices of key and termination, the speaker operates on the basis of her assessment of the state of convergence between herself, the hearer and the message. This assumption of common ground can be seen most clearly in cases where the hearer(s) cannot confirm the correctness of the assumption directly, yet some state of convergence is projected. In the following example, a news announcer in Britain assumes that the name of the prime minister of Britain will be known to the audience (hence the 'r' tone) whereas the name of her French counterpart may not:
However, it is also important to remember that choices are under the speaker's *executive control* (Levelt, 1989). In other words, speaker intention can override any 'expected' choices that may be anticipated based on context. For example, the system allows the speaker the option to *project* a state of convergence that has not existed until that moment, i.e. choose tones *as if* something had already been negotiated.

The tonal system is also used to reflect sociolinguistic variables such as differences in social status between speaker and hearer, or "social distance", i.e., whether interlocutors are intimates or strangers (Wolfson, 1988). For example, the '+' tones (r+/p+) carry the same information value as their r/p counterparts; however, Brazil suggests they carry an added value of *dominance*. Choice between the regular and '+’ version of these tones is often based on the status relationship between participants of the discourse where the '+’ tones, as dominant tones, are the prerogative of the *controller* of the discourse or the participant who *claims* control.

In cases where the status of participants is unequal, e.g. teacher-student, doctor-patient interactions, division of tone choices along dominant/non-dominant lines is more easily identifiable. The example below was heard in a college classroom where the teacher was a rather timid Chinese ITA with limited language proficiency and potentially ambiguous dominant status for the American listener. At one point, after several repetitive checks by the ITA on student comprehension, the following exchange occurred:
T: Does everyone understand? Are there any questions?
S: //p+ NO// p+ just go ON//p+ PLEASE

Despite the ostensibly polite form, judging by the reactions of the observer and other students in the class, this response was clearly perceived as disrespectful and as 'overstepping' the teacher-student boundary. This was seen as an example of the inappropriate use of a dominant proclaiming tone by the lower status participant in the context of this interaction:

The assumption of dominance in circumstances where there is an ongoing expectation that the speaker in question will accept a non-dominant role can sometimes amount to rudeness.

(Brazil, 1997: 86)

These interpretations are very dependent on the sociolinguistic context of the specific interaction in which they are used. In interactions between intimates or status equals, for example, use of '+\)' tones may represent not so much a dominant function, as a function of intervention or reminding, in that the speaker takes a positive initiative in invoking common ground (r+) or changing the world of the hearer (p+). Dominant tones may also be used in interactions between strangers when a certain situation briefly confers dominant status on one of the participants; for example, when a pedestrian is giving directions to a passing motorist.

The final possible tone, the 'o' or level tone\(^{7}\) is unique in that it places the constituent outside the context of the interaction, i.e., it is neutral in terms of its communicative value, and the speaker is essentially marking it off from the surrounding informative content. Halliday (1967) does not recognize a neutral tone as part of his main

\(^{7}\) This tone may also be realized with a slight low rise.
tonal inventory, as he suggests it is rarely used in normal, everyday conversation. This, in fact, supports Brazil’s contention that use of the tone places information outside of the interactional context; something that presumably most interactants would not want to do unless for very specific reasons. Halliday (1967), Crystal (1969) and Brazil all suggest that the level tone is used for semi-ritualized or routinized language behavior such as choral prayer or giving directives in the classroom: "//o stop WRIting//o PUT your PENS down//--" (Brazil, 1997: 138). Brazil also identifies another very specific use of level tone in the classroom in a routine formula used by teachers and recognized by students called the template technique in which the teacher invites the students to complete a sentence with the correct information:

T: //o and then I...//
S: Natural log of both sides

Despite what would seem to be isolated occurrences of this tone, it plays a significant role in Brazil’s model, in distinguishing two types of discourse that have important implications for successful interaction between participants. The reader will recall that the participants in any given interaction are involved in a process of reaching a mutual understanding of the status of the information being given and received, and that the tonal system is an essential part of this process as it indicates whether the speaker is projecting the matter as shared common ground or new information. This use of the intonation system for the benefit of the hearer’s comprehension is termed direct discourse, as the speaker is directly orienting intonational choices toward a state of convergence. Brazil suggests, however, that the system also allows
for a speaker to select choices that are not oriented toward the listener and do not place a given utterance/utterances in a relationship with other parts of the discourse message. In effect, the speaker temporarily withdraws from the context of the interaction, and the communicative values inherent in the system are temporarily suspended. In this case, choices in the system create oblique discourse, i.e. an orientation inward toward the language specimen rather than outward toward the hearer.

The principal characteristics of an oblique orientation are the use of a level 'o' tone in combination with a proclaiming tone, and multiple prominences within a single tone unit. For example, in normal conversation a speaker may decide to include a familiar quotation ('you can TAKE a HORSE to WAter but you CAN'T MAKE him DRINK'). An utterance presented in this manner can be glossed as "these are not my words addressed particularly to you on this occasion; they are rather a routine performance whose appropriateness to our present situation we both recognize" (1997: 136). A second condition under which choices indicating oblique orientation can occur is in places where the speaker has momentary problems with linguistic coding which temporarily cause an orientation change. Unplanned or partially planned discourse is often filled with pause fillers and other kinds of hesitation markers which will frequently be uttered in a level tone as the speaker's focus shifts briefly to the language sample. This description of oblique orientation subsumes various uses of the level tone that has been described by other researchers in situations such as choral prayer or other discourse events where participants recite formulaic responses or
in the hesitation phenomena commonly found in spontaneous speech. It also applies to an activity Brazil terms 'reading out', where decisions in the intonation systems are made on the basis of the linguistic organization of the text rather than concern with how any given utterance meshes with the context of the interaction.

In all the situations mentioned above, it is also possible to adopt a directly-oriented approach. This, for example, is the difference between 'reading out' and 'reading aloud'; again, the ability to make either choice highlights the fact that the decision lies to a large extent with the speaker. There is no situation where a speaker must make a particular choice; rather the system operates on the Gricean cooperative principle that, generally speaking, speakers' contributions are designed to be understood (Grice, 1975). As with any system in language, this creates an area of conventionalized choices, and prosodic composition is one way in which we identify different language events (Tench, 1996). Classroom discourse, for example, is likely to be characterized by certain intonation patterns such as clearly structured direct orientation choices for informative content, pitch concord in teacher - student exchanges, and the use of level tones for formulaic instructions (Brazil et al, 1980; Sinclair & Brazil, 1982).

**Summary of Brazil's Model**

In summary, the three interlocking systems of key, termination and tone form the basic components of an intonation system in English that has independent implications for the communicative value of the discourse. With the inclusion of key choice, the model provides a principled framework for the description and interpretation of
intonational structure in discourse as well as in individual utterances, allowing investigation of structures larger than the tone unit or intonational phrase. Choices in the three systems of the model and structured phonological paragraphing show that spoken discourse, whether overtly dialogic or not, is organized for the benefit of the hearer and toward a mutual understanding by participants of the discourse message. Certain combinations of systems also demonstrate that intonation choice is under speaker control, and that the speaker may exploit the system to alter the communicative value of the utterance or, alternatively, temporarily withdraw from the interaction under certain conditions. For these reasons, the model provides a systematic framework to analyze prosodic structure which can then be compared to other levels of linguistic description.

Comparison with Two Models of Intonation in English

This section will compare Brazil’s model with aspects of two other models of intonation in English (Halliday, 1967; Pierrehumbert & Hirschberg, 1990). These comparisons are limited and selective. However, they show in general terms why Brazil’s model is considered to be the most economic and insightful for the data analysis undertaken in this study.

Halliday (1967)

Halliday also proposes that intonation structure consists of three separate systems: tonality (tone unit division), tonicity (internal structure of tone units) and tone (pitch movement on the final tonic). Taking first the two systems of tonality and tonicity, Halliday suggests a marked/unmarked distinction in which unmarked tone units are
coextensive with information units and syntactic clauses. For natural data, this can be problematic. First, as Couper-Kuhlen & Selting (1996) note, there may be no recognizable prosodic boundary between two nuclear or tonic syllables yet only one may appear in an unmarked unit. Therefore, boundaries are drawn on syntactic grounds even when they are not supported by any phonological criteria. An example is shown below:

the prince of WALES// is visiting CARdiff//
(Couper-Kuhlen & Selting, 1996: 15)

In this case, a tone unit boundary is drawn between the two tonics; however, 'is visiting' could be analyzed as either a proclitic or enclitic element without materially affecting the meaning inherent in the intonation structure, and without recourse to syntax.

Secondly, natural data is replete with identifiable pause defined or pitch defined prosodic units that are not coextensive with traditional syntactic units including hesitation markers, false starts and truncated sentential structures (Crystal, 1969; Brown, Currie & Kenworthy, 1980; Couper-Kuhlen & Selting, 1996). In Halliday's system these would be considered marked structures yet they are a common feature of spontaneous and partially planned spoken discourse. Similar difficulties apply to the concept of tonicity. Halliday suggests that the internal structure of an unmarked tone unit consists of "given" information followed by a "new" or focal element coinciding with the tonic syllable on the last lexical item. Once again, as Brown, Currie and Kenworthy (1980) show, in many cases in natural data, a new item may appear at the beginning of the unit followed by a given structure:
THAT'S what I regret....
(Brown, Currie & Kenworthy, p.156)

In this case, the tonic falls on the first item. As the authors suggest, it is only because two separate systems (given versus new, and identification of prominent syllables by phonological criteria) are merged, that data is forced into a marked category. In Brazil's system, 'new' information is not connected to particular syntagmatic slots in the tone unit. In the example above, choice of prominence in and of itself reflects the speaker's intention to project this as informative content, and tone choice will indicate whether the speaker believes this to be new information for the hearer.

The third system in Halliday's model is tone. Five possible primary tones differentiated by pitch movement, may appear on the tonic syllable. This system is closely tied to the syntactic structure of the discourse and also employs the marked/unmarked division:

Distinctions expressed by the choice of different tones...belong in the realm of grammar (and within grammar, the realm of syntax). Halliday, 1970: 21

The following example (taken from Brazil, Coulthard & Johns, 1980: 107) exemplifies the unmarked distinction for WH- questions (falling) and its marked counterpart. The example is followed by the equivalent tone choices in Brazil's system:

(d) WH- question: tone 1, neutral; tone 2, mild (tentative/deferential)

//1 what's the time//
//2 what's the time// ('may I ask please')
(Halliday, 1970: 27)

//p what's the TIME//
//r+ what's the TIME//
In Brazil's system, the difference between these two tonal values would be in the assumed 'state of convergence', i.e., questions in referring tone may be heard as in some way anticipating the answer, or as a request to be reminded rather than told, and overtones of 'tentative' or 'deferential' are dependent on the specific context of the interaction. Seen in this light, the supposed neutral tone for WH-questions may be less appropriate in one particular context than it is in another. This point is also taken up by other researchers (Crystal, 1969) who argue that it is not productive to assign tones to certain structures, particularly different kinds of questions, as the data does not support this kind of dichotomy:

Analysis of most varieties of English speech shows that the issue is hardly as simple as this, it being quite possible to have both a falling and rising tone with each kind of question. (p.3)

These difficulties with all three - tonality, tonicity and tone - suggest that intonation should be viewed as an independent level of meaning, not as a device defined by grammatical choices.

In addition to the five primary tones, Halliday also proposes a system of secondary tones which appear on both the tonic and the pretonic (equivalent to Brazil's onset syllable). This system, which Halliday calls 'key' also includes three pitch levels (as well as tonal movements) but differs from Brazil's key system in that one level is recognized as the 'norm' or neutral tone, and most importantly, that its sole function is to indicate affective meaning.

Pretonic secondary tones extend from the onset to the tonic syllable and are attached to primary tones. For example, the pretonic
on tone 1 can be a neutral, even tone, or a ‘bouncing’ tone, that Halliday glosses as ‘forceful or querulous’:

//1 why don’t you make up your mind// (unemotional)
//1 why don’t you make up your mind// (for heaven’s sake)
(Halliday, 1970: 32)

With Halliday’s recognition of the internal foot structure of the unit, each ‘salient’ syllable would bear the ‘bouncing’ movement. This creates three prominent syllables:

//p WHY don’t you MAKE up your MIND //

This multiple prominence pattern alone would separate the unit from the surrounding discourse and suggest a stronger focus on the message itself, rather like giving an instruction. In fact, the same effect can be achieved using falling contours on the pretonic segment, and the substitution of a p+ dominant tone implies even more ‘forcefulness’:

//p+ WHY don’t you MAKE up your MIND//

However, within Halliday’s system the equivalent of the p+ tone, tone 5, attaches to its own secondary pretonic tone and is glossed as ‘awestruck or disappointed’:

//5 LOOK at that MARvelous old STEAM engine//
(p. 33)

These examples demonstrate that great care needs to be taken in separating intonational effects from the effects of the lexical items themselves. In the following example of Halliday’s tone 1 with a ‘bouncing’ pretonic, it is difficult to assign a ‘forceful or querulous’ interpretation:

//p JOHN’s deCIded to beCOME a DOCTOR//
Again, the interpretation seems to be more like some kind of concern with the way the message is being said as though it were being quoted or somehow distanced from the speaker largely due to the effect of the multiple prominences. Intonation clearly has an affective component (Bolinger, 1988); however, there is a danger in applying too many precise labels and unnecessarily complicating the tonal inventory. This is particularly true of affective meaning, as there are many other prosodic and paralinguistic variables that are invariably involved, such as loudness, extra-heavy stress, rate, tension, choice of lexis and kinesics (Crystal, 1969; Tench, 1996). In addition, there is the issue of separating universal indicators of some kind of emotional effect from language specific conventions (Bolinger, 1988; Vaissiere, 1983). Certain prosodic features such as a change in volume or an increase in tempo may be universally recognizable, whereas other more subtle effects may be more language specific. In the discussion of this example given earlier: //p+ NO//Just go ON// PLEASE//, it was suggested that the effect of rudeness was at least partially conveyed by the use of dominant p+ tones by an unequal participant. In the same context, in a language other than English, the attitudinal effect conveyed by this contour may be very different. At the very least, discussion of intonational correlations with affective meaning show that examples should be analyzed as they occur in individual speech communities, and in authentic contexts of interaction.

In summary, this brief examination of Halliday's model suggests that intonation choices should be interpreted independently and
uncoupled from grammatical categories and attitudinal labels in order to investigate their contribution to discourse.

Pierrehumbert & Hirschberg (1990)

This second more recent model has also been used in the comparative analysis of NS and NNS discourse (Wennerstrom, 1997, 1998). In agreement with Brazil, Pierrehumbert & Hirschberg propose an independent system, based only on phonological form, which assigns a primarily pragmatic function to intonation choices:

We propose that a speaker chooses a particular tune to convey a particular relationship between an utterance, currently perceived beliefs of a hearer or hearers and anticipated contribution of subsequent utterances. (1990: 271)

Unlike the tonal contour analyses discussed above, the model comprises a series of static tones or tonal targets that together with a series of phonetic implementation rules, determine the shape of the Fo contour. There are two groups of tones: pitch accents and boundary tones. There are six pitch accents (H*, L*, H* + L, H + L*, L* + H, L + H*) which occur on stressed or 'salient' syllables and mark the information status of the item. For example, high pitch accents mark the 'new' information on the following example:

The train leaves at seven

\[ H^* \quad H^* \quad H^* \] (p. 286)

The second group of tones are those that associate with the right edge, or closing boundary of either intermediate phrases, or intonational phrases (L%, H%). Phrases are identified by phonetic criteria and pausing. As the end of an intonational phrase is also the end of an intermediate phrase, this creates four possible 'complex' tones at the
end of an utterance. The following example exemplifies a typical declarative contour:

The train leaves at seven
\( H^* \quad H^* \quad H^* \quad L \ L\% \) (p. 286)

Final boundary tones also indicate whether a section of the discourse is complete (L.L%), or if further discourse is required for its interpretation (H.H%). Finally, a number of automatic phonetic implementation rules also apply. Two of the most significant are an upstep rule which raises a L% boundary tone after a H phrase accent, and a catethesis rule which causes a gradual declination of pitch across a phrase.

Many of the tonal combinations that are identified by Pierrehumbert & Hirschberg and the values attached to them bear a great deal of similarity to Brazil’s interpretations. For example, the following contour - an \( H^* \) pitch accent followed by an L phrase accent and a L% boundary tone - is said to "convey new information" in much the same way that Brazil’s proclaiming tone adds a new variable to the background:

Legumes are a good source of vitamins
\( H^* \quad L \quad L\% \) (p. 272)

If the L phrase accent is followed by a H% boundary tone, the contour becomes equivalent to Brazil’s mid termination referring tone which is synonymous with Pierrehumbert & Hirschberg’s gloss of "when S believes that H is already aware of the information, if S wishes to convey that it is mutually believed" (p. 290). The next example was spoken by a young woman who was asked after a movie if she liked it and is made up of both a H phrase accent and H boundary tone:
I thought it was good
\( H^* \quad H^* \quad H \quad H \% \) (p. 290)

This is glossed as 'I thought it was good, but do you agree with me?' and corresponds to Brazil's interpretation of the adjudicating value of high key ('I would like a yes/no response'). In a final example, the authors suggest the \( L^+ H^* \quad L H \% \) marks background information:

A: What about the beans? Who ate them?
B: Fred ate the beans
\( H^* \quad L \quad L + H^* \quad L \quad H \% \) (p. 296)

The gloss here is 'as for the beans, Fred ate them', and this fall-rise pattern corresponds to Brazil's referring tone for information already established in the discourse.

Final boundary tones also play a less defined, but similar role to Brazil's termination choices. For example, Pierrehumbert & Hirschberg suggest:

An \( H \) boundary tone indicates S wishes H to interpret an utterance with particular attention to subsequent utterances. An \( L \) boundary tone does not convey such directionality.

(p. 305)

An example of this is given below:

a. Attach the jumper cables to the car that's running \( L \quad H \% \)
b. Attach them to the car you want to start \( L \quad H \% \)
c. Try the ignition \( L \quad H \% \)
d. If you're lucky \( L \quad H \% \)
e. you've started your car \( L \quad L \% \) (p. 306-7)

With the operation of the phonetic implementation rules, phrases (a) - (d) end with a mid termination, and (e) ends with a low termination corresponding to Brazil's pitch sequence closure.
At this level of comparison, there is clearly a strong resemblance between the two models in their mutual conception of the function of intonation in discourse and some similarities in how these are realized by Fo values. Both also claim that only salient or prominent syllables make up the meaning-bearing elements of the contour, although P & H also account for the phonetic variations between these syllables. Finally, both also recognize that intonation structuring extends beyond individual tone units and that this is signalled by the final choice(s) made in the unit.

However, there are also some notable differences in the interpretation of phonological constructs and in the recognition of boundary tones, two of which are discussed below. In the P & H model, pitch accents apply to individual salient items, and an unlimited number of syllables can be stressed in any given intonational phrase; consequently, there is no discussion of the possible effect of multiple prominences. Returning to an earlier example, 'the train leaves at seven', the high pitch accents would be analyzed under Brazil's system as //the TRAIN LEAVES at SEven//, an utterance only likely to occur in a situation where someone is being particularly insistent: "you know the TRAIN LEAVES at SEven (and you're going to miss it unless you hurry up') and interpreted as a change in orientation as the speaker 'pronounces' the information. This level of interpretation is not discussed by P & H, as they are largely concerned with describing the status of individual items rather than the effect of prominence choices on the unit as a whole.
Finally, there is no discussion of phrase initial, left edge boundary tones. The boundary tones proposed by Pierrehumbert & Hirschberg only apply to the end of utterances, and there is no suggestion of the possibility of equivalent initial boundary tones. Consequently, there is no discussion of pitch concord, or of the possibility of a larger phonological paragraphs marked by both initial and final pitch values. While Pierrehumbert & Hirschberg do suggest that a low boundary indicates some kind of closure, they do not examine this issue any further. In summary, the interpretive model provided by P & H up to this point, offers less insight into the larger prosodic units currently being investigated in discourse.

Summary

This limited comparative discussion of two models of the intonation system in English emphasizes the importance of recognizing prosody as an independent structuring device interacting with, but not necessarily defined by, other language systems in the discourse. In addition, it highlights the importance of an interpretive system that can offer insight into the larger prosodic units currently being investigated in discourse. For these reasons, I conclude that Brazil’s model provides the most comprehensive and explanatory framework for the analysis conducted in this study.

Additions to Brazil’s Model

In this final section, I discuss two additions to Brazil’s original model that are used in the analysis presented in the following chapters. Both are included as they apply specifically to the data used in this study. They offer additional insight into the structuring of classroom
discourse by native speakers and incorporate previous findings regarding the prosodic features of typical nonnative speaker teaching discourse.

**Sequence Chains (Barr, 1990)**

In recent work that applies Brazil's model to the analysis of native speaker lecture discourse, Barr (1990) identifies a unit of intonation structure termed a *sequence chain*. Sequence chains formalize a group of pitch sequences. The opening boundary is indicated by the use of high key or one of the lecturing frames typically found in teaching discourse, i.e. OK, NOW, SO; and the sequence chain closes with a low termination:

> [The sequence chain] is above the pitch sequence and is defined as a string of pitch sequences such that the first pitch sequence and only the first sequence begins with a high key...Thus minimally, a sequence chain consists of a single high key-initial pitch sequence, but maximally, a sequence chain consists of indeterminate numbers of pitch sequences such that any non-initial pitch sequence is either mid/low key and therefore additive or equative to the previous one. (p. 11)

Barr suggests that sequence chain boundaries will begin with an introductory topic expression and are coextensive with the level of lecture organization found in the layout of prepared visuals such as overhead projections, the blackboard or handouts. Sequence chain boundaries may also parallel changes in *discourse plane* (Sinclair & Brazil, 1982); that is, shifts in the area of attention of the discourse such as a movement from talk about the content of the class to talk about the organization of the class. In the example below, a sequence
chain consisting of three pitch sequences marks a typical plane change.\(^8\)

Already

(7) /////p and i've MENTIONed/o what their MAIN decision IS///

/////it's this inVESTment//p in SHARES//o whether to BUY//o whether to SELL//p SHARES

/////o and i WANT to take that//r ARGument //p a STAGE FURTHER////

The boundary between this and the following sequence chain marks a change back to the content of the lecture:

CISion to in

(8) /////p the de VEST//

which is the beginning of another content chunk.

(Barr, 1990: 15)

As this study also investigates teaching discourse, I have decided to include an analysis of potential sequence chain structure. However, because of the particular style of classroom discourse examined here, there was a difficulty in applying Barr's criteria of co-occurring visual cues as support for sequence chain interaction with other levels of discourse organization. Barr's data consists of concept-based lectures where professors used a variety of prepared visual aids. The data in the present study are typical of the style of short prelab presentations given in introductory science laboratory classes (Jacobson, 1986). They

\(^8\) Pitch sequence boundaries are marked by '///' and sequence chain boundaries by '////'.

are much less formal in nature, and there are no accompanying prepared materials. TAs used only the blackboard as a visual aid, usually in a less systematic manner than might be found in a longer, more formal lectures. For these reasons, it was not possible to draw the same parallels between visual aids and SC structuring in the discourse.

In place of Barr’s original criteria, I have drawn on the transaction structure proposed by Coulthard & Montgomery (1981) and Shaw (1994) to investigate co-occurring cues at other levels of discourse organization. A transaction is a "chunk" of discourse containing a unifying topic and defined by prospective and retrospective markers at its boundaries. In an analysis of NS teaching discourse in university engineering and business and management classes, Shaw suggests that typical focussing markers include both verbal and non-verbal cues. For example, lexical phrases such as 'for the first part', micro-markers such as 'ok' and topic length pauses while the professor scans her notes or scans the audience. Shaw's analysis of the phonological structuring of transaction boundaries, however, is limited to a brief discussion of the use of rising or falling intonation on micro-markers. In this analysis I propose to unite both Barr and Shaw's findings and investigate the co-occurrence of phonological cues indicating sequence chain structure with transaction boundary cues. Places where these are coextensive are seen to be evidence of the speaker's intention to organize the discourse for the benefit of the hearer by providing a series of cues at different levels of discourse organization. Where Barr's original criteria do apply, their relationship to co-occurring transaction boundary cues as well as sequence chain structure is discussed.
In the example given above for instance, the high key lexical phrase 'I've already mentioned' is a prospective focussing marker. The high key on the lexical phrase unites cues at different levels of discourse to indicate a structural boundary related to a change in discourse plane. The same applies to the low termination on the retrospective marker 'I want to take that argument now a stage further.' Additional visual cues coinciding with the second sequence chain would be a possible further addition to the constellation of cues highlighting this boundary.

In summary, Barr's sequence chain structure formalizes a final level of intonation structure that can be incorporated into Brazil's original framework and provides further evidence of intentional use of the intonation system by the speaker organize the discourse.

Pause Analysis

The second addition is pause analysis, and is included in order to complete a comparison of the prosodic structure of NS and NNS data. In production and perception studies of pause boundaries in Dutch and English, Swerts & Gerlykens (1994) and Swerts (1997) found that pauses are longer for major than minor topic shifts and that longer pauses increase perception of boundary strength. Vaissiere (1983) suggests a universal tendency for pause defined units in spoken discourse, with pauses between sentences being longer than pauses within sentences. Analyses of nonnative speaker data show a qualitative difference in both placement and length of pauses which can materially affect the overall prosodic structure of the discourse. In a pilot study of two parallel lecture extracts, one given by an NS TA and the other by a Chinese
ITA, I found that pauses in the NNS data were both longer and more erratic than those in the NS data and tended to regularly break up conceptual units.

In agreement with Rounds (1987) my data were also characterized by empty pauses, regular moments of silence unrelated to boardwork or for dramatic effect, which Rounds suggests artificially increase the amount of silence in the discourse, creating a negative perception of the ITA. In light of these differences in pause structure between NS and NNS TAs, and its potential to disrupt the overall prosodic structure of the discourse, as well as the use of pauses to cue transaction boundaries, I decided a principled discussion should be included in the present analysis. Brazil does not elaborate on pause patterns apart from noting that they may and frequently do coincide with tone unit boundaries; however, one group of researchers (Brown, 1977; Brown, Currie & Kenworthy, 1980; Brown & Yule, 1983) has developed a model identifying pause defined units in discourse. They identify three major groups: pauses of 0.8 seconds or longer constitute topic boundaries and "clearly coincide with major semantic breaks" (p. 56). These are called topic pauses. The second group vary between 0.6 and 0.8 seconds and are referred to as substantial pauses which tend to coincide with single contours. The third and final set, very short pauses, vary between 0.2 seconds and 0.4 seconds and are identified as a 'sub-set of the contour pauses'. This final group frequently co-occurs with incomplete syntactic
structures. This model will be taken as a first approximation for pause analysis in the data.  

Conclusion

The model outlined in this chapter allows the analysis and interpretation of pitch movements over time within a principled framework uniting both the form and function of intonation in English. It proposes a hierarchical system of prosodic units which together provide an independent layer of structure to the discourse and contribute to the pragmatic message contained within the discourse as a whole. The identification and interpretation of phonological paragraphs, and their interaction with other levels of discourse organization is a relatively recent undertaking; however, it is clearly a potentially powerful organizational tool used by speakers in their production and interpretation of discourse. Lastly, in providing a comprehensive framework with which to describe the intonation structure of native speaker discourse, the model offers a way to undertake a systematic comparative analysis of prosodies in nonnative speaker discourse. Figure 2-1 summarizes the systems proposed in Brazil's model.

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These researchers are working with spontaneous speech not lecture discourse, and different genres can affect prosodic patterns such as pause structure (Crystal & Davy, 1969).
DISCOURSE

/////SEQUENCE CHAIN////
Pitch defined conceptual units bounded by a high key or 
lecturing frame and low termination

/////PITCH SEQUENCE///
Pitch defined conceptually related units bounded by two 
low tonic syllables

/////TONE UNIT////
Pitch defined units, may coincide with syntactic/pause 
boundaries. Each unit contains 1 or 2 prominent syllables

TONIC SEGMENT

ONSET
Key choice

Low key: Equative
Mid key: Additive
High key: Contrastive
   Particularized

TONIC SYLLABLE
Termination & tone choice

O tone: neutral
P/P+ tone: new content
R/R+ tone: recoverable content

Figure 2-1. A Model of Discourse Intonation (Brazil, 1997; Barr, 1990)
CHAPTER 3
METHODOLOGY

Database

This chapter describes the procedures used in the collection and analysis of the data investigated in this study. More specific information regarding individual teaching presentations will be given at the beginning of each section of the analysis.

The study is based on 56 minutes of data from teaching presentations given by 16 male teaching assistants teaching introductory labs in chemistry, physics, and electrical engineering and a pre-calculus math discussion section. The TAs represent three language groups: native speakers (NS), non-native speakers (NNS) and speakers of an indigenized variety of English (IVE) (Sridhar & Sridhar, 1992), and Indian English (IES) as shown in the table below.

The groups of nonnative and Indian international teaching assistants (ITA) were chosen based on their score on the ETS SPEAK test and their language backgrounds. All ITAs received 45-50 on the SPEAK am, which categorizes the speakers' communication skills as "somewhat to generally effective" in terms of the ETS guidelines. ITAs with overwhelming problems in one area of linguistic skill such as segmental pronunciation were not included. All the ITAs were the sole instructor responsible for their lab or discussion section and were recorded in their first semester of teaching. The six nonnative TAs were from mainland China, and their first language was Mandarin.
Table 3-1. Teaching Assistants

<table>
<thead>
<tr>
<th>TEACHING ASSISTANTS</th>
<th>NUMBER</th>
<th>NUMBER OF MINUTES</th>
<th>NUMBER OF TONE UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATIVE SPEAKERS: NORTH AMERICAN TAS</td>
<td>6</td>
<td>22</td>
<td>634</td>
</tr>
<tr>
<td>NONNATIVE SPEAKERS: CHINESE</td>
<td>6</td>
<td>20</td>
<td>530</td>
</tr>
<tr>
<td>IVE SPEAKERS: INDIAN</td>
<td>4</td>
<td>14</td>
<td>438</td>
</tr>
</tbody>
</table>

Chinese. The four Indian TAs were from both North and South India and their first languages are Tamil (1), Urdu (1), and Bengali (2). These TAs also spoke Hindi and a number of local Indian languages to varying degrees of competence and were educated in English medium schools from an early age. Native speaker TAs were contacted through the supervisors of the courses in question. All the TAs in this native speaker group were described as "relatively experienced" but none were specifically described as "model" TAs.

Where possible, the 16 TAs were recorded on the same day or in the same week in order to compare parallel teaching presentations. This was possible in all but two cases, and parallel discourse extracts are shown on the table below. The two presentations with no parallels are marked with an asterisk. The data represent a cross-section of typical functions performed by TAs in these prelab presentations, including giving theoretical background to the experiment, reviewing homework, explaining relevant terms or equations and demonstrating experimental procedures (Jacobson, 1986; Axelson & Madden, 1994).
Table 3-2. Teaching Presentations

<table>
<thead>
<tr>
<th>SUBJECT</th>
<th>TOPIC</th>
<th>PARALLEL PRESENTATIONS</th>
<th>TEACHING ASSISTANTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry</td>
<td>Unknown Analysis</td>
<td>3</td>
<td>1 NS TA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 NNS TAs</td>
</tr>
<tr>
<td></td>
<td>Thin Layer Chromatography</td>
<td>2</td>
<td>1 NS TA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 NNS TA</td>
</tr>
<tr>
<td>Physics</td>
<td>Torques and Forces in Equilibrium</td>
<td>4</td>
<td>2 NS TAs</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 NNS TA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 IES TA</td>
</tr>
<tr>
<td>Math</td>
<td>Exponential Growth and Decay</td>
<td>3</td>
<td>1 NS TA</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2 NNS TAs</td>
</tr>
<tr>
<td>Electrical</td>
<td>Drawing a Bode Plot</td>
<td>2</td>
<td>1 NS TA</td>
</tr>
<tr>
<td>Engineering</td>
<td></td>
<td></td>
<td>1 IES TA</td>
</tr>
<tr>
<td></td>
<td>*Ideal and Practical Diodes</td>
<td>1</td>
<td>1 IES TA</td>
</tr>
<tr>
<td></td>
<td>*Using the PALasm Program</td>
<td>1</td>
<td>1 IES TA</td>
</tr>
</tbody>
</table>

Data Collection & Analysis

The data were recorded in the classroom on audio and videotape using a Sony TCD-D8 Digital Audio Tape-corder, a Sharp VL-L490U VHS Camcorder, a Telex FMR-150C Wireless system, and a Telex SCHF745 Headset microphone. The wireless sound system and headset microphone allowed the TA complete freedom of movement while the researcher remained at the back of the room with the sound and video equipment. This method of collection produced high quality sound and video recordings appropriate for instrumental analysis, without the problems typically associated with natural data collection in a classroom. DAT recordings were transferred to a Kay Elemetrics Model 4300
Computerized Speech Laboratory (CSL), and fundamental frequency (Fo) traces were computed for all the data using the pitch extraction function of the CSL at a rate of 10,000 samples per second.

All data were subjected to both auditory and instrumental analysis. Brazil's original model was based on auditory analysis, and his published work includes only a few examples of oscilloscope traces produced in the laboratory. Although a number of analyses of natural data using the model have since been published (e.g., Hewings, 1990) none of these have included any discussion or presentation of instrumental work. As is true of any model where a fit is attempted between theoretical categories and actual data, particularly where this involves gradient characteristics, the researcher must make numerous decisions regarding whether a given phonetic realization constitutes a variation within one category or a change of category. The addition of instrumental evidence provides a permanent visual record of the basis for these decisions and addresses the issue of internal reliability, i.e., "the degree to which other researchers given a set of previously generated constructs would match them with the data in the same way as the original researcher" (Edge & Richards, 1998: 9). For these reasons, Fo traces have been included in the analysis as pictorial representations of the constructs proposed in the model and to show how gradient Fo movements have been analyzed.¹

Some examples from this data set are given below to show how typical transcription choices were made. The diagrams are printed out

¹ Precedents for using both auditory and instrumental analysis to investigate intonation structure in discourse can be found in Watt (1997) and Schuetze-Coburn, Shapley & Weber (1991).
directly from the CSL and show amplitude and Fo readings from portions of these data. Pitch level and movement are indicated by the dotted lines in the lower box on the diagram (marked PITCH). Voiceless segments cause breaks in the Fo contour, and the articulation of both voiced and voiceless obstruents can cause noise which results in pockets of random dots at a higher frequency than the actual Fo contour (see, for example, Figure 3-2). Figures 3-1, 3-2 and 3-3 contain samples of key and tone choices and Figures 3-4 and 3-5 show examples of hesitation markers. Momentary coding problems causing false starts, hesitation markers, filled pauses and so on are typical characteristics of spontaneous or partially planned speech. In agreement with Hewings (1990), I continued to use Brazil's conventions to transcribe these features. For example, prominent hesitation markers such as the one shown in Figure 3-5 were transcribed as level 'o' tones. Finally, several of the speakers in the data set occasionally exhibited creaky voice or vocal fry. As shown in Figure 3-6, the pitch extraction function of the CSL was unable to read this data. In these cases, auditory analysis was used for transcription decisions.
Figure 3-1. An Example of the Transcription of Key Choices in a Series of Adjacent Tone Units. a) The first tone unit begins with a low key choice on 'question', and moves up to a mid termination on 'three'; b) The second tone unit consists of a mid key marker 'ok'. The following unit begins in a high key on 'find'.

FIND the HALF LIFE of UH; /
//ok//
Figure 3-2. An Example of the Transcription of Key and Termination Choice in a Single Tone Unit. 'Exponential' and 'growth' are transcribed as high and mid key prominences. This is followed by a low termination on 'decay'.

Figure 3-3. An Example of the Transcription of P Tone Choices. There is a rise-fall P+ tone on 'when', followed by a falling P tone on 'balance'. 
Figure 3-4. An Example of the Transcription of a Short, Non-prominent Hesitation Marker 'uh' at the Beginning of the Tone Unit.

Figure 3-5. An Example of the Transcription of a Prominent Hesitation Marker. This long hesitation marker 'uh' is transcribed as a level tone.
Figure 3-6. An Example of the Effect of Creaky Voice. There is no clear Fo contour for the phrase 'because it'll be balanced' as the CSL is unable to effectively read the data.
Transcription Conventions

All data was transcribed according to Brazil’s transcription conventions with the addition of the conventions used by Barr (1990) to indicate sequence chains, and my own to indicate pause structure. A summary of these is given below:

Onset Syllable: YES
Tonic Syllable: YES
Pause boundary: //
Length of pause: [ ]
Pitch Sequence boundary: ///
Sequence chain boundary: /////
H: high
M: mid
L: low
{ } key & termination choices
Tones: p, p+ proclaiming tones
       r, r+ referring tones
       o neutral/level tone

In order to simplify the reading of the examples used in the text, some transcription features have been excluded if they are not immediately relevant to the discussion.
CHAPTER 4
ANALYSIS OF NATIVE SPEAKER DATA

Introduction

This chapter presents the analysis of the native speaker (NS) data. The analysis shows evidence of a systematic and independent use of prosody by the speakers in this sample, which supports both the structure and interpretation of intonation in discourse proposed by Brazil. Choices within the systems of key, termination and tone are consistent with the hypothesis that the teaching assistants intentionally use intonational cues both to mark structural boundaries in the discourse and to negotiate a common ground with their students. The analysis also suggests that intonation structure consistently interacts with other levels of discourse organization, and that prosodic cues operate in conjunction with other structural cues to assist the listener in the interpretation of the discourse message. Based on these results, it is argued that intonation choices should be viewed as interactive in nature, i.e., organized for the benefit of the hearer and as contributing independently to the overall comprehensibility of the discourse.

The results of the analysis are divided into three areas of intonation structuring: sequence chains, pitch sequences and discourse markers, and lastly, tone choice and orientation. The chapter begins with a more detailed description of the data included in the native speaker group.
Native Speaker Data Set

A summary of the NS data set is given below, followed by a brief description of the content of each of the teaching extracts:

Table 4-1. Summary of NS data

<table>
<thead>
<tr>
<th>LAB/DISC. SECTION</th>
<th>NATIVE SPEAKER</th>
<th>TIME</th>
<th>NUMBER OF TONE UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEMISTRY</td>
<td>MK</td>
<td>4 MINS</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>SN</td>
<td>4 MINS</td>
<td>113</td>
</tr>
<tr>
<td>PHYSICS</td>
<td>KN</td>
<td>4 MINS</td>
<td>141</td>
</tr>
<tr>
<td></td>
<td>LE</td>
<td>4 MINS</td>
<td>100</td>
</tr>
<tr>
<td>ELECTRICAL</td>
<td>BD</td>
<td>4 MINS</td>
<td>109</td>
</tr>
<tr>
<td>ENGINEERING</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH</td>
<td>BL</td>
<td>2 MINS</td>
<td>71</td>
</tr>
</tbody>
</table>

**MK.** The opening of a chemistry prelab presentation. The students are about to begin an unknown analysis for which they first have to complete and hand in a scheme, i.e., a plan of how they will conduct the analysis. The TA is reviewing the procedures that should appear in the unknown analysis scheme.

**SN.** The opening of a chemistry prelab presentation. The students are beginning a Thin Layer Chromatography experiment. The TA is demonstrating the procedures and equipment the students will use.

**KN.** The opening of a physics prelab presentation. The students are conducting an experiment investigating torques and forces in equilibrium using a meter stick and some weights. The TA is explaining the procedures, the physics equations the students will be testing, and
pointing out a potential confusion the students may encounter near the end of the lab.

**LE.** The opening of a physics prelab presentation. The students are conducting the same torques and forces experiment as in (KN) above; however, in this extract, the TA is reviewing a question the students had difficulty with in the prelab homework.

**BD.** This extract comes from the middle of a 45-minute prelab lecture the course supervisor asked the TAs to give in electrical engineering. Students are about to conduct an experiment testing a mathematical equation that relates input to output voltage. One subtopic was chosen, in which the TA explained how to plug the experimental results into the equation, and graph these findings using a Bode Plot.

**BL.** For the pre-calculus math discussion sections, students complete a set of problems for homework prior to the class. Students then choose a number of these problems they would like the TA to review on the board. In this extract, taken from the middle of the class, the TA reviews a question from a section on exponential growth and decay. Each problem is presented as a complete discourse event bounded by long pauses as the TA erases calculations from the board, checks the next question in the textbook and so on. Therefore, presentation of one problem only was chosen for this analysis.

**Sequence Chain Structure**

The reader will recall that the sequence chain (SC) structure proposed by Barr (1990) suggested that larger prosodic units bounded by a high key or lecturing frame and a low termination could be found in teaching discourse. Her analysis also proposed that SCs coincided
with shifts in discourse plane and the layout of prepared visuals such as overheads or handouts. As noted in the previous chapter, due to the lack of prepared materials in these prelab presentations, this analysis will focus on co-occurrence with plane changes and transaction structures.

Sequence chain structure was readily identifiable in the data set analyzed here. There were 36 SCs in total\(^1\) (between 5 and 9 SCs were found in each extract). 15 of the SC openings began with a mid or high key lecturing frame such as //SO//, //oK// or //NOW// and the remaining with a high key. SCs closed with a low termination on a content word or a structural discourse marker such as //oK//, and in one case (discussed below in Figure 4-2) a low key filled pause. The length of SCs varied between 12-25 tone units across speakers and typically consisted of a focusing boundary or frame in one tone unit followed by a number of tone units containing a topic expression and development and a final tone unit or small group of units forming a closing boundary. SC boundaries did coincide with changes in discourse plane, and the majority were clearly coextensive with transaction boundaries denoted by other non-prosodic criteria.

Typical examples of SC structures coextensive with shifts in discourse plane are illustrated in Figures 4-1, 4-2, and 4-3. Figure 4-1 shows the final tone units of the first SC in MK's presentation and the opening tone units of the second. The SC boundary separates the first part of the presentation concerned with the organization of the class.

\(^1\) The final SC in MK and SN were not analyzed in their entirety as they were very long. In both cases, I stopped the transcription at a low key pitch sequence boundary.
from the presentation of the main content 'for our unknown, we have
seven ions we have to test for'.

Figure 4-1. Co-extensive Sequence Chain and Plane Change Boundary in
MK’s Presentation.

Figure 4-2 shows a series of two adjacent sequence chains from
LE’s transcript. The first SC begins with a high key focusing
expression 'so you guys had problems with the prelab right', followed
by LE reading aloud the problem question. This SC closure is the only
example in this data set of a low key filled pause being analyzed as a
SC boundary (note the mid key choice on 'zero'). Support for this
analysis is found in a number of co-occurring cues such as the shift in
discourse plane as LE moves to the blackboard to explain the problem
('the way this thing goes is'), the topic length pauses either side of
the filler and the behavior of the TA who clearly scans the audience
before moving toward the blackboard. Finally, figure 4-3 illustrates a
shift in discourse plane and co-occurring SC boundary as KN moves from talking about the content to initiating a direct exchange with the students.

Figure 4-2. Coextensive Sequence Chain and Plane Change Boundary in LE's Presentation.

Shifts in discourse plane occur frequently in the classroom as the teacher moves from 'telling something' to 'talking about telling something' or to 'asking something', and the sequence chain structuring illustrated above increases boundary strength at these points in the discourse.

Turning now to the co-occurrence of sequence chains with transaction structures, there was a marked correspondence between SC
boundaries and a constellation of cues marking a transaction boundary. 24 of the 34 complete sequence chains were also marked as transaction boundaries and coincided with both prospective and retrospective marking by non-prosodic means. A further four SCs coincided with the kind of shift in discourse plane illustrated in Figure 4-3. The six remaining SCs co-occurred with either prospective or retrospective marking. Transaction boundary cues were identified using Shaw's (1994) criteria, and a brief description of the examples found in this data set is given below.

The most typical of the 28 prospective markers found in the data were high or mid key lexical phrases (10)  

FIRST thing you wanna do is//  // the  
the WAY this thing  // GOES IS//  
THIS  //in case//

Figure 4-3. Coextensive Sequence Chain and Plane Change Boundary in KN's Presentation.
or high or mid key lecturing frames (15) such as: //SO//, //OK//, or //NOW//. In three cases, the boundary was marked with a non-prominent //ok//, followed by a high key topic statement.

The 29 retrospective markers found in the data were divided fairly evenly between recapitulation statements (7) in a mid or low key with a low termination:

//that's just a sorta explanation of the FIRST QUESTION //
//so that's the BAsic gist of the LAB//

or lexical micro markers (11) such as //OK// and //SO// in a low key. Speakers also used topic length unfilled pauses accompanied by a preceding low key choice (10) as they scanned the audience and the board.²

Figure 4-4 illustrates coextensive transaction and sequence chain boundaries. This shows a series of two adjacent sequence chains and the beginning of a third from SN's presentation, in which the structural markers separate a series of instructions given to the students concerning the equipment they will be using for the experiment. The first SC begins with two prospective focussing markers in a high key 'ok for TLC you're gonna need several pieces of equipment' and 'first off', and the final transaction and sequence chain boundary co-occur with the recapitulation 'you're gonna make your own little developing chambers' ending in a low termination and accompanied by a topic length pause. The second SC, as SN moves from discussing the developing chamber to the chemical solvent, is marked with a non-

² The final case is the filled pause in LE's transcript discussed above.
prominent focussing marker and a high key 'ok the solvent you're gonna use'. Again, this ends in a recapitulation 'so it's there if you forget what solvent system to use', ending in a low termination.

As with the shifts in discourse plane, the constellation of cues provided by the co-occurring transaction and SC boundaries indicate places of maximal disjunction in the discourse, i.e., points where the language organization binding one group of pitch sequences or tone units is completed.

Regarding Barr's original criteria based on prepared visual materials, there was one teaching presentation (MK) in which 'real-time' boardwork always coincided with a new SC boundary and was used to emphasis structural boundaries. This is shown on Table 4-2. In the five other presentations in this data set, while SC junctures frequently marked a change in teacher activity such as writing on the board (see, for example, Figure 4-2), boardwork illustration was used to exemplify items described in the discourse such as particular equations or diagrams of equipment rather than to additionally mark structural boundaries in the discourse. As noted earlier, there were six SC structures in the data that did not coincide with both prospective and retrospective transaction boundary markers and exemplified two further features of typical classroom discourse. First, the kind of teaching presentations found in this data are examples of partially planned spoken discourse that is subject to the effects of 'online production' such as hesitation phenomena and repairs. Figure 4-5 shows BD initiating a repair structure from the low key 'take the mag(nitude)' to the high key 'take the twenty log of the magnitude' which then begins
TLC you're gonna need SEveral// [0.68] //p pieces of
OK for
FIRST OFF// [0.17]
EQUIPMENT// [1.2] //p OK /o o you're gonna
NEED one of your two hundred and FIFTy milliliter BEakers//
/p and one of your WATCH GLASSES// [0.5] //ok this is gonna be
now your dEVeloping CHAMber for the// [0.45]
/o UM// [0.74]
/p TLC// [0.57] //p you're gonna make your OWN little developing
SOLvent you're gonna
///p OK the
CHAMbers/// [1.14]
PLATES// [3.6] //p is ethoLAcetate// [2.4] //r and
deVelope the
this IS in the NOTES// [0.4]
/p SO// [0.82] //p it’s THERE if
you forget what SOLvent system to
///p OK//
USE/// [0.82]

Figure 4-4. Coextensive Sequence Chain and Transaction Boundaries from SN's Presentation.

a new sequence chain. In this case, it is not clear whether the SC
opening is an intentional structural boundary or a result of a rise in
key typical of repairs initiated by a speaker to ensure correct
Table 4-2. Visual Cues for Sequence Chain Structure in MK's Presentation

<table>
<thead>
<tr>
<th>OPENING TONE UNITS OF 3 SEQUENCE CHAINS (MK)</th>
<th>BOARDWORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>//but FOR our unKNOWN we HAVE em// SEven ions we have to TEST for//</td>
<td>Na+, K+, Nh4+, OH-, NO3-, Cl-, H2SO4-</td>
</tr>
<tr>
<td>//one of the FIRST things that we did was a FLAME TEST//</td>
<td>1. Flame test</td>
</tr>
<tr>
<td>//the SEcond set of TESTS we did was that cobaltinitrate TEST//</td>
<td>2. Colbaltinitrate test</td>
</tr>
</tbody>
</table>

interpretation of the message (Cutler, 1983). Earlier in his presentation, BD has already made it clear that it is important that the students remember to take the twenty log of the magnitude, suggesting that this is may be the reason for this particular high key choice. As Sinclair & Brazil (1982:31) note, spoken discourse is made in real-time, and many different considerations can lead to occasional ambiguous or indeterminate utterances.

The five remaining SCs coincided with activities outside the text itself. In a typical classroom setting, there are a variety of activities that accompany the presentation of the informative content. These are described by Coulthard and Mongtomery (1981) as forming a paradiscourse subtext. Paradiscourse includes activities directly related to the content such as boardwork and demonstrating equipment and

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3 The second sequence chain in BD's presentation focuses on this point: 'The reason they have the twenty log times the magnitude of the function is because whenever you take the log of something, instead of multiplying you can just add'.

Figure 4-5. A Sequence Chain Boundary Following a Repair Structure in BD’s Presentation.

more incidental actions such as opening windows or asides commenting on the lack of chalk or an eraser. Coulthard & Montgomery suggest that these actions can also shape features of the discourse text, particularly prosodic organization.

In this data, the five SCs which did not co-occur with transaction boundaries were directly related to this paradiscourse subtext. A typical example of the interaction between a procedural aside related to the boardwork and SC structure is shown in Figure 4-6 from MK’s presentation. The first SC boundary coincides with the prospective marker and topic statement ‘alright, the second set of tests we did was that colbaltinitrate test’. This is followed by a combined pause of more than seven seconds while he writes this on the board and adds the chemical notations. It closes with a low terminating procedural aside ‘I think that’s right’ directly related to the equation he has written on the board. The high key on ‘remember’ signals the end of this aside and technically begins a new SC although this is clearly the same topic.
SEC- SEond set of TESTS we did was

that cobaltINtrate //r+ i THINK that’s

right// [0.55] //er// [0.66]

DID that it WAS a it formed a yellow preCIpitate for both er

aMMOnium// [0.92]
poTAssium and

---

Figure 4-6. An Example of the Typical Interaction between a Procedural Aside and Sequence Chain Structure from MK’s Presentation.

Figure 4-7, taken from SN’s presentation, shows a high key on ‘pour it in there’ after a low terminating aside directly addressed to the students regarding the chemical he is using in the demonstration, ‘this is not etholacetate, don’t use it’. Again, although this technically begins a new SC, the topic is clearly a continuation of his discussion of the etholacetate solvent. Interactions with the paradiscourse subtext occur throughout the presentations in this data set and affected all levels of prosodics structuring investigated here (sequence chains, pitch sequences and tone units).

These examples highlight the interactive nature of discourse organization and the need to take into account different levels of structuring on a moment by moment basis in order to give a principled account of any one level. When viewed in conjunction with the
paradiscourse subtext, key changes which resulted in SC structuring apparently unmotivated by co-occurrence with transaction boundaries or obvious shifts in discourse plane could be reasonably explained and, presumably, reasonably interpreted by the hearer(s).

Summary of Sequence Chain Structure

The analysis of sequence chain structure found in the NS data suggests that this unit of prosodic organization is used consistently by the TAs in this sample to organize the discourse for the benefit of their students. Points of maximal disjunction in the prosody bounded by high key or lecturing frames and low termination were matched by a number of other focussing boundaries which together operated to divide the discourse into a series of "chunks" usually coinciding with topic boundaries.

| H | TAKE the ethoLAacetate this is |
| M | ///p o r+ then NOT ethoLAacetate |
| L | |
| H | ////p POUR it in |
| M | THERE/ [1.0] //so it |
| L | DON'T USE it// [3.47] |
| H | JUST// [0.05] //o COvers the |
| M | BOTtom and you've got MAYbe// [0.5] |
| L | |
| H | ///p r+ OH a CENtimeter or SO// [0.5] ///p or a little bit LESS than a |
| L | |
| H | M centimeter of SOLvent on the |
| L | BOTtom// |

Figure 4-7. An Example of the Typical Interaction between a Procedural Aside and Sequence Chain Structure from SN's Presentation.
Prosodic structuring of sequence chains was also shown to reflect the online nature of spoken discourse production and a close relationship with the paradiscourse subtext which forms an integral part of classroom discourse. For the purposes of this analysis, intonational features have been discussed largely independently of lexical content; however, it is clear in the majority of cases that lexical content and choice of key support each other, particularly in the kinds of high key lexical phrases that are often used to open transactions and the low key markers that signal their completion.

One final point should be made about the interaction of SC structuring and topic structure in particular. As noted by Levelt (1989: 385) in a discussion of intonational phrases which I think applies equally well here, "[A] break decision is under the speaker's executive control". The speaker's intent can outweigh any other considerations and will create exceptions to any patterns that can be established in the data. A typical example is shown in Figure 4-8. This is the only example in this data sample where SC structures extended no further than a focusing boundary and a topic expression. The opening of BL's

```
H ///p oK/// [0.7] ///p E.Xponential
M GROWTH and deCAy/// [3.4]
L
```

Figure 4-8. Two Short Sequence Chains Coextensive with Topic Pronouncements from BL's Presentation.
presentation is divided into two topic announcements. First the overall topic of the section 'exponential growth and decay', and then the subgroup this problem is part of 'this is exponential growth'. Each SC acts, in effect, as a 'pronouncement' of the topic using proclaiming tones and lecturing frames. The choice to present the information in this way creates an unusual series of short sequence chains compared to the rest of the data in this sample. However, it is likely that were more data analyzed, equivalent exceptional cases would be found. Examples such as this reflect the independent nature of intonation structure which need not be defined by other levels of discourse organization. Speakers may choose to exploit any part of the system within the given parameters.

**Pitch Sequences and Discourse Markers**

This section is divided into two parts. The first part will focus on the pitch sequence (PS) structure found in the data and the relationship between PSs and their internal tone unit structure. The second part examines discourse markers, and particularly, the speaker's choice of key on these markers and how this interacts with pitch sequence closure.

**Pitch Sequences**

Pitch sequences consist of a group of tone units bounded by low termination choices. The number of pitch sequences per sequence chain varied quite widely both within and between speakers (between 1-12 pitch sequences per sequence chain); internally, PSs ranged in length from one tone unit containing a low key marker such as //oK// to longer pitch sequences containing a number of tone units. This
variation meant that quantitative comparisons were not as productive as a qualitative analysis of the kinds of information typically associated with pitch sequence structure and how this was reflected in choice of key. To exemplify this, I have used Coulthard and Montgomery's (1981) classification of classroom content.

Coulthard & Montgomery (1981) divide classroom discourse into two overall types of content: main and subsidiary. Main discourse consists of the informative content of the presentation, and it may be interspersed with various kinds of subsidiary content such as the comments relating to the paradiscourse subtext that were discussed in the previous section. The category of subsidiary content subsumes a variety of teaching purposes from short glosses or asides that enlarge upon, exemplify or recapitulate informative content, to much longer chunks of discourse concerned with the organization of the class.

A typical example of this kind of subsidiary content is illustrated in Figure 4-9. This figure shows the first sequence chain in MK's presentation, which is made up of subsidiary content, followed by the beginning of the second sequence chain, which marks the boundary between this and the beginning of the main discourse, or informative content 'for our unknown we have seven ions we have to test for'. The first PS can be glossed as "getting the students attention" by first framing and focussing a topic expression 'Ok, begin about today', and then adding a mid key 'invitation' to the students to gather round the board. The second mid key pitch sequence adds further subsidiary content described by Coulthard and Montgomery as a gloss, i.e., a comment on previous information often containing an attributive term; in
this case 'it's a great time to see if you like it'. The following mid key unit consists of a procedural aside to check the students are ready to begin the unknown. A high adjudicating key is used for the yes/no question 'everybody has made it up to at least section 4 on lab 2?' and this is followed by a mid key repetition. This pitch sequence ends with the low key aside 'except for you'. MK's use of equative low key reflects both the parenthetical nature of the comment which is addressed to one student in particular rather than the whole group, and that he is evidently aware that this student is behind the others based on his nonverbal reactions. As is typical following a low key aside, MK raises the key of his next tone unit which opens a new pitch sequence directed back to the group as a whole. The final pitch sequence ends the direct exchange with the students using a typical concurring response 'good' given in a mid key and a falling tone, and adds a final comment regarding what MK will cover in his presentation. Immediately after this pitch sequence closure, MK opens the new sequence chain marking a shift in discourse plane from class organization to class content. Within the first sequence chain, the PS structure marks the boundaries between 'talking about telling' and 'asking' and further distinguishes between comments directed to one student and to the group of students as a whole.

This extract is the most complex example of relationships between different kinds of subsidiary content and PS structure found in the data. More frequently, pitch sequence boundaries separated one piece of subsidiary content from the main content surrounding it as shown in Figure 4-10. In this sequence chain from SN's presentation, there are
two pitch sequences. The first begins with the high key focussing marker 'now the first thing you wanna do' as he begins telling them how to mark the TLC plate. The main content continues until the tone units containing 'and there's rulers in the stockroom'. This second unit ends with a low terminating aside 'and I don't have a pencil with me' as SN realizes he does not have a pencil to demonstrate exactly what the students should do. This closes the pitch sequence and SN then rises to a mid key to complete the informative content. The mid key choice reflects the continuation of the topic, i.e., 'the first thing to do with your plate is to mark it' which was cut short by the aside.

A connection between pitch sequence closures and low key equative asides mirroring boardwork was also a consistent pattern and on several occasions, two low terminations marked the boundaries of a "paradiscourse" unit, i.e., a unit of structure consisting solely of boardwork. Figure 4-11 shows an example from BD's presentation where there were several extremely long pauses (close to 60 seconds) while he wrote on the blackboard. The low termination following the boardwork functions as a final boundary cue and is followed by a new sequence chain marked by a lecturing frame.

A final pattern that emerged from this data was groups of low key units directly following each other forming a series of separate pitch sequences. This pattern is not discussed in Brazil's work or that of his colleagues. Brazil (1997) suggests that "pitch sequences having initial low key tend to be short, often amounting to no more than one tone unit in length" (p. 124). While this is mostly true of the low key PSs in this data, particularly in their most common use to mark procedural
K em// p r beGIN about today i'm just gonna go over our

unknown anAlysis SCHEME// p cos it'll BEnefit anybody who's going
to need to be WORKing on it// pp so if you wanna gather ROUND
gonna do it up here on the HAVE ONE it's a BOARD/// // p p if you
great time to check to see if you // p o o r uh before i LIKE it///
Everybody has START MADE it up to at LEAST section FOUR on lab
tWO everybody's made it at LEAST that

FAR RIGHT// p eXCEPt for // r p section FOUR everybody's there YOU///

GOOD/// p that's about as FAR as it's NEcessary///

cos i'm BAseically only gonna go over our POsitive IONS//

Figure 4-9. An Example of the Interaction between Main and Subsidiary Content and Pitch Sequence Structure from MK's Presentation.
FIRST thing you wanna \WITH your tlc

NOW the DO\PLATE

HOPEfully you’ve got a PENcil\r+ o alRIGHT and they’ll there’s

RUlers////p r in the STOCKroom and i don’t have a PENcil with ME////

MARK// p at least a ONE

but what you wanna DO is you wanna

centimeter LINE//p down the BOTtom of this PLATE////

Figure 4-10. An Example of the Interaction between Pitch Sequences and Low key Subsidiary Content from SN’s Presentation.

EM let’s SEE// [45 seconds - boardwork] //p ok////

Figure 4-11. A Paradiscourse Unit Consisting only of Boardwork from BD’s Presentation.

asides, several times in the data an extended pattern of low key initial units was found which was unrelated to the paradiscourse text. Examples are given in Figures 4-12 and 4-13. Figure 4-12 shows the second sequence chain in BD’s presentation. The first sequence chain contains the topic announcement and a definition of a Bode Plot:

The Bode plot’s just a plot of the twenty log of the magnitude of the frequency response against omega.
The next sequence chain, shown here, marks a shift in discourse plane (i.e., a shift in the area of attention of the discourse) as BD talks about what the presentation will cover. It begins with a lecturing frame and focussing marker followed by an mid key enlargement 'we're just gonna

![Figure 4-12. A Series of Low Key Pitch Sequences from BD's Presentation.](image)

learn how to plot simple Bode Plots’. The prominence choice on 'simple' projects an existential paradigm in which 'simple Bode Plots' contrast with other types of Bode plot. The series of low key units that follow confirm this paradigm. The sequence of mid and low key units can be loosely glossed as: 'I've told you we are going to look at simple Bode Plots today, and I assume you understand that this means there are other kinds of plots, but I will repeat this already understood assumption now'. The low key units consist of this reformulation and a
low key gloss 'that are a little bit more complicated, not much'. When the focus returns to the main content, i.e., what the students will need for this lab, BD rises to a mid key 'for this lab, this'll do'.

Figure 4-13 shows a similar kind of reformulation in a series of low key units from BL's presentation. The sequence chain begins by describing one of the three variables the students will use to solve the equation (hence the use of the high key to distinguish \( R \) from the other two) and the definition of this variable constitutes one pitch sequence. The following PS begins in a mid key, enlarging on the first 'it's getting bigger' and providing a specific example 'you're getting more money'. This is followed by a series of low key units that personalize the previous example 'you want that, you want more money'. As in BD's extract, when BL returns to the main content, i.e., the distinction between a positive and negative \( R \), he moves to a mid key.

In summary, this analysis showed that speakers' made key and termination choices that created pitch sequence structures which were related to each other within sequence chains, and internally between tone units. PS structure emphasized the boundaries between main and subsidiary content and demonstrated a similar kind of relationship with other levels of organization as that seen in sequence chain structuring.

**Discourse Markers**

The analysis of pitch sequence structure also highlighted the speakers' use of discourse markers; particularly, what have been called frames or micromarkers such as *SO, NOW, OK*, rather than the longer
lexical phrases also used to mark transaction boundaries. In analyses of

---

**Figure 4-13. A Series of Low Key Pitch Sequences from BL’s Presentation.**

---

teaching discourse and particularly those related to this model, only
high and mid key markers appearing with a proclaiming tone and termed
*framing devices* are discussed (Sinclair & Brazil, 1982; Barr, 1990).
Other research investigating these markers in transactional discourse
suggests that framing devices are part of a larger set that combines
both pragmatic and semantic functions and can operate as both
structural boundary markers and logical connectors (Flowerdew &
Tarouza, 1995; Nattinger & DeCarrio, 1992). Nattinger and DeCarrio
further suggest that lexically equivalent markers operate differently in
discourse structure depending on tone choice. For example, *OK* realized
with a falling intonation and followed by a pause indicates a topic shift, whereas the same *OK* marker with a level intonation and no following pause marks a summary of the preceding information. In addition, they include a rising tone on the same lexical markers which indicates clarification is being sought from the hearer by the speaker.

Analysis of the discourse markers in this data confirmed that high and mid key frames formed part of a larger set of lexically equivalent, but prosodically distinct markers along the lines suggested by Nattinger & DeCarrio. Five lexical markers, *Alright, Right, Ok, So, and Now* appeared throughout the presentations and produced a total of 63 markers in this data set. The prosodic composition of these markers is summarized on Table 4-3.

Both the high and mid key proclaiming, or in a few instances level markers, functioned as typical frames usually in sequence chain or pitch sequence initial position, in the manner suggested by Brazil and other teaching discourse researchers. However, approximately a third of the discourse markers appeared in a low key or with rising tones. Looking

<table>
<thead>
<tr>
<th></th>
<th>P TONES</th>
<th>R TONES</th>
<th>O TONES</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIGH KEY</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MID KEY</td>
<td>20</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>LOW KEY</td>
<td>7</td>
<td>16</td>
<td>3</td>
</tr>
</tbody>
</table>

| Only markers that had an obvious structural function (whether that was combined with a semantic function or not) are discussed in this analysis. |
first at the low key markers, analysis of pitch sequence structure suggested that in approximately half of these examples (12 cases) markers operated not only as structural markers indicating transaction boundaries, but also as *dummy tone choices* (Brazil, 1997) to end pitch sequences which showed a mid key termination on the prior tone unit. While Brazil suggests that pitch sequence closure may be achieved through dummy tone choices, this is not included as a possible function of discourse markers. A typical example is given in Figure 4-14.

In this sequence chain, SN is working with the equipment as he is speaking, and this additional call on his attention appears to cause a momentary problem with linguistic coding shown by the hesitation and flattened intonation. The informative content 'one plate' finishes on a mid key termination and SN indicates a structural boundary by the addition of a low key falling marker. It is clearly the speaker’s intent to mark a boundary here as the following tone unit indicates a new sequence chain with the high key 'now that you’ve drawn this the next

---

**Figure 4-14.** An Example of a Low Key Dummy Tone Choice from SN’s Presentation.
thing', and it is possible that the additional focus on the equipment interfered with the intonation structure SN intended to project in the final unit of the sequence chain. Reconstruction of speaker intent at this level is clearly difficult to show. Even the speaker himself would, in all likelihood, not be able to recall this kind of online decision. However, the number of similar cases in this data suggest that low key markers maybe used to fulfill this function.

Turning now to discourse markers exhibiting a rising tone, Nattinger & DeCarrio suggest these indicate the speaker is seeking clarification from the hearer. Certainly this notion can be subsumed under Brazil's definition of referring tones by suggesting that rising markers are a cue to the listener that the speaker is asking for (or will be seen as asking for) confirmation of her belief that speaker and hearer have negotiated a common ground, i.e., that the speaker is right in assuming the hearer can interpret the discourse message. An example from KN's presentation is shown in Figure 4-15. KN completes the answer to the problem he has worked through on the board, and then follows this with a low rising OK marker followed by a long pause in which students could confirm their understanding or ask any questions they have.

I noted above that rising markers could be seen as asking for confirmation, rather than genuinely asking for confirmation as in Figure 4-15. Figure 4-16 shows another rising marker 'right' from BL's transcript. In this case the marker is followed by a barely audible pause (0.08 seconds) and there is clearly no "wait time" for a student response. In this case, I suggest these markers are acting rather as
solidarity markers. They indicate to the hearer that the speaker is aware of her audience and imply that the speaker is directly confirming common ground. It is suggested that this is a technique used to create solidarity with the hearers by acknowledging their participation in the discourse, and it may be that frequent use of rising markers will encourage more participation indirectly by giving this impression.

It is probable that these markers are not discussed in Brazil's work or the teaching studies that stemmed from it (Brazil, Coulthard & Johns, 1980; Sinclair & Brazil, 1982) because of the different nature of the classroom discourse used in these analyses. Brazil and his colleagues worked with primary or middle school data, and much of this
involves "telling" in proclaiming tones. When "asking" is included, it is usually in the context of tightly structured IRF exchanges such as the following in which the teacher is asking for the correct response only:

T: What's the annual rainfall here?
P: About thirty inches
T: Yes, good. (Sinclair & Brazil, 1982: p. 57)

In addition, the status of the teacher as controller of the discourse in these classrooms is invariably absolute, and confirmation of student understanding is often achieved through the kinds of display questions exemplified above rather than by direct appeal to the students. In contrast, in university classrooms, especially those taught by TAs, the relationship between the teacher and students can be more open to negotiation and more fluid (Shaw & Bailey, 1990; Tyler, 1995). One manifestation of this recognition of the TA as more of a "facilitator" is the use of 'asking' rather than 'telling' and evidence of negotiation cues such as the use of rising markers.

Summary of Pitch Sequences and Discourse Markers

In summary, pitch sequence structuring was consistently used by all the speakers in the sample to mark relationships within sequence chains and between tone units. Pitch sequence boundaries frequently marked changes between main and subsidiary content by alternations in key choice and interacted with other levels of organization such as the paradiscourse subtext. Discourse markers marked both sequence chain and pitch sequence boundaries, and the prosodic features of these markers suggest that key choice is an important part of understanding how these markers work. There is some evidence to show that low key markers are multifunctional, acting both as structural boundary markers
and as dummy tone choices to complete pitch sequence closure. Finally, low key markers and rising markers are added to the original set of frames proposed by Brazil, and it is suggested that these reflect the particular type of classroom discourse constituting this data set.

Tone choice and Orientation.

This section investigates tone choices made in the data. The reader will recall that the system of tone choice realized both an information function (adding new information or marking information as assumed to be known) and also a social function in expressing relationships between participants in the discourse (exemplified above in the discussion of rising markers). In addition, choices in the system projected speaker orientation. In direct discourse, i.e., discourse oriented toward the hearer(s), speakers negotiate a state of convergence using R and P tones. In oblique discourse, marked by 0 and P tones, the context of interaction is temporarily suspended and orientation is toward to the language sample. This section is divided into two parts. The first part focusses on direct orientation in the teaching presentations and the use of R and P tones. The second looks at the use of 0 tones and evidence of oblique orientation.

The four-minute extracts taken from the prelab presentations in the laboratory classes each contained a lower limit of 100 tone units; therefore, tone choices were counted as percentages for the first 100 tone units of each presentation. The math extract was only two minutes in length, and a count was made of the first 50 tone units, which was then doubled for the purposes of describing the numbers of tone choices across the data set. This decision was made on the basis that
presentations of each math problem in the math discussion sections seen by this researcher are virtually identical in their organization and composition, and the features found in the presentations given by this TA also match those found in analyses of similar math discussion sections conducted by other researchers (Rounds, 1987; Byrd & Constantinides, 1990).

Direct Orientation: R and P Tones

The following table summarizes the tone choices made in the first 100 TUs of each teaching presentation. The table is ordered by the amount of R tone choices found in each presentation.

The tone choice counts show a predominance of P tones. This is typical of classroom discourse which is largely involved with "telling".

Table 4-4. Percentage of Tone Choices in the First 100 TOne Units in Each Presentation in the NS Data.

<table>
<thead>
<tr>
<th>TA</th>
<th>% OF P TONES</th>
<th>% OF R TONES</th>
<th>% OF O TONES</th>
</tr>
</thead>
<tbody>
<tr>
<td>BL (doubled)</td>
<td>62</td>
<td>34</td>
<td>4</td>
</tr>
<tr>
<td>MK</td>
<td>57</td>
<td>31</td>
<td>12</td>
</tr>
<tr>
<td>LE</td>
<td>43</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>KN</td>
<td>66</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>SN</td>
<td>72</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>BD</td>
<td>75</td>
<td>13</td>
<td>12</td>
</tr>
</tbody>
</table>

i.e., using proclaiming tones to present new information to the students. The use of R tones separates the six presentations into two groups based to some extent on the amount of information the TA can assume the students know and what is assumed to be new. In the first group
containing approximately 30 R choices. BL, LE, and MK’s presentations all cover material the students have done before. BL and LE’s students have completed the material for homework, and MK’s presentation reviews procedures the students have covered in previous labs which they will use again in the unknown analysis. The second group, each containing less than 20 R choices, are presentations of new experimental procedures the students are about to perform for the first time.

In the first group, the area of presumed convergence at points in the presentation, i.e., the information that both the TAs and their students know, is assumed to be greater, and tone choice reflects "confirming" or "reminding" as opposed to "telling". A typical example is shown in Figure 4-17. This extract, from MK’s presentation, reminds the students of what they found when they conducted flame tests a few weeks earlier. The discussion transcribed here forms part of a longer discourse extract which focuses on the three possible results of the flame test: an orange flame indicating sodium, (discussed in the SC preceding the one shown here), a purple flame indicating potassium, or no particular color indicating no positive ions. The possibilities are realized using a series of directly oriented R and P tones interspersed with occasional level tones.

The extract begins with an O tone, associated in this case with a typical organizational marker, followed by three R tone choices that parallel the reminding function clearly intended in the tone units ‘you remember potassium gave a purple or a violet flame’. MK then tells the students how this should help them using a P tone 'that helps you
in two different ways' and switches back to an R tone to repeat the earlier, assumed to be known, information that the purple flame means potassium. The $0 \pm P$ tone combination shown on 'because sodium would have been...bright orange' marks a typical template construction often used by teachers to encourage students to "fill in the blank" when the teacher believes the answer is recoverable. In this case, it is a direct reference back to information contained in the preceding sequence chain. The final choice in the extract is an R tone which again refers to student experience in the set of flame tests they have already completed. Therefore, this group of tone choices project a context in which known information comes from both the text itself and the prior knowledge held by the students.

Brazil suggests that the difference between R and P tones can be summarized as "what is projected on behalf of the speaking 'I', and what is projected on behalf of the participating 'we'" (1997:79). The concept of 'participating we' incorporates both the notion of shared information such as that seen in the example above, and the idea of shared situation. In other words, R tones project a context which highlights what Sinclair and Brazil (1982) call a community aspect in the classroom, i.e., a projection of solidarity between teacher and students. An example of this kind of projection was noted in the previous section in the discussion of the use of referring tones on discourse markers such as 'right' and 'ok'. The extended series of R tones shown in Figure 4-18 creates a similar effect.

In this example, BL is explaining the last of the 3 variables the students will need to understand the equation used in this problem.
H //o r+ r+ now of COURSE er you remember poTAssium was PURple
L

H M a PURple or a ViOlete flame// r you MIGHT see that as WELL//
L

H M //p and THAT helps you in TWO different ways// r so if you see a
L

H PURple flame you know there's
M poTAssium// p but you ALso know there
L

H M CAN'T be ammon- or SOdium//o because SOdium would have BEEN//
L

H M //p bright  //r+ and the THIRD possibility is that there
L _Orange//

H M be no color at ALL//
L

Figure 4-17. An Example of Tone Choices that Project a Context of
Known Information from MK's Presentation.

H //p and R's what's
M CALLED// p it's a GROWTH
L  //r if r's

H CONstant//
M
L

H BARGger//
M POSitive the THING's getting
L  //r you're getting MORE MOney//

H
M //r+ RIGHT//
L  //you WANT// //r r+ you WANT THAT you want your money
H
M
L to GROW in a BANK//

Figure 4-18. An Example of the Use of R Tones from BL's
Presentation.
The first 2 TUs 'proclaim' the new terminology 'R's what's called a growth constant' as this is the first time the variable R has been mentioned. The following R tone choice 'if R's positive, the thing's getting bigger' is something the students should know from completing the homework, and the continuing referring tones 'you're getting more money', including the rising marker, draw connections between the math problem and the students' real world experience. The total effect can be loosely glossed as 'I am telling you that R is called a growth constant. I assume you understand that if R is positive the element is increasing. Let's think together about what that means.' These kinds of examples demonstrate how the teacher can use the intonation system to reduce the distance between the material or themselves and the students by projecting a context in which material is accessible and the teacher is approachable.

The second group of presentations presumed a lesser degree of convergence; however, all three used R tones in situations where information was assumed to be recoverable from the preceding discourse or from knowledge outside the direct context. In Figure 4-19, the R tone choices on 'you can just add, right' suggest BD considers this to be the kind of general knowledge the students should already know, and it is followed by a rising marker to confirm that this assessment is correct.

The majority of R tones in these presentations, however, were restricted to references to something that was immediately "conversationally in play" within the direct context of the discourse, i.e., something written on the blackboard or equipment that they were
Figure 4-19. An Example of the Use of Rising Tones from BD’s Presentation.

demonstrating at that moment. Figure 4-20 shows a typical example from KN’s presentation where the final R tones coincide with clear gestures toward the diagram on the board.

Figure 4-20. An Example of the Use of Rising Tones for Items that are Currently ‘In Play’ in the Discourse from KN’s Presentation.

In summary, all the TAs used a combination of R and P tones to mark the informative content in their presentations. As expected in teaching discourse, the majority of tone choices were proclaiming tones marking the new information given to the students. R choices were used in all the presentations; however, where assumed area of convergence was seen to be greater, R tones were more frequent. Referring tones were used to establish a sense of mutual participation in
the discourse by making reference both to shared information and
shared situation. Rising discourse markers were used to create a sense
of negotiated convergence between teacher and students and establish a
sense of solidarity.

The use of 0 Tones and Oblique Orientation

As a choice of 0 tone places elements outside the context of
interaction and indicates a withdrawal by the speaker from negotiation
with the hearer, they are an unlikely tone choice for teaching discourse;
yet in four of the six presentations, the number of 0 tone choices
matched the number of referring tones. An analysis of where these
tones appeared showed that the level tone was consistently used by all
the speakers in the sample for specific kinds of language activity.

First, 0 tone choices represented isolated occurrences in the
discourse. None of the presentations contain a long 'chunk' of content-
based discourse presented with an oblique orientation, i.e., with a
combination of 0 and P tones. The only time a chain of three 0 tones
appeared in succession, these marked a listing structure in which 0
tones are commonly used (Brazil, 1997). Second, choices rarely appeared
on tonic syllables that formed part of the main content and where a
direct tone would be expected: rather, 0 tone choices appeared at
points in the discourse anticipated in the model such as at moments of
orientation change due to linguistic coding problems or on precoded
language. All the TAs used 0 tones under certain conditions, and these
could be grouped into a small number of categories that applied across
the data and are shown below:
1. **Paradiscourse:** Places where the TA was simultaneously talking to the students and writing on the board or demonstrating equipment.

//so if you HAVE// (KN)
//you ALso might HAVE// (LE)
//how to PREP// your little JAR// (SN)

2. **Linguistic coding:** Momentary orientation changes where there was evidence of problems with linguistic coding or evidence that the TA was planning the next utterance.

//AND// //UH// //ACTual um TLC// (SN)

3. **Idioms or lexical phrases:** Precoded expressions that are frequently found in any extract of teaching discourse.

//in Other WORDS// (LE)
//as you see HERE// (SN)
//now of COURSE// (MK)

4. **A definitive expression of a truth:** Expressions such as equations or formula.

//whenever you find the transfer function of a// CIRcuit// (BD)

5. **Template structures:** Template questions or analogous structures.

//because SODium would have BEEN//
 bright Orange// (MK)
//you can write H omega// AS// (BD)

6. **Listing:** Lists of equipment, chemicals or equation variables.

//M one IS x ONE m ONE// (LE)

With the addition of the 0 tones found on discourse markers, these categories described the level tones found in the data. Where the amount of O tones are greater, for example in LE’s presentation, the numbers were inflated by a larger amount of filled pauses and a frequent use of level tones while he wrote on the blackboard.

In addition to a combination of 0 and P tones, oblique orientation can be cued by the use of multiple prominences (more than two
prominences per tone unit), particularly for precoded language that may be 'quoted' by the speaker. This use of multiple prominence occurs when the tone unit carries no individual sense selection. i.e., prominences do not select from a paradigm. In this case, Brazil suggests that prominences maybe assigned in a "more or less automatic way to the open-class words...In a way that presupposes engagement with the language system" (1997:146). As with the use of 0 tones, all the TAs showed examples of multiple prominences (24 in total) that suggested the use of a 'citation' tone, particularly on lexical phrases or technical expressions. Examples of these are given below:

1. Listing: // let's see ONE TWO THREE FOUR FIVE// (SN)

2. Technical Expressions: //EXponential GROWTH and deCAY// (BL)
   //ONE PLUS J omega TAU// (KN)

3. Boardwork: //point ZEro SIX T// (BL)

   There were also several places in the data where multiple prominences in a particular tone unit were the result of direct rather than oblique orientation. These were clearly motivated by the TA's intention to make contrast relationships between certain items explicit or to emphasize a particular point:

   //cos i'm BAsically only gonna go over our POsitive Ions// and BRIEFly over the NEgative Ions// (MK)

   //THIS TORQUE is trying to rotate it// COUNterclockWISEx and so it's gonna be BALanced with the TORQUE that's gonna rotate it CLOCKWISEx// (KN)

   //and this IS IN the NOTES// (SN)

Summary of Tone Choice

Analysis of tone choices found in the NS sample showed that TAs made intentional choices between R and P tones based on assumed area
of convergence. In addition, R choices could be exploited by speakers to project informative content as accessible to the students and to mark solidarity between the speaker and the hearer(s). The use of level 0 tones and multiple prominences was restricted. Level tones marked momentary changes in orientation related to precoded language and momentary coding problems; and language activities unique to classroom discourse such as template structures and interactions with the paradiscourse text. Tone choice in this data set is consistent with prior research concerning teaching discourse, and suggests that the choice of tone by teachers follows typical patterns unique to the speech event of classroom discourse.

Conclusion

There is quite a substantial body of literature concerning classroom discourse. Researchers have recognized a number of typical features such as shifts in discourse plane, the use of a small number of markers to emphasize topic structure and typical patterns of interactions between teachers and their students. The present analysis contributes to that research by investigating the typical prosodic composition of native speaker teaching discourse. Based on the results of this analysis, I propose that NS teaching discourse is characterized by a number of prosodic features that contribute to both comprehensibility of the discourse and relationship-building between teachers and students. The intonation system is organized into a series of hierarchical levels that are used intentionally by the speaker to create an independent layer of discourse structure which interacts with other linguistic and paralinguistic systems.
One of the most important patterns to emerge from this data was the use of phonological paragraphing structures such as sequence chains and pitch sequences. These were shown to co-occur with cues at other levels of the discourse to create 'chunks' of information and thereby increase discourse comprehensibility. This kind of overall design is particularly important in teaching discourse, as the teacher primarily controls the negotiation of the discourse message.

Patterns of tone, key and termination clearly demonstrated the interactive nature of intonation choices. The TAs in this sample were seen to project a context of interaction based on their understanding of the assumed state of convergence between themselves and their students. Choices of tone particularly, showed the importance of assessing choices within the situated context of the interaction. Assumed area of convergence between discourse participants changed on a real-time basis and extralinguistic activity frequently shaped choices on a moment by moment basis and could be reconstructed satisfactorily only when these considerations were taken into account. Finally, the speakers in this sample also demonstrated how choices in the system could be exploited to build a positive rapport between themselves and their students. This was particularly evident in the use of rising solidarity markers, but also in the use of referring tones to directly infer a mutual participation in the discourse despite the lack of overt participation on the part of the students.

The analysis is clearly constrained by the limited nature of the sample; however, I have included a number of the less typical patterns found in the data, such as the analysis of all the sequence chain
structures that occurred and specific types of pitch sequence structures, as it may be that these will be found more frequently in a larger sample. In addition, care was taken to ensure that this subset of presentations were typical of the larger group of prelab presentations given in the introductory science laboratories. The less rhetorical style and partially planned nature of the six presentations discussed here matches the typical examples given by other researchers investigating similar data.
CHAPTER 5
ANALYSIS OF NONNATIVE SPEAKER DATA

Introduction

This chapter presents the analysis of the nonnative speaker (NNS) data. The analysis shows that the NNS TAs as a group do not use the same systematic and independent prosodic structure to consistently mark structural boundaries in the discourse or to negotiate a common ground with their students as seen in the NS discourse. Breakdowns at each level of the hierarchical system proposed in the model contribute independently to problems in the overall comprehensibility of the discourse and a mismatch with NS expectations in the use of organizational cues. The analysis also shows that despite variation among the speakers in terms of individual prosodic features, certain intonational cues are used more consistently than others throughout the data set (e.g., high key to mark sequence chain boundaries and proclaiming tones), and that these contribute to the perception of a typical 'prosodic composition' in NNS discourse. Based on these results, it is argued that the prosodic features found in the NNS teaching presentations have a detrimental effect on both discourse comprehensibility and rapport building between teacher and students.

Parallel to the discussion of the NS data given in Chapter 4, the analysis is divided into three areas of intonation structuring: sequence chains, pitch sequences and discourse markers, and finally, tone choice and orientation. Throughout the discussion, examples from the NNS data
set are compared to parallel extracts from the NS teaching presentations and where appropriate, the reader is referred back to sections of the NS analysis.

Nonnative Speaker Data Set

A summary of the NNS data set is given below followed by a brief description of the content of the teaching extracts. Each of the NNS teaching presentations parallels one from the NS data set. The equivalent NS extract is indicated in the final two columns of the table below.

Table 5-1. Summary of NNS Data Set and Parallel NS Presentations

<table>
<thead>
<tr>
<th>LAB/DISC. SECTION</th>
<th>NON-NATIVE SPEAKER</th>
<th>TIME</th>
<th>NUMBER OF TONE UNITS</th>
<th>PARALLEL NS PRESENT</th>
<th>NUMBER OF TONE UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEMISTRY</td>
<td>KC</td>
<td>4 MINS</td>
<td>103</td>
<td>MK</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>TY</td>
<td>4 MINS</td>
<td>120</td>
<td>MK</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td>JA</td>
<td>4 MINS</td>
<td>101</td>
<td>SN</td>
<td>113</td>
</tr>
<tr>
<td>PHYSICS</td>
<td>XG</td>
<td>4 MINS</td>
<td>105</td>
<td>KN</td>
<td>141</td>
</tr>
<tr>
<td>MATH</td>
<td>BG</td>
<td>2 MINS</td>
<td>50</td>
<td>BL</td>
<td>71</td>
</tr>
<tr>
<td></td>
<td>SM</td>
<td>2 MINS</td>
<td>51</td>
<td>BL</td>
<td>71</td>
</tr>
</tbody>
</table>

*The first language of all six speakers is Mandarin Chinese

KC. The opening of a chemistry prelab presentation. The students are about to begin an unknown analysis for which they first have to complete and hand in a scheme, i.e., a plan of how they will
conduct the analysis. The TA is reviewing the procedures that should appear in the unknown analysis scheme.

TY. This extract is the same as (KC) above.

JA. This extract comes from the middle of a 40 minute prelab presentation given by the TA in a chemistry lab. The TA is discussing the principles and procedures of Chromatography experiments. One subtopic was chosen, in which the TA demonstrates the procedures and equipment the students will need to complete a Thin Layer Chromatography experiment.

XG. The opening of a physics prelab presentation. The students are conducting an experiment investigating torques and forces in equilibrium. The TA is explaining the physics principle and pointing out a potential confusion the students may encounter near the end of the lab.

BG. This extract comes from the middle of a pre-calculus math discussion class. The TA is reviewing a question from a section on exponential growth and decay. One problem was chosen from this section.

SM. This extract is the same as (BG) above.

**Sequence Chain Structure**

The reader will recall that sequence chains (SC) are larger prosodic units (or speech paragraphs) bounded by a high key or lecturing frame, and a low termination. A SC structure, based on these phonological criteria, was readily identifiable in the NS data. In addition, SCs consistently co-occurred with non-prosodic cues such as changes in discourse plane or transaction boundary marking. In the NS
extracts, this created points of maximal disjunction in the discourse marked by multiple cues at all levels of discourse organization which "chunked" the information contained in the presentation.

A prosodic SC structure was also identified in the NNS data. However, the SC analysis was hampered by a compression of overall pitch range in the NNS group compared to the NS data set. Although individual movements between the three levels of key varied both within and between speakers in the NS group, the overall pitch range of all 6 speakers was approximately 250hz-50hz, with a median frequency of 100-150 hz. In addition, as suggested by Wennerstrom (1998) and Lehiste (1979), SCs often began with a heightened pitch value or at a level higher than any value internal to the SC, which contributed to the impression of a maximal boundary. In contrast, overall pitch ranges in the NNS data were more variable and tended to be smaller. Three of the speakers (SM, BG, and JA) had reduced pitch ranges of 200hz-100hz, 170hz-75hz, and 200hz-75hz respectively. Both KE and TY had an equivalent top range (approximately 250hz) but showed less distinction at the bottom end of the range, falling to approximately 100hz. Only one TA (XG), used the same pitch range as the NS group. There was also virtually no use of heightened pitch at the beginning of SCs in the NNS data. TY occasionally employed an extra-high key (up to 300hz); however, these high key prominences did not appear at SC boundaries marked by a preceding low termination. Therefore, although high, mid and low key choices were identified in the NNS analysis, the pitch

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1 Crystal (1987) notes that the typical fundamental frequency of an adult male is around 120hz.
intervals between prominent syllables were less distinct and pitch peaks were often less pronounced.

In a study of advanced Dutch learners of Greek, Mennen (1998) also reports that even very advanced learners showed a significantly narrower pitch range, and she suggests that this contributes to accented speech. Within this analysis, while it is not clear exactly what effect such phonetic differences may have on listener comprehensibility, both SM and BG were judged by two naive listeners as difficult to follow at least partially because there was no "variation" in their speech.²

In the NNS data, there were 37 SCs in total (between 3-10 SCs were found in each extract).³ Eight of the SC openings began with a mid key lecturing frame and the remainder with a high key on a content word. The majority of the SCs (28) closed with a low termination on a content word and nine ended with a structural discourse marker such as //OK/>. These numbers are essentially comparable to those found in the NS data set (34 SCs); however, SC openings are less well defined in the NNS group. There were 15 frames in the NS group including four high key frames. This difference contributed to a qualitative and quantitative reduction in initial focussing markers in the NNS data. This will be discussed in detail below.

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² This judgement was obtained from two undergraduate listeners.

³ Despite reduced pitch ranges in some of the NNS data, it was possible to identify higher key choices within each individual range. These were used to determine SC structure.
The length of SCs in the NNS group varied from 2-41 tones units in 36 of the sequence chains, compared to 12-15 units in the NS data. This crucial difference reflected the fact that, in the majority of cases, SC boundaries identified using Barr’s phonological criteria were either not matched by non-prosodic cues indicating transaction boundaries, or that the transaction structures themselves were not comparable to those found in the NS data. Therefore, where boundaries did occur, they did not necessarily indicate points of maximal disjunction or speech paragraphs marked by multiple cues. The discussion below will focus on problems of boundary marking and transaction structure.

Tables 5-2 and 5-3 below show the number of transaction boundary markers in the NNS data set compared to those found in the NS group. As the tables show, the NNS group approximated the NS model in their use of boundary marking although there were fewer focussing markers overall: 82% of initial boundaries and 85% of closing boundaries are marked in the NS group, compared to 51% of initial boundaries and 62% of final boundaries in the NNS set. Where prospective and retrospective markers did occur, they were similar to those used by the NS group. Prospective marking included mid key lecturing frames such as //SO/ and //NOW//, and high or mid key lexical phrases:

  SEcond step I think is//
  //and the
  ONE CASE is that you are
  //                       //

---

4 The final SC in TY’s extract consisted of 74 tone units and will be discussed separately.
Table 5-2. A Comparison of Prospective Markers in the NNS and NS Data Sets.

<table>
<thead>
<tr>
<th>PROSPECTIVE MARKERS DATA SET</th>
<th>LEXICAL PHRASE</th>
<th>HIGH KEY FRAMES</th>
<th>MID KEY FRAMES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNS (37 SCs)</td>
<td>9</td>
<td>0</td>
<td>10</td>
<td>19</td>
</tr>
<tr>
<td>NS (34)</td>
<td>10</td>
<td>4</td>
<td>4</td>
<td>28</td>
</tr>
</tbody>
</table>

Table 5-3. A Comparison of Retrospective Markers in the NNS and NS Data Sets.

<table>
<thead>
<tr>
<th>RETROSPECTIVE MARKERS DATA SET</th>
<th>RECAPITULATION PHRASE</th>
<th>LEXICAL MARKER</th>
<th>PAUSE BOUNDARY</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>NNS (37 SCs)</td>
<td>7</td>
<td>9</td>
<td>7</td>
<td>23</td>
</tr>
<tr>
<td>NS (34 SCs)</td>
<td>7</td>
<td>11</td>
<td>11</td>
<td>29</td>
</tr>
</tbody>
</table>

Retrospective marking included the use of topic length pausing, low key discourse markers and recapitulation statements such as:

// THAT is the definition of HALF LIFE //

// you'll GET a deVEloped TIC PLATE //

Despite the similarities however, in addition to the drop in numbers of markers, they were also less prosodically distinct in the NNS discourse; for example, there are no prospective high key frames in the NNS group. This particularly applied to retrospective pause boundaries. As suggested by Rounds (1987) and in my original pilot study, there was a qualitative difference in the nature of the pause structure in the two data sets. Following Rounds, longer topic length pauses in the NS teaching group ([0.8-1.0] seconds and above) were classified as either
administrative or strategic. Administrative pauses occurred when the TA was writing on the board or handling equipment. Strategic silences consisted of "wait-time" after the TA asked the students a direct question, pauses appearing as part of template structures (e.g., 'because sodium would have been [1.0] bright orange'), and pauses following structural markers at the beginning of SCs (e.g., 'Ok [1.0] P is the amount you have to start with'). Retrospective pause markers in the NS data set were classified as part of this strategic pause group, and as topic length pauses only appeared at points in the discourse described above, they were considered to be reliable indicators of a boundary.

In contrast, the NNS data was characterized by frequent, random silences of varying lengths which could not be classified as strategic or administrative. These "empty silences" (Rounds, 1987:652) included topic length pauses internal to SCs causing retrospective pauses to be less reliable cues for boundary marking. This was particularly the case with two speakers (XG) and (KE) who used pause boundary marking to close SCs which contained a number of topic length pauses. Figure 5-1 shows an example from XG's presentation.

The SC begins with a prospective marker, 'one case is that you are' followed by a one second pause and a redrafting of the initial marker, 'basically you always have the center'. The remainder of the SC contains a number of problematic tone units such as 'to be the, to be the' and topic length pauses [1.0], [0.82], [0.92], [0.92] unconnected with administrative or strategic work, before closing with a low key and
A sentence length [0.68], rather than paragraph length, pause, followed by a mid key prospective marker beginning the next SC.

Figure 5-2 from KE's presentation, also contains a number of topic length pauses within the SC [1.67], [0.95], [1.0], [0.99], [1.14], [0.95] before closing with a low key hesitation marker surrounded by similar length pauses. In addition, there is some confusion with the initial boundary marking of this SC. The first tone unit, 'this two step is very easy' is uttered with a high key and mid termination which is a prosodic indication of a prospective marker. However, the content of the marker refers back to the previous SC, and the more appropriate topic marker for the material in this SC is the following high key unit,
'then you make solution'. In the analysis of boundary marking in the NS data the lexical content of markers and choice of key consistently supported each other. In this case, in terms of lexical content, KE's opening marker is more like the kind of retrospective comment that appeared in the NS data in a mid or low key such as 'so that's the basic gist of the lab'. This kind of mismatch between prosody and content also contributes to difficulties in determining transaction marking. As Rounds suggests, long silences will confound the listener rather than help to focus their attention. This is particularly the case when there is a mismatch in organizational cues. In both of the examples given above, SCs close with a low termination and include some discourse marking; however, other prosodic features obscure this pattern and reduce its effectiveness for native speaker hearers.

In addition to the problems in assessing boundary marking, transaction structures co-extensive with SCs were often ill-formed in terms of topic structuring in comparison to the NS model; for example, the topic expression did not match the material in the SC, or the SC consisted of only a partial topic expression and no development. In the NS data, SCs typically consisted of focussing activity at the opening boundary followed by a topic expression and its development, and a closing boundary; hence the consistency in the length of SCs across the data set. No such systematic pattern was found across the six speakers in the NNS data, and this accounts for the wide variation in SC length found in the NNS group. An example from KE's presentation is shown in Figure 5-3.
The first SC functions as an attention getter as the students gather at the board. This is a well formed SC, and has both a prospective marker, 'ok students' and recapitulation statement, 'just wait a minute then continue your lab'. The second SC consists only of the

```
H M // p this EAsy // [0.4]
L [0.85] //p SO// [1.17]

H M //p THEN you make soLution// [1.67] //p do pH TEST// [0.18]//o to
L
H //r+ p 0 h MInus and //o p THIS
M TEST// [0.6] H o four MInus// [0.95]

H M one should be Ph equal to THREE// [1.0] //if
L
H Ph is THREE// [0.26] //p er thirTEEN// [0.99] THIS one
M //p that means
L
H NOT there// [0.48] //r because
M
L
H the SAME Ph is// [0.26] TWO that
M TIME// [0.66] //if your //p aROUND
L
H means THIS// [0.48] //p THIS should be ALso
M THERE// [1.14] //p p that
L
H means THIS is
M NOT there// [0.95] //because THIS// [0.26] //p these two
L
H M canNOT preSENT at the SAME
L TIME// [1.7] //p AND er//
```

Figure 5-2. Problematic Pausing and Topic Structure in Sequence Chains from KE's Presentation.
topic statement, 'today we make two sample for your unknown test', and appears to indicate a plane change between the administrative organization of the lab and the actual chemistry content. In fact, in the third SC, KE returns to the organization of the presentation and reminds the students that they have covered this material previously. SC 4 begins with a repeat of the earlier topic statement, 'first you will have two samples' which is again followed by administrative instructions, 'because this is a time limit so I suggest you make sure how to do this first'. Finally, the same topic expression is repeated for the third time, 'you get two sample it's a solid' and does mark a plane change to the chemistry content of the presentation, 'the first step you do is flame test'. This constant repetition of the same introductory statement at the opening of three of the SCs followed by unexpected shifts back to administrative procedures clearly contradict any sense of topic development and would not allow the native speaker listener to accurately predict what information may follow the SC opening statement.

In the parallel presentation given by MK (shown in Table 4-2 and Figure 4-9) opening statements given in the first three SCs clearly divide the organization of the presentation into administrative procedures, 'ok begin about today i'm just gonna go over our unknown analysis scheme', topic announcement 'but for our unknown we have seven ions we have to test for', and the steps in the experimental procedure 'one of the first things that we did was a flame test'. A second characteristic of several of KE's opening SCs which contributes to the lack of development is their brevity, particularly the second sequence chain, which consists of only two tone units.
Students, just wait for a minute. Please pay attention for this unknown scheme. Also good for you to do next week if you do it today. Don't just wait today; we make a minute then continue your peers. DO this unknown today for your unknown test. Stuff is all we have learned from assignment one and this my suggestion for assignment two. First you will ever have two samples because this a time limit. So I suggest you make figure 5-3. Problematic topic structuring and sequence chain boundaries from KE's presentation.
The reader may recall that there was only one similar case in the 
NS data set in BL’s presentation (see Figure 4-8) where the first SC 
was co-extensive with a ‘pronouncement’ of the overall topic. The 
equivalent topic announcement in KE’s transcript is less effectively 
organized as it is followed by the continued repetitions discussed above, 
and is therefore less clearly motivated.

There were a number of similar examples in the NNS data where 
prosodic boundary cues divided clearly related units and created 
‘truncated’ SCs. Two examples are given in Figure 5-4. In the first 
example from TY’s presentation, the low termination at the end of ‘the 
ions contained in the sample are’ is followed by the low key hesitation 
marker which divides the topic statement into two SCs as the second 
part ‘possibly these eight ions’ begins in a high key. In the second 
example, from XG’s extract, the TA is moving from a review of the 
overall procedures in the lab which are quite straightforward, to one 
particular question near the end of the lab which may confuse the
students. The SC opens with a high key comment, ‘I don’t think you will have any problems’ which is followed by a series of mid and low key

Figure 5-4. Examples of Disrupted Sequence Chains and a Comparative NS Example. a) TY; b) XG; c) KN.
units interspersed with topic length pauses as the TA redrafts the SC opening. A new SC begins with a high key prospective marker, 'in one case...'. Neither of these examples coincide with interference from the paradiscourse subtext, and both appear to be caused by difficulties in online verbal planning.

The disruption to the overall discourse message can be seen more clearly in the final example in Figure 5-4, which shows the equivalent section to XG’s (NNS) extract from KN’s (NS) parallel presentation. The first SC ends with a mid-low key recapitulation statement, 'so that's the basic gist of the lab' followed by a clear high to mid key prospective marker, 'toward the end though you will be doing something a little bit different'. The 'um' hesitation marker surrounded by short pauses does not materially affect the organization. These comparative examples show that despite the appearance of a SC structure in the NNS presentations, phonological cues in many cases do not actually mark maximal points of disjunction and could not be used reliably by the native speaker listener as an organizational cue.

As the above analysis suggests, SC structure across the NNS group was subject to variation both within and between speakers. Within one presentation, a TA could produce one or more interpretable SCs followed by a sequence of structures in which the specific nature of the difficulty varied, but which illustrated a mismatch of organizational cues on some level. In TY's presentation, for example, the final SC (consisting of 74 tone units) includes three typical classroom
exchanges (Initiation-Response-Feedback) with the students. Although Barr does not specifically discuss IRF exchanges, they are equivalent to a plane change, i.e., the teacher moves from "telling something" to "asking something". Brazil (1997) suggests that teachers characteristically treat the IRF exchange as a pitch sequence, and as the dominant party in the teacher-student interaction, the teacher will initiate closure with a low termination. A typical example of this pattern from an earlier part of TY's presentation is shown in Figure 5-5.

Following the student's response, TY repeats the correct answer with a mid key and proclaiming tone indicating agreement, and closes the exchange with an evaluation, 'right'. In the final SC in TY's extract

```
H
M what's the FIRST STEP you\[0.48\] //p you WANT to TAKE//
L

Student Response: Flame Test
H
M
L //o p p ER RIGHT//
```

Figure 5-5. A Typical IRF Exchange from TY's Presentation.

however, key and termination choices throughout the three IRF exchanges continually extend the SC in terms of phonological boundary cues. This is despite a number of lexical discourse markers which do suggest a series of shorter transactions. The complete SC is too long to quote in its entirety and can be found in the appendix; however, Figure

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5 See Chapter 2 for a discussion of IRF exchanges within Brazil's model.
5-6, taken from the middle of the SC, exemplifies the typical difficulties found throughout this section.

TY has just covered the first step in the unknown analysis procedure, the flame test to investigate sodium ion. It is only possible to check potassium ion with the flame test if sodium is not present, and the section shown here begins where TY reminds the students of this: 'if this test is positive for sodium ion you need uh you can't er get er potassium'. In addition to verbal planning problems which break up the tone units, this section ends with a mid key statement 'you need to do a further bit'. This is followed by a [2.3] second pause and a mid key marker 'SO' which would normally cue a new SC or transaction structure; however, the previous mid key termination does not meet the phonological criteria for the end of a SC. In the next section, TY reviews the first step in the procedure and asks the students what the second step should be, 'and what's the second step?'. One student responds with essentially a repetition of TY's earlier point that it depends on whether sodium is present and suggests that if there is sodium in the sample, they will have to do a solution test to find any potassium that may be there. TY responds to the student with high key, dominant rising tones, 'directly then, you mean here you want to prepare solution now'. The combination of the high adjudicating key and dominant tones effectively limits the student's response to a Yes/No answer. This was clearly given hesitantly and in a flat 0 tone,

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6 It was not possible to transcribe the key and termination choices of student responses as the headset microphone worn by the TA did not record this data. Transcription of the student responses was made from notes taken by the researcher at the time of the recording.
H //p if THIS test is P0sitive for// [0.43] //p S0dium ion// [0.06]

H M//o you NEED// [0.53] //o UH// [0.09] //you you CAN’T er// [0.09]

H M//GET// [0.06] //p er poTAssium// [0.4] //r+ RIGHT// [0.43]

H M//you NEED to DO a// [0.95] //p FURther BIT// [2.3] //p SO//

H //p WHEN you receive a SAMple// [0.22] //p the FIRST STEP is

H M to do a// [0.22] //p FLAME test// [7.2] //p p THIS

H M STEP//

Student Response: It depends on if you have Na in the sample or not in the flame test/ if you have Na then you can’t tell if you have potassium so you have to do a solution test for potassium/

H //r r+ diRECTly THEN// [0.09] //you MEAN// [0.2] //p r+ HERE you

H M want to prePARE soLUtion RIGHT//

Student Response: Yeah (silent beat, flat tone)

Figure 5-6. An Example of a Mismatch in Discourse Cues from TY’s Presentation.
Figure 5-6, continued

indicating withdrawal on the part of the student who was probably surprised by the unusual 'interrogation' style of the questioning. TY responds with a prominent low key hesitation marker followed by a mid key unit 'ok, you can do that'. The hesitation marker, realized with an O tone, is likely to be understood by the student as an implicit cue to mean that TY is withholding his assessment because the student's response is incorrect. The following mid termination (as opposed to a low key confirmation) in conjunction with this hesitation marker, leave the hearer with a sense of a lack of closure at the end of this exchange. Yet the following mid key discourse marker 'SO' and high key statement 'make solution', indicate a new section of the discourse. This choice of mid or high key termination continues for some time, thereby producing this very long SC.

The interesting aspect of this exchange is that TY's intonation choices probably reflect the fact that the student response is wrong. The second step should be a volatile test for potassium rather than a solution test. Later in the SC, TY makes this point 'but before you make solution you can do ammonium (volatile) test...just between these (the flame test and the solution test) you can do ammonium test simply by adding sodium hydroxide'. However, by this point he has
compounded the difficulty by his discussion of how to do the solution test directly following the flame test. In one sense then, the long SC does in fact cover one topic in four subsections, i.e., (1) the second step in the solution (2) the incorrect response which TY accepts (3) discussion of the third step and (4) a return to the second step. The end result however, is a long confused piece of discourse where the mismatch in discourse cues reflects the mismatch in the overall organization of the content. In addition, TY's intonation choices in the teacher-student exchange clearly disconcert the student, possibly contributing to problems in rapport building between the student and TA.

There is an equivalent section in MK's parallel presentation where a student gives an incorrect response to MK's question about a step they need to take later in the procedure. The exchange is shown in Figure 5-7. MK's response to the incorrect answer is both clear and non-threatening. He also uses an initial 0 tone, which temporarily withholding assessment and implicitly indicates a problem. This is then confirmed in the following mid key referring unit directed toward the student in which he validates some part of the response, 'and it will tell us some things', before he explains the problem. The exchange continues until MK is given the correct response, which he affirms by closing the exchange with a final low key proclaiming 'yeah'.

Discontinuities, such as those found in the example from XG's presentation shown above in Figure 5-6, were also a recurring pattern in the NNS data. Linguistic repairs and disfluencies caused disturbance in the prosodic structure at every level of the analysis. Figure 5-8
Figure 5-7. An Example of Matched Discourse Cues in an IRF Exchange from MK's Presentation.

shows consecutive SCs from KE's presentation. The first sequence chain begins with a clear prospective marker, 'and the second step I think is
volatile test for NH4', followed by a single mid-low key unit, and closing with a low key filler. The second SC begins with a high key and attempted topic statement, 'use red red lis paper about the red crucial'. On the basis of a later statement that appears in the third SC, 'don't use blue lisma paper use red lis paper', this initial statement is probably meant to read: "it is crucial that you use RED litmus paper and not BLUE litmus paper". In fact, the second sequence chain closes after four tone units with a low key hesitation marker and topic length pausing. This typically indicates a boundary although KE returns to the topic statement in the third SC.

It is important to note that this kind of reconstruction based on later redrafting or repetition was only available to the analyst and not to the listeners at the time of the original utterance. In the real-time of these presentations, the hearer will rely on prosodic cues to make sense of the discourse organization at the moment of speaking. Miscues in structuring devices will require the listener to make constant online revisions regarding information structure. A parallel can be drawn between the extra effort required on the part of the hearer to reconstruct the overall structure of the discourse, and Chafe's concept of activation cost. In his discussion of sentence accent placement, Chafe (1994) proposes that new (inactive) information will be accented by the speaker in order to activate the referent in the listener's mind. Given (active) information will usually be unaccented as it is assumed to be
Figure 5-8. Problematic Topic Statements and Sequence Chain Structure from KE’s Presentation.

currently active in the discourse. If the information state projected by the speaker does not match the knowledge state of the hearer, e.g., if an inactive referent is introduced in an unaccented form, the activation cost for the hearer will be high, i.e., the hearer will be required to adjust her knowledge state retrospectively in the absence of the expected cue from the speaker. The same concept of retrospective adjustment applies here. Native speaker hearers must continually

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7 Chafe’s full proposal includes a three-way distinction: active, semi-active and inactive. For the purposes of this comparison, only a partial description is needed. See Chafe (1994) for a full discussion.
reassess the validity of cuing devices used by the TA, and comprehensibility comes at a 'higher cost' to the listener.

The analysis of boundary marking and transaction structure given above shows that there was no simple correlation between the NS and NNS data sets, i.e., no features that consistently appeared in the NS group were consistently lacking in the NNS group. Rather, due to the variation in the NNS group, individual SCs were problematic for a variety of reasons and interpretable SCs also appeared in the data set. In total, using both the phonological and transaction based criteria suggested in the analysis of the NS model, 15 of the 37 SCs (41%) in the NNS group were considered to be interpretable for a native speaker participant. These included the first SC of each of the six speakers (which often consisted of no more than a brief introduction to the topic) and the two complete math presentations which are discussed separately below.

Both of the math presentations divided into 3 SCs respectively and covered the same problem from the exponential growth/decay section in the same way. The decay problem, finding the half life of radium, requires the students to write up the formula, apply a decay constant (rather than a growth constant in the NS parallel presentation) and then solve for $T$ using the natural log method they have used before. Both BG and SM divide the problem into three stages which correlated with the 3 SC structures as shown below:

**Stage 1:**

$$ A_t = A_0 e^{-kt} \text{ when } k = .00043 $$

**Stage 2:**

$$ \frac{1}{2}A_0 = A_0 e^{-kt} $$

$$ \frac{1}{2} = e^{-kt} $$
Stage 3: Natural log of both sides

Both TAs cue SC boundaries with a low termination followed by a high key or a mid key marker. In two cases, there is an additional plane change as the TA asks the students to give him the next step in the problem. An example from each transcript is shown in Figure 5-9.

The example from SM's extract shows the boundary between the first and second SC. The first SC ends with a low key marker followed by a topic length pause [1.25]. The second begins with the high key statement of the next step immediately followed by a shift in discourse plane as the TA asks a question to the students, 'find the half life of radium what's that mean half life?'. The second example, from BG's extract, shows a similar plane change between the second and third sequence chain, in addition to the low termination and high key start. Both the TAs are following a logical sequence exactly as it is given in the textbook, and have used this predetermined pattern to frame their discourse organization. As noted earlier, however, pitch boundaries in these two presentations are particularly weak, and the actual differentiation between key choices was slight in comparison to other TAs across both data sets. It is possible that these boundary cues are less easily perceived by the hearer, who may rely rather on the non-prosodic criteria such as plane changes and lexical content.

These presentations do suggest, however, that if an organizational framework is in some way pre-imposed on the spoken discourse, overall structuring may improve. This is supported to some extent by several of the SC boundaries in KE's transcript. KE was the only TA in the
Figure 5-9. Sequence Chain Boundaries Coextensive with Discourse Plane Changes.  a) SM; b) BG.

NNS sample who had prepared the chalkboard prior to his presentation. The major steps the students needed to take were listed on the board, and he referred to them during his presentation. The opening tone units of three SCs (5-7) and the equivalent boardwork is shown below on Table 5-4. As the table shows, these SC openings exemplify Barr's original criteria in that they coincide with divisions in the prepared visual material. It is possible to speculate that had KE also written up some of the administrative details he covered at the beginning of his presentation, he may have avoided the initial SC structures discussed earlier and shown in Figure 5-5.

It is important to note, however, that in all three of these presentations (SM, BG and KE) these "outside" organizational resources
Table 5-4. Visual Cues for SC Structure in KE’s Presentation

<table>
<thead>
<tr>
<th>OPENING TU(s) OF 3 SEQUENCE CHAINS</th>
<th>BOARDWORK</th>
</tr>
</thead>
<tbody>
<tr>
<td>///you get TWO SAMple it’s a solid/// the FIRST STEP you do is FLAME TEST</td>
<td>Flame Test Orange</td>
</tr>
<tr>
<td>///and the SEcond step i think is VOlatile test for nh4+//</td>
<td>Volatile Test</td>
</tr>
<tr>
<td>///use the RED// RED litmus PAPER</td>
<td>Red litmus Paper</td>
</tr>
</tbody>
</table>

only appeared to improve sequence chain structuring, and in KE’s case, only to a limited degree. All three TAs exhibited a number of problems at other levels of prosodic organization, such as pitch sequence structure and tone choice, and KE’s considerable disfluencies at SC openings (see Figure 5-8) lessened the effectiveness of these visual cues.

Summary of Sequence Chain Structure

The analysis of SC structure in the NNS data set revealed a number of difficulties interpreting this level of prosodic structure. Although intonational cues appeared throughout the data and were largely similar to those found in the NS presentations (e.g., prospective or retrospective markers accompanied by the appropriate choice of key), they frequently did not match the organizational cues at other levels of the discourse and therefore, did not indicate points of maximal disjunction. This applied particularly to the relationships between SC and transaction boundaries which often were confused by unintelligible topic statements or a lack of topic development. When both problematic SC and transaction boundaries were taken into consideration, fewer than
half of the sequence chains found in the data matched those found in the NS data. In addition, high and low key marking in the majority of the presentations were phonetically less distinct due to a narrower overall pitch range, and pause boundaries were less effective organizational cues in light of the amount of "empty" pauses that appeared throughout the data. There was some evidence to suggest that if an outside structure was imposed on the content, e.g., prepared visuals, this did assist the overall organization of the text; however, difficulties encountered in verbalizing this organization remained. In summary, although many of the prosodic cues found in the NS model were also evident in the NNS data, they did not consistently cue phonological paragraphs that would assist the native speaker hearer in their comprehension of the discourse message.

**Pitch Sequences and Discourse Markers**

This section is divided into two parts. The first part will focus on the use of pitch sequence (PS) structuring the NNS data, and the effect of tone unit structure on these sequences. The second part examines the use of discourse markers by these speakers, particularly the rising solidarity markers found in the NS model.

**Pitch Sequences**

Pitch sequences (PS) consist of a group of tone units bounded by low termination choices. In the NS model, this level of structure was used within SCs to distinguish main (informative) content from subsidiary material such as glosses or asides, or to divide the topic of a transaction into smaller subtopics. Pitch sequence patterning reflected the speakers' use of key to distinguish contrastive or 'particularized'
statements (high key) from additive (mid key) or equative (low key) material.

In the analysis of the NNS group, the number of pitch sequences per sequence chain varied between 1-15 PSs per SC. This is within the range of the NS model (1-12 PSs per SC) where it reflected a wide variety of possible subsidiary content, from short paradiscourse-related asides, to much longer recapitulations or exemplification. In the NNS data, however, pitch sequence boundary cues did not necessarily indicate a principled grouping of tone units along the lines described above. In some cases, prosodic disturbance due to linguistic repairs or disfluencies made an overall pattern difficult to establish; and in others, there appeared to be no apparent motivation for PS closure by the standards established in the NS data. In the case of one TA (KE), this level of structure was virtually non-existent, as only one of eleven SCs in the presentation contained any type of pitch sequencing. In the discussion below, I will use parallel extracts from the NS and NNS data sets to exemplify two issues: first, differences between the two groups in the use of PS cues; and second, the relationship between this prosodic unit and other levels of discourse organization, such as content structuring and the paradiscourse subtext.

Figure 5-10 shows part of the parallel opening sections from MK NS) and KE's (NNS) presentations (shown completely in Figure 4-9 and Figure 5-3). Both TAs have a similar objective, which is to suggest the best method for the students to use to complete the unknown analysis scheme. MK's extract consists of two PSs, an initial high key unit to open the presentation and invite the students up to the board, followed
by a mid key additive unit which functions as a kind of 'gloss' or comment on the previous unit, 'it's a great time to see if you like it'.

The parallel extract from KE's presentation is characterized by a consistent return to a high key, which creates SC rather than PS structures. The highlighted units in this extract, 'this my suggestion for the unknown test, I think it will save you time' together form a similar kind of comment structure to that shown in MK's extract. However, the conjunction between the units themselves, and between this comment and the surrounding discourse is obscured by initial high key choices. The high-mid pattern shown in this extract characterizes much of KE's presentation, effectively excluding a pitch sequence structure and creating a series of short SCs. As SC boundaries and high key choices cue points of maximal disjunction, prosodic cues frequently do not match the content structure or non-prosodic cues available to the hearer, and may negate the effectiveness of high key choices where they are used appropriately to indicate material that is contrasted or somehow particularized.

Figure 5-11 shows a similar comparison using roughly equivalent extracts from KN (NS) and XG's (NNS) presentations, which describe the overall objective of the physics lab. KN begins with a high key lexical marker, 'basically what you guys are gonna be doing...' followed by a series of mid key units describing the procedures which end in a low termination and close the first PS. The low key confirmation marker 'ok' marks a second PS boundary and the final PS consists of a typical mid-low key recapitulation or retrospective marker, 'so that's the basic gist of the lab'. Throughout this extract, KN's key choices reflect content
based relationships between tone units and are reliable cues to information structure. In contrast, XG's extract shows evidence of a similar kind of structuring, but this is complicated by a number of low terminations and truncated tone units. The first PS begins with a high key topic statement, 'the physics principle is quite easy', followed by a mid-low key repetition which closes the unit. The second PS begins appropriately in a mid key and restates the physics principle in less technical language. This closes with a low key discourse marker 'SO' which is immediately followed by what can be interpreted as a third statement uniting the information in the first two PSs. This final section, however, is fractured by a series of alternating mid and low terminations and disfluencies that break up the content into a series of short PSs for the listener, 'torque one is/// so you just try to, calculate torque one/// and calculate torque two and uh make them equal and you can find some/// measure some variables/// based on this'. The prosodic structure of this final section in conjunction with the lack of any kind of pause boundary between the second and third PS boundaries, makes this three-part content structuring very difficult for the hearer to establish. The "empty silences" found in the NNS data and discussed in the sequence chain analysis, also interfered with internal PS structure. As with the NS data, pauses related to the paradiscourse subtext appeared throughout the NNS presentations; however, these were interspersed with both topic length and sentence length empty pauses (0.6-1.0 second) within PSs. Two examples are
(a) K em/\ [0.88] /p r beGIN about toDAY i’m just gonna go over our unknown aNALysis SCHEME/\ [0.14] /p cos it’ll BENefit anybody going to need to be WORKing on it/\[0.07]/p p so if you wanna ROUND i’m gonna do it up here on the BOARD/\ [1.17]

M ONE it’s a great time to check to see if you LIKE it/\ [2.42]

(b) per toDAY we MAKE have TWO SAMple/\ [0.09] /p for your unKNOWN

//THIS a all STUFF is a/\ [0.09] /p o p we have

M LEARNED from aSSIGNment ONE and aSSIGNment TWO/\[0.57]/p r+

my sugGESTion for THIS unKNOWN/\ [0.28] /p TEST/\ [0.57] /p uh i

THINK itss it will SAVE you /\ [0.94]

TIME/\ [0.94]

Figure 5-10. A Comparison of Pitch Sequence Structure in NS and NNS Parallel Chemistry Presentations. a) MK; b) KE.

shown in Figure 5-12. In the first example, from JA’s presentation, the highlighted pauses indicate breaks which coincide with equipment
handling or writing on the board. The first mid key PS contains a [1.2] second pause as JA draws a line on top of the jar he has drawn on the board, 'then you [1.2] close the cap', and the following low key unit consists only of the repetition, 'close the cap'. In the third PS, however, two topic length pauses which are neither administrative or strategic, break up the internal structure of the unit: 'and watch [1.8] watch the advance of the solvent; when the solvent's [0.9] reached here'. The example from TY's presentation does not coincide with any paradiscourse activity, but is characterized by frequent pauses of varying lengths which then create a series of minimal or truncated tone units constituting the only unit of prosodic organization.

Analysis of the NS model showed that effective pitch sequence structuring relied on the principled use of the three key choices available to the speaker, and particularly, the specific combinations of key and termination choices within tone units, e.g., a high-mid, mid-mid or mid-low pattern. Although this kind of patterning could be established in the NNS data, key and termination choices were more often determined by other factors. In some cases, reconstruction suggested that linguistic coding problems or some kind of habitual pattern (such as KE's consistent returns to a high key) prompted these choices; however, in others it was less clear whether outside factors actually motivated or only exacerbated problems with key choice. This was particularly true of the two math presentations (BG and SM) which centered exclusively on the TAs work on the board. Both adopt what
Basically what you guys are gonna be doing is you’re gonna have this MEter STICK and you’re gonna FIND the center of HANG it.

MASS and you’re gonna from the KNIFE EDGE by the CENTer of MASS and then you’re gonna be ADDing MASses.

/p to EACH SIDE of it/ p at DIFFerent distances aWAY.

/p and you’re BAically gonna SHOW that/ p p p the SUM of the TORQUES is equal to ZErO and that’s when it BALances.

/p so that’s the BAic gist of the LAB.

(b)

/p p the PHYSics PRINCiple is QUITE EASY it’s JUST the

ler [0.63] //o p the TORQUE ONE Equal TORQUE TWO.

[0.82] //p p PHYSics PRINCiple just TORQUE ONE Equal

Figure 5-11. A Comparison of Pitch Sequence Structure in NS and NNS Parallel Physics Presentations. a) KN; b) XG.
Figure 5-11, continued.

Rounds (1987) describes as a "talking-textbook" style of problem solving frequently found in math discussion classes given by NNS TAs. There is minimal framing and elaboration, and the TAs simply say what they are writing on the board. This particular style of presentation also appeared to largely dictate choices of key and termination. In the two-minute presentations, there were only two examples of high key in SM's presentation, both appearing at SC boundaries, and only four in BG's extract. Prosodic structure was largely made up of a series of phrasal units exhibiting either mid-mid or mid-low key and termination choices which were "collected" into SC structures rather than pitch sequences.
Figure 5-13 shows the opening section of BG’s presentation. In the first stage of the presentation, BG checks the problem in the textbook and writes it on the board. After an initial template type structure, 'for number three the formula is...', breaks between tone units are dictated by the speed at which the material is written on the board. This creates a series of minimal tone units made up of only key or key and termination choices with no proclitic or enclitic material. As BG reaches a break in the boardwork, he drops to a low termination, creating a number of short PS structures. The second stage begins with the mid key unit, 'and we want to solve for T' and this is again followed by a series of short units alternating between mid and low termination choices. These key choices produce an undifferentiated prosodic structure which is compounded by the large number of prominent constituents. There is little evidence in either presentation of a structured prosodic unit below the sequence chain. Extended tone units are rare, and low termination choices mark the boundaries of phrasal units as opposed to PSs. In conjunction with the relatively narrow pitch range exhibited by both TAs, these features provide the native speaker hearer with few prosodic structuring devices beyond the SC boundary marking discussed in the previous section.

The two math presentations offer a particular insight into the connection between content and prosody in comparison to the parallel NS extract. Both Rounds (1987) and Byrd & Constantinedes (1990) report that the most important characteristic shared by less successful NNS TAs in math discussion classes is that classroom talk is limited to a "minimal narration of the problem". In contrast, successful NS TAs
(a)  
//THEN you/ [1.2] //r+ p CLOSE the CAP THAT's very impORtant//  
  //r+ and  
  L [0.78] //p ok// [0.3] //p CLOSE the CAP// [0.56]  
  H M WATCH// [1.8] //p WATCH th- the advANCE of the SOLvent// [0.54]  
  L  
  //p when the SOLvent's// [0.9] //o REACHED HERE// [0.65]  
  H M imMEdiately take  
  L //p you THIS plate  
  H M OUT//  
  L  
(b)  
  //p so MIXture// [0.23] //p ONly// [0.33] //o when THERE is  
  H M NO// [0.65] //p SOdium// [0.1]  
  H M //o you CAN er// [0.1] //p CHECK  
  //o you poTAssium ion// [0.09]  
  H M OUT er// [0.09] //o poTAssium ion// [0.09] //p o SIMply by FLAME  
  H M TEST but// [0.43]  
  //p if THIS test is PSitive for// [0.43]  
  H M //p SOdium ion// [0.06]  
  H M //o you NEED// [0.53] //o UH// [0.09]  
  H M you you CAN'T er// [0.09] //GET// [0.06] //p er poTAssium//  

Figure 5-12. Examples of the Typical "Empty Silences" Found in the NNS Presentations.  a) JA; b) TY.
tended to incorporate a range of additional material into the problem solving, such as hints on general problem-solving strategies, connections to other homework problems, or to the outside world. In the data analyzed here, this combination of various kinds of content in the NS presentation also coincided with a more varied prosodic structure that distinguished it from the two NNS extracts. The NS math presentation (given by BL) is discussed in detail in Chapter 4; however, one section is repeated here for the purposes of comparison. Figure 5-14 shows the two sequence chains immediately following the opening topic announcement. The three variables in the problem, 'P is the amount you have to start with', 'A is the amount you end up with' and 'R's what's called, it's a growth constant' are introduced with a high key and exemplified in a series of mid key additive units such as, 'whatever, it could be money, maybe it's growing' which connect the variables in the problem to the outside world. In the case of the constant value \( R \), BL indicates that this can be positive or negative using a contrastive high key choice followed by a number of examples given in a lower key, 'if \( R \) is positive the thing's getting bigger'; 'if \( R \) is negative the stuff is getting smaller' thus connecting this exponential growth problem to others in the growth and decay section. This kind of framing and elaboration is entirely absent from SM and BG's presentations; therefore, it is not simply a lack of prosodic structuring which separates the two groups, but the omission of a 'layer' of discourse organization which in turn has additional ramifications for both the prosody and content.

Both SM and BG fall into a category Bailey (1984) describes as "mechanical problem solvers". One characteristic of this group is an
overall passive teaching style which includes "little or no difference" between the volume and pitch used throughout the presentations regardless of whether the TA is writing on the board or talking to the students (p. 114). This is consistent with the narrow pitch range found in both these presentations, and in addition to effects on volume and pitch, this data suggests that the identification of units of prosodic structure below the level of SCs are also adversely affected by this style of presentation.
In summary, this analysis showed that clear pitch sequence structuring in the NNS data was difficult to establish from the perspective of a native speaker listener. In addition, the amount of prosodic disturbance at this level of organization made any patterns difficult to interpret. Pitch sequences and tone units were less comparable than SC structures to those found in the NS data, and in the case of one TA (KE), this unit of prosodic organization was essentially missing. There was some evidence to suggest that individual speakers preferred certain key choices, e.g., a frequent high-mid pattern (KE) or a mid-low pattern (BG, SM) which then precluded effective use of key choice; however, this may also have been the result of interference from the paradiscourse subtext, particularly in the math presentations.

Discourse Markers

The analysis of discourse markers such as SO, NOW and OK in the NS data demonstrated that lexically equivalent but prosodically distinct markers were used by the NS TAs to perform a variety of functions. Markers operated as framing devices, particularly at SC/PS boundaries; as dummy low tone choices to end PSs; and when used with a rising tone, as solidarity markers acknowledging the students' mutual participation in the discourse.

Discourse markers were found throughout the NNS data set; however, there were considerably fewer markers overall and the range of functions they performed, particularly solidarity marking, was more limited. Four lexical markers appeared across the data set, RIGHT, SO,
Figure 5-14. An Example of the Interaction between Matched Content and Prosodic Structure from BL's Presentation.
This produced a total of 37 discourse markers in the NNS group compared to the 63 in the NS group. The prosodic composition of both these sets of markers are compared in Table 5-5 below.

Two important differences between the NS and NNS groups emerged from this comparison. First, looking only at the 0 and P markers, the combined total of these two groups is similar across the data sets: 37 in the NS data set, and 29 in the NNS data. These markers also appeared at SC and PS boundaries. In some cases, however, the lexical content of the marker was the primary boundary cue as its phonological shape, or the key and termination choices surrounding it were difficult to interpret (see for example, the

Table 5-5. Prosodic Composition of Discourse Markers in the NS and NNS Data

<table>
<thead>
<tr>
<th>TONE CHOICE</th>
<th>P TONES</th>
<th>O TONES</th>
<th>R TONES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NS</td>
<td>NNS</td>
<td>NS</td>
</tr>
<tr>
<td>SPEAKER</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HIGH KEY</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MID KEY</td>
<td>20</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>LOW KEY</td>
<td>7</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>TOTAL</td>
<td>31</td>
<td>16</td>
<td>6</td>
</tr>
<tr>
<td>% OF TOTAL #</td>
<td>49</td>
<td>43</td>
<td>10</td>
</tr>
</tbody>
</table>

8 There was also one //r+ YEAH// token (in BG's extract) which functioned in the same manner as a //r+ RIGHT// marker.
discussion of TY's final SC in Chapter 5). There are also qualitative differences between the O and P markers in the NNS set compared to the NS set that reduce the overall effectiveness of this group. There are no high key frames in this group, and 45% of the markers appear in an O tone as compared to only 16% of the markers in the NS group.

The reader will recall from the discussion of orientation in Chapter 4 that the use of an O tone indicates a withdrawal from the context of interaction on the part of the speaker. The O tone is the preferred choice for filled pauses and hesitation markers in the NS group of speakers, as it projects the item outside of the directly oriented tonal structure constructed for the benefit of the hearer. Consequently, where discourse markers are used to mark boundaries for the hearer, in the majority of cases, the NS TAs use a falling or 'proclaiming' tone to assert the organizational break for the hearer. The more equal division between O and P tones in the NNS data contributes to the overall lack of clarity in boundary marking for a native speaker hearer discussed in the previous two sections of this analysis.

Low key O and P markers were also used by the NS speakers as dummy low key choices to complete PS units. Across the NNS data set, there were five occasions where the reconstruction suggested that NNS TAs were also using discourse markers to perform this function (see for example, Figure 5-11 where XG inserts a low key 'SO' between the second and third statement). However, the effectiveness of low key markers was compromised in several presentations (KE, TY and XG particularly) by the number of prominent low key hesitation markers.
found in the NNS data which interfered with PS structure (see, for example, Figures 5-4 and 5-8).\(^9\)

The second crucial difference between the two data sets, shown in Table 5-5, is the paucity of rising solidarity markers in the NNS data set. It is this difference that causes the overall drop in the total number of markers between the two groups of speakers. In the analysis of the NS data, it was suggested that TAs used these markers to seek confirmation that the teacher and students had negotiated a common ground, i.e. that the speaker is right in assuming the hearer can interpret the discourse message. It was further suggested that this technique had a rapport-building function, creating solidarity between teacher and students by acknowledging their mutual participation in the discourse. The eight rising discourse markers found in the NNS data were used in a similar manner to those found in the NS data. One of the markers coincided with a SC boundary followed by a \([1.26]\) second pause in which the ITA scanned the audience. In six other cases, the TA made direct eye contact with the students, although the following pauses (between \([0.22]\) and \([0.7]\)) were not long enough for the students to respond. This was also a characteristic of a number of the markers found in the NS data, and it was suggested that these continued to perform the same rapport building function by acknowledging the importance of student comprehension.

The crucial issue is the overall paucity of these markers across the NNS data set, particularly as the eight markers were distributed

\(^9\) Only one TA in the NS group (LE) had an individual tendency to use a prominent //AND// in either mid or low key as a hesitation marker, and these appear without an additional prominent //UH// filler.
among only three of the speakers (JA, TY and BG). A recurring theme in much of the ITA literature is the perceptible 'distance' between ITAs and their students. Researchers have suggested a number of ways in which this can be decreased, and a perception of solidarity with students can be increased. Techniques based on NS models include the use of inclusive pronouns to refer to teacher and students and more direct eye contact (Rounds, 1987; Bailey, 1984). As shown in the analysis given above, rising solidarity markers were rarely exploited by the ITAs in this data set to build rapport with their students. This previously overlooked prosodic feature may be another characteristic of NS teaching discourse that NNS TAs lack, and which may contribute to a perception of increased distance between the TAs and their students.

**Summary of Pitch Sequences and Discourse Markers**

In summary, the analysis shows that this level of prosodic organization was difficult to establish in the NNS TA data in comparison to the NS model. The NNS group did not consistently use high, mid and low key choices to distinguish between main and subsidiary content or to mark pitch sequence boundaries containing related tone units. Low termination choices, which typically indicate PS closure, often appeared unmotivated in light of the criteria established in the NS data or were the result of prosodic disturbance due to linguistic coding problems. As a result, from the perspective of NS listeners, pitch sequence patterning was difficult to interpret. Taken in conjunction with the findings regarding sequence chain structuring, this shows that phonological paragraphing was considerably weaker in the NNS presentations than in the parallel NS group. Regarding discourse markers, while the NNS TAs
did use markers at SC and PS boundaries, they were fewer in number and less powerful in their phonological shape. This applied particularly to the R tone solidarity markers found in the NS data which were used to build rapport between the teacher and students. Only three of the six NNS TAs used these markers, and then, only infrequently. It is suggested that this limited use will contribute to a 'distancing' effect between the TA and students in the same way that other researchers have proposed for some lexical and paralinguistic features.

**Tone choice and Orientation**

This final section of the analysis will investigate tone choices made in the data. The system of tone choice is used to project speaker orientation. In direct discourse, i.e., discourse oriented toward the hearer, speakers negotiate a presumed area of convergence using R and P tones. These choices realize both an information function (adding new information or marking information assumed to be known) and a social function in building rapport between the participants in the discourse. This division is approximate, as the use of R tones to project material as accessible incorporates both the functions of "reminding" or "confirming", and the notion of simultaneously projecting a context of shared situation or a community aspect in the classroom. Oblique orientation is characterized by a combination of O and P tones and indicates that the speaker is temporarily oriented away from the hearer and toward the language sample. This part of the NNS analysis is divided into two sections. The first part focuses on direct orientation and the use of R and P tones, and the second will discuss the use of O tones and evidence of an oblique orientation. In line with the NS data
set, each of the NNS prelab presentations contained a lower limit of 100 tone units. The two NNS math presentations contained a lower limit of 50 tone units and tone choices were then doubled for the purposes of describing the percentage of tone choices across the data set.

Direct Orientation: R and P tones

The table shown below summarizes the percentage of R, P and O tone choices made in the first 100 TUs of each NS and NNS presentation. The table is organized by the number of R choices in each NS presentation and grouped so that parallel presentations appear next to each other.

Table 5-6. Percentages of tone choices in parallel NS and NNS Presentations

<table>
<thead>
<tr>
<th>SUB</th>
<th>MAT</th>
<th>CHEM</th>
<th>PHYS</th>
<th>CHEM</th>
<th>E.E</th>
</tr>
</thead>
<tbody>
<tr>
<td>D.S</td>
<td>NS</td>
<td>NNS</td>
<td>NS</td>
<td>NNS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TA</td>
<td>BL</td>
<td>SM</td>
<td>BG</td>
<td>MK</td>
<td>KE</td>
</tr>
<tr>
<td>% R</td>
<td>34</td>
<td>4</td>
<td>6</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>% P</td>
<td>62</td>
<td>82</td>
<td>68</td>
<td>58</td>
<td>85</td>
</tr>
<tr>
<td>% O</td>
<td>4</td>
<td>14</td>
<td>26</td>
<td>12</td>
<td>9</td>
</tr>
</tbody>
</table>

SUB = subject; D.S = Data Set; MAT = Math; CHEM = Chemistry; PHY = physics; E.E. = Electrical Engineering

Looking first at the directly oriented tones, the most common choice in both data sets is clearly a P tone. In all but one presentation (LE), P tones make up well over half of the total tone choices in any given presentation. As was noted in the previous chapter, this is a typical characteristic of classroom discourse which is inevitably largely involved in asserting or 'proclaiming' new information. As shown on the table, the crucial difference between the two data sets is a considerable drop in the use of R tones in the NNS group (note that the highest
number of R tones in the NNS data set (19%) is in the range of the lowest number in the NS set (13%). This was confirmed by a T test which showed a significant difference (p < .05) between the number of R tones in the two groups (NS: M = 23, SD = 9.36; NNS: M = 8.83, SD = 5.38).

The reader will recall that the use of R tones in the NS data set, particularly for information functions, separated the six presentations into two groups. The first group (BL, LE, and MK) containing the highest number of R tones, covered material that was accessible to the students, i.e., information that had been covered in earlier labs or for homework. The second group, on the other hand, (KE, SN, and BD) were covering new experimental procedures and contained less information that could be assumed to be known. In these presentations, the information function of R tones was largely used to refer to items that were outside the direct context of the interaction, but were assumed to be common knowledge, or that were currently 'in play' in the discourse, i.e., being introduced on the blackboard or in a demonstration.

No such division was found between the presentations in the NNS data set. Rather, in the parallel presentations to the first NS group (SM, BG - parallel to BL; KE, TY - parallel to MK), R choices are virtually omitted from the tonal system altogether. In particular, there is no use of the information function of R tones to project material as accessible to the students. However, in three of these four presentations (TY, SM, XG was not considered directly parallel to LE in this particular respect as LE is specifically going over the prelab report the students have already completed, while XG is reviewing the lab the students are about to begin, which parallels KN.)
and BG), the TAs do assume a greater area of convergence but exploit the students' knowledge by substituting an alternative questioning strategy. Both SM and BG ask the students at one point to tell them what the next stage in the solution should be, 'so what shall we do?'; 'what we do next?', and TY includes a number of questions designed to elicit information the students should be able to recall, 'What's the first step you wanna take?'; 'What ion can you check out simply by flame test?'. Therefore, in these three presentations, there was no simple correlation between a lack of R tones and a lack of recognition on the part of the TA that at least some of the material should be accessible to the students. However, the analysis of the complete NNS data set also showed that with only one exception, R tones were never used to perform this information function.

The exception to this pattern was found in JA's (NNS) extract and is shown in Figure 5-15 along with the parallel section from SN's (NS) presentation. Both TAs are discussing the micro capillary tubes the students will need to use to 'spot' their samples on the silica TLC plates. As the students should use only a very small amount of the sample, they must first melt the micro capillaries in a flame and then pull them out to create a very fine point. From SN's brief review, it is clear from the content and the use of an R+ tone in the final tone unit that the students have already done a similar procedure in a previous lab, 'what you do is you take an open ended capillary and you pull it out exactly like making a bore pipette, one of those real capillary bore pipettes.' The equivalent structure in JA's presentation is much less clear in terms of content, and the "reminding" function is expressed
through the R+ tone and the use of the rising marker rather than any explicitly worded statement, 'but here is too wide, you'd better to make the thin, make the thinner, ok'. In fact, although the reconstruction of JA's probable intention is supported by his final appeal to the hearers, it is far from clear and was only noted after I had reviewed SN's parallel presentation. In the NNS data, the only other use of R tones for an information function was for items that were currently 'in play' in the discourse. This applied particularly to JA's extract, where it accounted for his remaining R tone choices. An example is shown in Figure 5-16 where the three R tone choices coincide with a diagram JA is simultaneously drawing on the board.

The social function of R tone choices is most clearly seen in the use of rising solidarity markers which directly acknowledge the participation of the hearer. As was noted in the previous section, these markers were used by the NNS TAs; however, there were far fewer tokens across the data set (8 in the NNS data compared to 26 in the NS data), and three TAs (SM, XG, and KE) used no rising markers. As these TAs also exhibited the fewest number of R tones, the three presentations contained no obvious negotiation moves toward the native speaker hearers. The few remaining R tone choices in the NNS data appeared in IRF exchanges between the TAs and students in typical question intonation patterns, 'Do you have any idea?' (XG); 'Does anyone else have any idea?' (TY); 'So you mean here you want to prepare solution now?' (TY), (see also Figure 5-6 and accompanying discussion of TY's problematic rising tone choices in this exchange).
In summary, R tones were used infrequently by the NNS TAs. Where there was evidence of NNS TAs projecting information or social functions through the use of R tones, these were isolated occurrences scattered across the data rather than consistent patterns of use. Analysis of individual R tone choices suggested that some TAs had acquired some of the information and social functions shown in the NS model, such as the use of R tones to refer to items that are currently in play in the discourse or for solidarity marking. However, this applied to individual speakers rather than the group as a whole, and this is reflected in the different percentages of R tones in each presentation shown on Table 5.6.

The results of this analysis are in basic agreement with an investigation of NNS data and R/P tone choice conducted by Hewings (1995). In the Hewings study, a group of NSs and advanced NNSs from Korea, Greece and Indonesia recorded a scripted dialogue which was then transcribed for direct tone choices using Brazil's framework.\(^{11}\) The results show that while the NNS group used rising tones to indicate referents that had recently been introduced into the discourse, R tones were not used for any of the social functions demonstrated by the NS group. For example, in places where NS informants used R tones to express contradiction or to withhold agreement in order to mitigate their disagreement, NNSs consistently used proclaiming tones. Hewings suggests that while NNS speakers appear to be largely familiar with the information function of R tones, the "exploitation of the Rising/Falling

\(^{11}\) The NNS group were international postgraduate students studying in Britain and appear to be a roughly equivalent group to the international graduate students studied here.
(a) | NOW that you've NEXT thing you wanna
     | DRAWN this the

H | DO// is you wanna GET// p little Micro CApillaries//
   | //r alRIGHT//

H |//pi'll SHOW you how to make those LAter what you DO is you TAKE
   | a// p Open ended CApillary// p and you PULL it OUT// p exACTly

H | like making a BORE piPETTE one of those real// r+ CApillary bore
   | p piPETTES//p it's the SAME THING it's a little EAsier and QUICker//

(b) |//THEN take a//p CApillary// p it SHOULD like of
    | THIS//

H | p but HERE is TOO //r+ you'd BETter to make the
   | WIDE//

H | THIN// p MAKE the THINner// r+ ok//

Figure 5-15. An Example of the Use of R Tones for a Reminding Function in Parallel NS and NNS Presentations. a) SN; b) JA

opposition for socially integrative purposes is rarely found in the NNS readings" (p. 262). Although the data used by Hewings are quite different from the teaching presentations shown here, the results of the
two analyses support a general finding that NNSs may not typically produce socially oriented tone choices in English.

Use of 0 tones and Oblique Orientation

Returning to the percentages of tone choices given in Table 5-6, the numbers of 0 tones in individual presentations show some variation (from 7 in SM to 25 in XG). This was also the case with the NS group; however, as there were significantly fewer R choices by the NNS TAs, this resulted in a higher number of overall O/P combinations across the NNS group, and in all the parallel presentations (with the one exception of JA and SN where they were roughly equal, see discussion below).

The crucial difference between the use of 0 tones by the two groups emerges from a qualitative analysis of where these tones appear. Rather than the isolated occurrences of 0 tones found in the NS data, choices in the NNS data created long passages of oblique orientation in the NNS teaching discourse. The reader will recall that 0 tone choices place the material outside the direct context of interaction and indicate a temporary withdrawal from negotiation with the hearer(s). Analysis of the NS data in the previous chapter showed isolated uses of the 0 tone at points in the discourse anticipated by the model, such as momentary
changes in orientation while the TA is working with equipment or for certain structures common in teaching discourse, such as listing or use of the template technique. In contrast, in the NNS data, entire passages of informative, content based discourse were presented with an oblique orientation, i.e., with a combination of 0 and P tones. An example is shown in Figure 5-17 from JA’s presentation. In the first unit in JA’s presentation, the initial r+ tone, 'this the TLC' is used as JA holds up a TLC plate for the students and is an example of the use of a rising tone for an item currently in play in the discourse. In the remainder of this extract, JA begins instructing the students on the procedures they will follow, including a warning that they must remember to use a pencil rather than a pen to mark lines on their TLC plate. This entire section is comprised of 0 and P tones, and the tonal structure shows typical features of an oblique orientation, such as the use of 0 tones at points of potential completion and P tones at actual completion points. For example, in the opening statement, 'the first thing you have to do in this experiment is to mark a starting line on this plate', the natural break is marked with an 0 tone at 'experiment' and completed with a P tone 'on this plate'. However, it is also clear that tonal structure is not consistently guided by even this principle, as the final clause is divided into two separate units with proclaiming tones '//'p mark a starting LINE//' //p on this PLATE//'.
FIRST  
THING  

H  
M  
L  

H  
M  
L  

H  
M  
L  

H  
M  
L  

H  
M  
L

Figure 5-17. An Example of Informative Discourse Presented with an Oblique Orientation from JA’s Presentation.

Prosodic organization is clearly affected by linguistic coding problems throughout this extract, (e.g. // MARK about// //mar--// //MARK//) and this was also a cause of momentary orientation changes in the NS data (e.g., //o ACTual um TLC// (SN)). However, even at points where the TA seemed more comfortable with the actual verbalization of the message, it was confused by tone choices. For example, in his warning to the students at the end of this extract, //p
that won't WORK// //beCAUSE// //p THAT contain some orGAnic COMpound// //p that will GET some MEssy//, the combination of the syntactic structure and proclaiming tones divide the message into a series of separate propositions which must then be reconstructed by the hearer.\textsuperscript{13} This was also a recurring pattern in the NNS group. In KE's presentation, for example, although there are relatively few 0 tones (9%), there are also virtually no R tone choices (6%). This resulted in a large number of short, proclaimed minimal tonic segments which did not reflect the relationships between the propositions contained within them.

Figure 5-18 shows an example from XG's presentation where the prosodic choices reflect problems in linguistic coding. The extract is made up entirely of O and P tones apart from the final unit '/r+ FIVE//' where the rising tone refers to the immediately preceding referent 'the last case'. There are clear signs that XG is having some difficulty coding the message, '/o WELL in A// //p o in a FIinal AND//: //o to BE THE// //o to BE THE//, and this in turn causes this part of the informative content to be presented with an oblique orientation. Passages such as the two shown here characterize the discourse structure of the NNS group as a whole, and suggest that the TAs in this group are likely to be primarily oriented toward their production of the linguistic sample as opposed to being oriented to their listeners.

In addition to a combination of O and P tone choices, oblique orientation can be cued by multiple prominences in a tone unit, i.e.,

\textsuperscript{13} It was this difference between the tonal expression of informative content that separated JA and SN (the parallel NS TA) despite the similar number of O tones that appear in their presentations.
units where stress may be assigned automatically rather than based on any particular sense selection. This suggests the speaker is 'citing' or 'quoting' language that falls outside the direct situated context of the interaction. In the NS data, the 24 cases of multiple prominences

```
H DON'T think YOU will have any
M /p i PROBlem/ [0.32] /exCEPT in a/
L
H M [1.5] /o WELL in A/ [2.16] AND/ [0.98] /er/
L
H ONE CASE is that /p p BAsically you ALways
M /p o one YOU ARE/ [1.0]
L
H M have the CENter/ [0.82] /p MEter stick CENter/ [0.92]
L /o to BE
H M L THE/ [0.2] /o to BE THE/ [0.53] //p the PIvot POINT but er/
H M /p p in in the LAST CASE in the compreHENsion QUESTION/ [0.53]
L
H M //r+ FIVE/`
L
```

Figure 5-18. Oblique Orientation due to Problems in Linguistic Coding from XG's Presentation.

found in technical expressions, in a group of items that formed a list (including items written on the board), and in a few instances in places where the TA wished to make a contrast relationship explicit, or to underline an important point through the use of emphatic stress. In the NNS data, there were 63 cases of multiple prominences, and only 27
of these (43%) were comparable to those found in the NS presentations. This group included very similar examples to those found in the NS data set:

1. Listing: //FOUR FIVE SIX// (KE)
2. Technical Expressions: //the HALF LIFE of RAedium// (SM)
4. Emphasis: //DON'T use FLAME TEST// (KE)
5. Contrast: //the COUNter CLOCKwise// should Equal the CLOCKwise TORQUE// (XG)

However, over half of the multiple prominence patterns in the NNS data did not coincide with any of these functions, and speakers simply assigned stress to any open class word in the tone unit. Some examples are shown below:

//GET a PLATE REAdy// (JA)
//you NEED a PIECE of PAper// (JA)
//WATCH the adVANCE of the SOLvent//(JA) //REpreSENT the WHOLE efFECT// (XG)
//toDAY we MAKE TWO SAMple// (KE)
//i THINK it will SAVE you TIME// (KE)
//so you JUST LOOK at the BOARD// (TY)
//GIVE you aNOther CHANCE// (TY)
//TAKE the NATural LOG of BOTH SIDE// (SM)

When the total number of tone units in the NNS data (530) is taken into consideration, this may not appear to be particularly damaging. However, the pattern is exacerbated by the number of minimal tonic segments and truncated tone units that appear in the
presentations. In other words, even tone units that contain only key and/or termination prominences also contain very few unstressed content words, which increases the amount of overall stress in the NNS data in comparison to the NS group. In particular, this is likely to negate the use of contrastive or emphatic stress in the NNS presentations, as its effect is diminished by the additional stress surrounding it. In a comparison of NSs and NNSs from Italy, Pirt (1990) reports the same findings regarding oblique intonation choices and prominent words in her NNS data and states that:

Non-natives evidently have no difficulty in producing minimal tone units: that is to say, in placing prominence on as many words as possible. They do, however, have trouble with non-prominence. (p.152)

Pirt also suggests that the NNSs are "saying rather than meaning the words" (p. 154) as the predominant tone choices will suggest an orientation toward the language for the NS listener.

For the native speaker hearers in the data presented here, this means that much of the informative content is presented outside of the context of the interaction, and there is little sense of a negotiation between the speaker and hearer toward a common state of convergence. Rather, hearers must attempt to suspend their implicit understanding of the communicative value of tone choice, as these cues are frequently unreliable or inexplicable within the parameters of the NS model.

Summary of Tone Choice

Taken as a whole, the NNS group do not produce a tonal structure that oriented material toward the hearers through the use of direct R and P choices. Both a significant drop in R tones and an increase in O
tones to express informative content in the presentations created a largely oblique orientation. In agreement with the NS model, the majority of tone choices in the NNS data were P tones; however, these did not necessarily indicate a direct orientation, as they often obscured rather than highlighted the relationships between propositions. All the speakers in this group showed some evidence of an ability to exploit either the information or social functions of the R tone choice; however, these were isolated occurrences which were limited in the range of functions they expressed, and breadth of use varied widely between speakers. For example, only three of the six speakers used solidarity markers, and, with the exception of one example in JA's presentation, NNS speakers did not use R tones to negotiate common ground with their hearers.

The most common use of R tones in the data was to refer to items currently in play in the discourse. In conjunction with the use of R tones for solidarity markers by only some of the speakers, this suggests that as a group, the NNS TAs have learned to effectively use individual functions of tone choice as a "chunk". Finally, the use of prominence patterns, although complicated by linguistic coding problems, suggests that the NNSs have difficulty discriminating between word accent and sentence stress. There is a clear tendency across the speakers to make any content word prominent rather than to make any kind of sense selection. While there appears to be evidence that some speakers will also use prominence patterns to mark contrast relationships or for emphasis, it is difficult to be certain of this analysis and perception based on the surrounding prominence choices.
Conclusion

The analysis of the NS data given in chapter four showed that the prosodic features of native speaker discourse are systematically organized in a hierarchical model, and contribute independently both to information structuring and rapport-building between teacher and students. The analysis of the NNS data given in this chapter shows that speakers approximate the NS model on a number of levels but do not consistently exploit prosodic choices for either information or social functions. As a group, the six NNS presentations were characterized by breakdowns in every system proposed in the model. The analysis revealed a general pattern in which prosodic structuring devices (sequence chains, pitch sequences, tone units) became, for the most part, progressively more difficult to interpret the further down the model they appeared. Of the two phonological paragraphing devices, pitch sequences were the most difficult to establish, suggesting that the NNS TAs may be unable to make the finer distinctions between key choices needed for this level of structure.

A similar pattern was also found in the analysis of the tonal structure. The NNS TAs showed limited use of the tonal system. As direct tone choices were far outweighed by combinations of O/P tones across all six speakers, tonal structure in conjunction with minimal tonic segments and a heavy use of prominence, created a typical prosodic composition, or 'accent' that was recognizably nonnative.

Both individual variation among the speakers and features that characterized the group as a whole suggest that a simple explanation of prosodic choices, such as L1 transfer, is unlikely. Based on this
analysis, at least three factors are contributing to the intonation structure found in the discourse, only one of which is L1 transfer. Transfer effects will be discussed in detail in chapter 7 along with other possible causes of the prosodic structures found in the nonnative data; however, the two additional factors are briefly outlined below. The first is obvious problems with linguistic coding. Online verbal planning clearly accounts for many of the truncated tone units and some of the 0 tone choices found in this data. Ochs (1979) suggests that if the cognitive demands of one language function are high, this can constrain the speaker's ability to maintain planned production even if the discourse is essentially a 'planned' performance. This factor may contribute to the improved sequence chain boundaries found in BG, SM and KE's data, as the overall design is in some way preplanned. However, this does not necessarily help with the actual exposition, which is clear from the problems which occur in structures internal to the sequence chains.

The second factor is the speakers' unfamiliarity with the prosodic system in English. As both Pirt (1990) and Hewings (1995) report similar results to those found here with speakers from different L1 groups, it is possible that many L2 learners are unaware of some of the social and informational functions of intonation choices. For example, it is unclear if the NNS TAs who use solidarity marking understand the communicative value of the tone choice on some level or whether these are formulaic, as there are so few tokens in the data set. There is certainly an argument to be made that the prosodic system is one of the least taught aspects of English in most formal settings.
Whatever the causes of the intonational features that characterize the data, the result is a detrimental effect on discourse comprehensibility for the native speaker discourse participants. Clearly, prosodic structure is only one level of discourse organization; however, miscues in the prosodic system, in addition to mismatches with organizational cues at other levels of discourse structuring, will have a cumulative effect and contribute to an overall lack of clarity. Tyler (1992) suggests that similar kinds of miscues contribute to a lack of "explicitness" in NNS discourse. As she points out, while there is no established rule for how discourse relations must be made explicit to ensure comprehensibility, it seems reasonable to assume that the hearer(s) will be guided by expectations based on a typical NS model of spoken discourse. As the comparison between the two data sets shows, a NS hearer is likely to be perplexed by many of the choices made by the NNS TAs. For example, on the basis that the hearers will assume a direct orientation in the situated context of classroom interaction, they will be required to constantly make retrospective adjustments following oblique choices of tone and prominence.

In addition to issues of comprehensibility, prosodic cues also affect the maintenance of a social relationship between discourse participants. In her article entitled "Inscrutability Revisited", Young (1982) suggests that Chinese speakers transfer L1 discourse strategies which can frustrate American English hearers. Chinese speakers may not use initial topic statements, preferring to reason with the speaker before 'coming to the point'. Young argues that we need to look further than grammatical structure to uncover potential areas of conflict
between Chinese and American discourse participants. The typical prosodic choices found in these data may also contribute to underlying tension in these cross-cultural interactions. In one example given in the preceding analysis,¹⁴ choice of key and tone by the Chinese speaker lead to the perception of an interrogation rather than typical classroom questioning. Less dramatic, but equally important, is the overall sense of a lack of interest and commitment to the students created by the ITAs' oblique tonal structure. Choices in the NNS discourse, for the most part, do not project a sense of mutual participation. In fact, they tend to increase the distance between the speaker and the hearer(s) and the hearer(s) and the material. This becomes particularly important in the context of a teaching situation. Students are likely to feel that they have considerably more at stake than the TA, and this may result in increased resentment and hostility.

¹⁴ See Figure 5-8 and accompanying discussion.
CHAPTER 6
ANALYSIS OF IVE SPEAKER DATA

Introduction

This chapter presents the analysis of the prosodic systems used by speakers of one indigenized variety of English-Indian English. This final analysis comprises a sub-study of Indian English speaker (IES) data. In comparison with the NS and NNS groups, the IES data set includes fewer speakers and less actual discourse in terms of the length of the extracts taken from the teaching presentations. In addition, unlike the NNS group who were all Mandarin Chinese speakers, these IE speakers represent three different first language backgrounds (Hindi-Urdu, Bengali and Tamil). Possible effects of first language transfer will be discussed later in the analysis; however, it is noted here that due to the limited amount of data included in this sub-study, this analysis can only suggest possible areas of future investigation (see Pickering & Wiltshire, in prep.).

Despite these different L1 backgrounds, the analysis of this group suggests that Indian English has a number of systematic prosodic conventions that differ from the American NS model. These differences center particularly on the phonetic realization of key, tone, and intonational phrasing. Unlike the previous two groups, some of the typical phonetic patterns found in this data set could not be adequately described within the transcription system used in this study. Therefore, in this analysis, I have included additional transcription
diacritics in order to exemplify these characteristics. This is discussed in detail in the opening section of the analysis. These phonetic patterns reduce the effectiveness of prosodic paragraphing units for American hearers (sequence chains and pitch sequences), and tone unit structure, and contribute independently to problems in overall comprehensibility of the discourse and a mismatch in organizational cues. Taken together, they also contribute to the perception of a typical 'prosodic composition' in IES discourse. Based on these results, it is argued that the prosodic features found in the IES teaching presentations have a detrimental effect on both discourse comprehensibility and rapport building between teachers and American students.

In line with the discussion of the data in the previous two analyses, following an initial discussion of the unique pitch characteristics found in this group of speakers, the analysis is divided into three areas of intonation structuring: sequence chains, pitch sequences and discourse markers, and, finally, tone choice and orientation. Where examples from the IES data set are compared to parallel extracts from the NS or NNS teaching presentations, the reader is referred back to the appropriate sections of these analyses.

Indian English Speaker Data Set

A summary of the IES data set is given below, followed by a brief description of the content of the teaching extracts. Two of the four IES teaching presentations parallel two from the NS data set. The equivalent NS extract is indicated in the final column of the table below.

KK. This extract comes from a physics prelab presentation. The students are conducting an experiment investigating the torques and
forces in equilibrium using a meter stick and some weights. In this part of the presentation, the TA is explaining how to plug the experimental results into the mathematical equation.

Table 6-1. A Summary of the IES Data Set

<table>
<thead>
<tr>
<th>LAB/DISC. SECTION</th>
<th>IES TA</th>
<th>FIRST LANGUAGE</th>
<th>TIME</th>
<th>NUMBER OF TONE UNITS</th>
<th>PARALLEL NS PRES.</th>
<th>NUMBER OF TONE UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS</td>
<td>KK</td>
<td>BENGALI</td>
<td>3.5 MINS</td>
<td>102</td>
<td>KN LE</td>
<td>141 100</td>
</tr>
<tr>
<td>E.E.</td>
<td>UT</td>
<td>BENGALI</td>
<td>3.5 MINS</td>
<td>122</td>
<td>BD</td>
<td>109</td>
</tr>
<tr>
<td></td>
<td>SF</td>
<td>HINDI-URDU</td>
<td>3.5 MINS</td>
<td>106</td>
<td>NONE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>SH</td>
<td>TAMIL</td>
<td>3.5 MINS</td>
<td>108</td>
<td>NONE</td>
<td></td>
</tr>
</tbody>
</table>

* Electrical Engineering

UT. This extract comes from the middle of a 50-minute prelab lecture in electrical engineering which the course supervisor asked the TAs to give. The students are about to conduct an experiment testing a mathematical equation that relates input to output voltage. One subtopic was chosen explaining how to plug the experimental results into the equation, and then how to graph these findings using a Bode Plot.

SF. The opening of an electrical engineering prelab presentation. The students are conducting an experiment investigating rectifier circuits using a diode. In this extract, the TA is introducing and comparing the characteristics of an ideal and practical diode.
SH. The opening of an electrical engineering prelab presentation. The students are conducting a simulation using a computer program. The TA is reviewing the procedures the students will need to use, particularly those that have appeared on exam questions in the past.

Unique Pitch Characteristics in IES Data Set

As noted above, it became clear as the analysis progressed that there were a number of pitch characteristics that were unique to this group of speakers. These features affected both transcription and interpretation of the prosodic systems proposed in the model. They included the phonetic realization of prominence (and, therefore, key and tone identification), intonational contours, and tone unit division. While several of these features varied between individual speakers and will be discussed throughout the analysis, two pitch movement patterns which were not found in the NS model characterized the group as a whole. As these patterns could not be accommodated within the transcription system used in the previous two analyses and outlined in Chapter 3, I have used additional diacritics in the transcriptions of these presentations.1

In this section, I will describe these patterns and the alternative transcription system I have used where they occurred. The transcription devices are used as a descriptive tool to highlight those phonetic patterns that interfere with interpretation of the prosodic

---

1As most transcription systems are designed to describe NS prosody, De Bot (1990) suggests that they are unable to accommodate the atypical movements that may be found in second language intonation. This was the case with regard to the patterns discussed here.
structure based on the NS model. They do not constitute a proposal for an alternative prosodic model unique to Indian English.\(^2\)

The first pattern concerns the realization of prominence on stressed syllables. In the NS model, the prominent syllable is distinguished from the surrounding syllables by an Fo peak on the primary stressed syllable of the word.\(^3\) Enclitic syllables following a prominent tonic syllable continue the direction of the tonal movement, i.e. continue a rise or fall in the Fo contour. In contrast, many of the prominent syllables in the IES data are realized with a drop in pitch on the syllable bearing the primary stress (indicated by a 'dip' in the Fo contour) or a low level pitch, followed by a rising pitch or higher, level pitch on the following non-prominent syllables. Parallel NS and IES examples are shown in Figures 6-1 and 6-2 from an NS TA (ST) and IES TA (SF).\(^4\) Figure 6-1a shows two adjacent tone units from ST's presentation:

```
// in ORder to find VOLtage// given a CURrent//
```

\(^2\)The limited amount of data used in this sub-study precludes this possibility; however, the probability of a conventionalized IE prosodic model will be discussed in the final section of this chapter.

\(^3\) Brazil suggests that the 'minimal specification' of pitch is sufficient to recognize the meaningful choices inherent in the intonation system. This study does not include a formal investigation of amplitude or length. However, Bush (1968) suggests that stressed syllables in IE speech have a shorter consonant to vowel duration ratio than those in American English (also see Pickering and Wiltshire, in prep.). Several of the examples shown here include amplitude readings to show how pitch and amplitude typically interact in NS and IES realization of prominence.

\(^4\)ST was originally recorded as a parallel NS presentation to SF. However, ST only gave a few short statements and student input was so frequent, it was not possible to use this as a parallel discourse extract. It was possible to analyze a few of the tone units for a comparison of the prosodic patterns under discussion here.
These exemplify the typical NS pitch pattern found on prominent syllables. Figure 6-1b shows an energy reading (a contour showing the variation of the speaker's amplitude over time) for the same tone units. Note that the amplitude pattern matches the pitch pattern and the intensity drops on the non-prominent syllables of 'VOLTage' and 'CURrent'.

Figure 6-2a shows a comparative example from SF's parallel presentation. These two adjacent tone units are transcribed:

\[
tage \text{ across a } \quad \text{ode } D // \text{ is } \\
\quad / / \text{ the } VOL \quad DI \quad V \quad \text{Given AS//}
\]

The italic print is used to indicate the very different phonetic realization patterns on the prominent syllables. VOLTage, DIode and Given are characterized by a drop in pitch which remains level or rises on the prominent syllable. The Fo peak appears on the following non-prominent syllables which then either fall in pitch or remain level. In the prominent 'VD' pattern, the primary stress should fall on the 'V'; however, the higher pitched, level Fo pattern on the 'D' creates the effect of an O tone. The amplitude reading of these tone units, given in Figure 6-2b shows that in some cases, the pitch drop is matched by a drop in amplitude (VOLTage and DIode), while in others amplitude remains the same on both syllables (VD), or is stronger on the lower pitched syllable (Given). In comparison to the American English (AE) or British English (BE) phonetic realization of stress, these constitute mismatches in pitch and amplitude which make it more difficult for the NS analyst to assess which syllable is prominent. A second parallel
example from the same two presentations is given in Figures 6-3 and 6-4. Figure 6-3 shows two tone units from ST’s presentation,

//for any given //I can find \( V_d \)//

Both the Fo contour and amplitude reading show peaks in pitch and amplitude on the tonic syllable followed by a drop in amplitude and sustained pitch movement in the same direction on the following non-prominent syllables. In a comparative example from SF’s presentation shown in Figure 6-4, the primary stress on ‘T’ coincides with a drop in pitch and the amplitude is the same for both the prominent and non-prominent syllable.

Figure 1. Instrumental Readings of Typical NS Prominence Patterns from ST’s Presentation. a) Pitch Pattern; b) Amplitude Pattern.

Figure 6-1, continued.
These phonetic patterns do not create what we might typically think of as a 'word accent' problem, i.e., volTAGE rather than VOLtage, as there is typically no reduction in any syllable in the word, or reduction in one parameter, such as amplitude, is not matched by other parameters such as vowel reduction or pitch lowering. In some cases there is a perception of equal stress on polysyllabic words, i.e., VOLTAGE. When this pattern is multiplied over a stretch of discourse, the AE/BE listener may find it more difficult to identify tonic segments and intonational phrases.

Both Gumperz (1982) and Spencer (1957) also refer directly to the pitch drop pattern found here on prominent syllables: "the tendency in South Asian English is for stressed syllables to be accompanied by a fall in pitch and this to replace stress" (Spencer, 1957:74). It is also possible that this is the cause of some of the perception problems noted by other researchers, as suggested by Mohanan (1986) in his discussion of low-pitched prominence patterns in the Dravidian language group:

speakers of [AE/BE] English tend to perceive the low tone as an absence of stress and high tone as its presence, which makes them hear stress on the last syllable instead of the first. Those phoneticians who are trained to hear stress in terms of English patterns do likewise which is one of the reasons for the amount of confusion reigning in discussions of word stress in Indian languages. (p.126)

---

5Word accent problems do appear in the data; for example, SF frequently consistently pronounces 'imPEdance' with prominence on the first syllable so it is perceived as 'IMpudence'. These examples are far outweighed by prominence patterns displaying the pitch characteristics discussed here.

6Cited in Bansal (1967).
The second pattern which characterized the group as a whole and affected interpretation of the systems in the model was a constant shift between levels (or register) in a given speaker's range, often in place in place of tonal movement. The reader will recall that the speaker selects a key (high, mid or low) for each tone unit. Movement between this key choice and the termination choice in the same unit is subject to

Figure 6-2. Instrumental Readings of Typical IES Prominence Patterns from SF's Presentation. a) Pitch Pattern; b) Amplitude Pattern.

Figure 6-2, continued.
an adjacent level constraint, and typically, there are no sudden shifts in pitch register within the tonic segment. In the IES data, there were frequent abrupt changes in pitch level on individual syllables, both within words and across tonic segments. Parallel examples are shown from LE (NS TA) and KK in Figures 6-5 and 6-6. In both extracts, the TAs are 'talking through' the formulas as they write them on the blackboard. Figure 6-5 shows three tone units from LE's presentation transcribed as:

```
//  X ONE/\ M ONE/\ X ONE/
```

The Fo contour shows a construction similar to the template pattern used by the NS TAs and discussed in Chapter 4. There is a rise in pitch level from low to mid as LE highlights the three variables, and the intonation phrase ends with a falling contour from mid to low on the final tonic syllable. In contrast, the three tone units from KK's presentation, shown in Figure 6-6, are characterized by 'leaps' in pitch rather than a gradual movement between levels. These are transcribed as:

```
[Diagram showing Fo contour with annotations]
```

Figure 6-3. Instrumental Readings of Typical NS Prominence Patterns from ST's Presentation. a) Pitch Pattern; b) Amplitude Pattern.
Figure 6-3, continued.

\[
\text{IS} \quad \text{two} \quad \text{nus} \quad \text{C}
\]

//this ONE // X \(\text{MI} \) // X //

The sharp rise on 'IS' contrasts with LE's level syllable, and is followed by a series of pitch drops and peaks on the remaining syllables that do not form a unified contour. Another example of both jumps between pitch levels and the pitch drop stress pattern is shown in Figure 6-7 from UT's presentation. This is transcribed as:

\[
\text{IS} \quad \text{POINT}
\]

//and the \(\text{AN} \) \(\text{TEN} \) // FIVE

Both the prominent syllables 'ANgle' and 'TEN' are realized with a low key pitch drop and are followed by sharply rising R+ tones. Again, there is no sense of a unified contour as the pitch shifts consistently between a high and low key.\(^7\)

\(^7\)This particular pattern may be based on a conventionalized contour from UT and KK's L1.
These unique pitch characteristics and mismatches in phonetic features which normally work together in the AE/BE realization of stress create prosodic patterns which do not match NS listener expectation, and there is no sense in which prosodic cues consistently operated in the same way as those found in the NS data. Brazil (1997) suggests that "language users must be presumed to operate within an area of tolerance where intonation is concerned" (p. 155). It is proposed that the phonetic features described above will fall outside any acceptable range of variation that may be anticipated by native speakers of AE and BE. Previous research reported in the IE literature supports this proposal. Although these studies rely on impressionistic rather than instrumental analysis, they include a number of references to difficulties on the part of AE/BE speakers in assessing prominence or nucleus placement, substitution of pitch register shifts for tonal movement, and the lack of a unified intonational contour (Bansal, 1967; Gumperz, 1978, 1982, 1983; Mishra, 1983).

Figure 6-4. Instrumental Readings of Typical IES Prominence Patterns from SF's Presentation. a) Pitch Pattern; b) Amplitude Pattern.
Figure 6-4, continued.

Figure 6-5. Instrumental Reading of a Typical NS Fo Contour from LE's Presentation.

Sequence Chain Structure

The reader will recall that sequence chains (SC) were larger prosodic units (or speech paragraphs) bounded by a high initial key and a low termination choice. In the NS analysis, SCs consistently co-
occurred with non-prosodic cues such as changes in discourse plane or transaction boundary marking. In the NS extracts, this created points of maximal disjunction in the discourse which "chunked" the information contained in the presentation.

A sequence chain structure was also identified in the IES data. Although there was some interference related to the pitch patterns described above, this level of structure was the least affected by these characteristics of the prosodic systems investigated here. All four TAs signalled points of maximal disjunction using both prosodic and non-prosodic cues. In addition, three of the four TAs used boardwork throughout their presentations (KK, UT, SF), and interaction with the paradiscourse subtext heavily contributed to boundary marking.

![Figure 6-6. Instrumental Reading of a Typical IES Fo Contour from KK's Presentation.](image)

![Figure 6-7. Instrumental Reading of a Typical IES Fo Contour from UT's Presentation.](image)
In the IES data, 30 SCs (between 5 and 10 SCs in each speaker) were identified using the prosodic criteria of an initial high key or discourse frame and low key closing. Four of the SC boundaries co-occurred with shifts in discourse plane, and an example from SH's extract is shown in Figure 6-8. The SC boundary separates SH's discussion of the procedures the students should follow regarding prelabs, 'try to come prepared for all the labs', from the presentation of the main content, 'these statements', which is written on the board.

The majority of the SCs were also marked as transaction structures, and transaction boundary marking coextensive with SC structure is shown in Tables 6-2 and 6-3 below. Prospective markers were similar to those found in both the NS and NNS groups and included lexical frames such as //SO// and //NOW//, and lexical phrases:
Table 6-2. Prospective Markers in the IES Data Set

<table>
<thead>
<tr>
<th>PROSPECTIVE MARKERS</th>
<th>LEXICAL PHRASE</th>
<th>HIGH KEY FRAMES</th>
<th>MID KEY FRAMES</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>IES (30 SCs)</td>
<td>11</td>
<td>1</td>
<td>8(^8)</td>
<td>20</td>
</tr>
</tbody>
</table>

Table 6-3. Retrospective Markers in the IES Data Set

<table>
<thead>
<tr>
<th>RETROSPECTIVE MARKERS</th>
<th>RECAPITULATION PHRASE</th>
<th>LEXICAL MARKER</th>
<th>PAUSE BOUNDARY</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>IES (30 SCs)</td>
<td>3</td>
<td>3</td>
<td>22</td>
<td>28</td>
</tr>
</tbody>
</table>

TWO// (KK)

//for PART

TWO// (SH)

//and about LAB

Retrospective markers also included typical low key //OK// markers and recapitulation phrases:

//so this is HOW you make the STATEment//(SH)

As shown on Table 6-3, the most common boundary marker was a low key termination accompanied by strategic or administrative pausing at transaction closings. Unlike the NNS presentations, these boundary markers were not compromised by 'empty silences' appearing within unit boundaries, and pause structure in the IES group was similar to that found in the NS data. Administrative pauses frequently directly connected the paradiscourse sub-text to transaction structures as shown in Figure 6-9. The first SC closes with the tone unit, 'it's gonna be something like this', followed by a [1.2] second administrative pause

\(^8\) This includes two non-prominent discourse markers, //ok// and //so//, which are followed by high key topic statements.
while SF draws a graph on the board. The new SC begins with a high
key as the TA begins to explain the graph, 'at zero input voltage'.
Topic length pauses internal to SCs (such as the [1.64] second pause
between the final two tone units in Figure 6-9) occurred only when the
TA was writing on the board, as strategic silences preceding or
following lexical markers, or while the TA scanned the audience.

Only one of the 30 SCs was not also marked with a retrospective
transaction boundary, and this is shown in Figure 6-10. This extract

```
H /////p if you SEE the RISTics of an
M CHAracte
L IDEAL DIode// [0.23]
H
M ///p it's gonna be SOMEthing like
L THIS// [1.2]
H VOLtage// [0.09] NO// [1.64]
M //o there is //p CURrent at
L ALL//
```

Figure 6-9. An Example of Administrative Pauses Connected to the
Paradiscourse Sub-text from SF's Presentation.

begins with the end of the first SC in SH's presentation. There is a
clear low termination pitch boundary at 'aBOUT' which is followed by a
SC opening on the high key, 'but IF at ALL'. The [0.4] second pause is
not topic length, and does not constitute a coextensive transaction
boundary. This second SC consists of only four tone units and appears
to be added as an afterthought (Chafe, 1994: 142). According to Chafe,
an afterthought is a supplement or brief additional focus connected to a
topic that has already been stated. In this case, SH tells the students
that he will check their prelabs as they are working; however, in this
particular class, the prelab is not mandatory, i.e., it does not form part of the grade on the experiment. It is possible that SH uses a high key to begin the 'afterthought' to correct a mistaken impression he believes he may have given to the students, 'but if at all you are not prepared for the prelabs it's ok as I told you last class'. This short SC is followed by the plane change and clear transaction boundary discussed in Figure 6-8 above.

Turning now to opening SC boundaries, seven of the SCs were not marked as either coextensive with a plane change or a prospective transaction marker. These SCs were marked with high key topic statements such as those shown above in Figure 6-9 ('at ZErO INput VOLtage') and Figure 6-10 ('but IF at ALL'). The lack of an initial

H //?r+ 0 r+ r+ you can KEEP it M REAdy AND uh when i COME to L

H M YOU just i'll SEE what have you L DONE it aBOUt// [0.4]

H ////p r r+ but IF at ALL if you are not M prePARED for the L

H M PRELABS it's ok as i TOLD you CLASS// [0.43] //p but L LAST

H M try to come prePARED for L ALL the LABS//

Figure 6-10. A Short Sequence Chain with no Coextensive Transaction Boundary from SH's Presentation.
prospective marker tended to coincide with places in the discourse where the TA was focussed on boardwork rather than 'talk' to the students, suggesting an orientation change toward the paradiscourse sub-text. On the whole, boundary marking in the IES group more closely approximated the NS model than the NNS data. In conjunction with shifts in discourse plane, SC structures in IES presentations co-occurred with points of maximal disjunction indicated by other features of discourse organization in 80% of the SCs found in the data, and there was a clearer perception of boundary marking in the IES presentations in comparison to the NNS group. Despite this closer approximation of the NS model however, SCs in the IES presentations differed from the NS model in their internal structure. In the NS data, apart from the short topic announcements given in BL's presentation, SCs varied in length between 12-15 units. In the IES data, there were 2-37 tone units per SC, which more closely approximates the pattern found in the NNS data (2-41 TUs per SC). However, a qualitative comparison of the SC structures in the IES and NNS groups shows different underlying causes for this similar pattern. The following section will compare the structure of SCs in the IES data to those found in the NNS and NS groups.

Analysis of the NNS teaching discourse revealed two major problems with SC structuring. First, prosodic SC boundary markers, e.g. low termination and high pitch, were often not matched by non-prosodic criteria; in other words, SC boundaries did not necessarily indicate points of maximal disjunction in the discourse message as a whole. Second, where transaction structures were co-extensive with
SCs, they often did not match NS expectation; for example, the topic expression was incomplete or did not match the material in the SC (See Chapter 5, Figure 5-3).

In the IES group, when SC structures were viewed in conjunction with the way in which the content was divided and the paradiscourse sub-text, neither of these problems applied. There were 12 short SCs (2-8 tone units in length) in the IES model. One was described above in Figure 6-10 from SH’s transcript, and a further eight SCs consisted of the same kind of topic pronouncement as that found in BL’s transcript or were truncated due to interference from the paradiscourse sub-text (see Figure 6-9). Therefore, these were SC patterns that were also found in the NS model. Figure 6-11 shows two examples of SCs coextensive with short topic pronouncements from UT’s presentation. The first SC describes the two kinds of Bode Plot the students will learn in the lab, and the second announces the particular subtopic the TA is about to discuss, ‘first I’ll explain what is an amplitude plot’.

Figure 6-11. An Example of Two Short Sequence Chains Coextensive with Topic Announcements from UT’s Presentation.
The remaining three short SCs reflect the unique pitch patterns found only in this group of speakers. One is shown above in Figure 6-7 from UT's presentation, and two are shown below in Figure 6-12. In this part of the presentation, KK is explaining the equilibrium equation used in this experiment (Force = Mass x Acceleration). The two SCs refer to the masses on each side of the meter stick. Each SC has a similar prosodic structure, and both end with a sharply rising R+ tone followed by a low key falling tone which completes the SC, 'times the acceleration due to gravity'. The Fo contour for both these final patterns is shown in Figure 6-13. Both contours are characterized by the pitch jumps shown in the earlier examples in Figures 6-6 and 6-7.

In the second example in Figure 6-12, the falling tone on 'gravity' is preceded by a short [0.4] second pause, and a similar [0.24] second pause occurs in the example shown in Figure 6-7, 'and the ANgle is TEN POINT// [0.24] //FIVE//'. This structure sounds similar to the template pattern used by the NS TAs and discussed in Chapter 4. The template construction is often used by teachers to encourage students to "fill in the blank" when the teacher believes the answer is recoverable. It is characterized by the use of a level tone and a short pause, followed by a single or compound item given in a low key with a falling tone. An example from MK's presentation is given below:

H M o because SODi um would have BEEN// [0.44] //p bright L

The difference between the NS and IES pattern lies in the dramatic shifts in key prior to the final tones, and the rising tone that precedes the pause. However, it is a recognizable approximation of a pattern
used by the NS TAs to close pitch sequence or sequence boundaries, and may be interpreted as such by the NS hearers.

There were also examples of very long SCs (between 20-37 TUs in length) in each of the four IE presentations. With the exception of one speaker (SH), the SCs in the IES data were divided into PSs which tended to coincide with the paradiscourse sub-text and create a sense of prosodic paragraphing. Only SH did not use regular SC boundaries. In addition, SH’s presentation had the highest word count\(^9\) of this group, and the TA did not use the board; therefore, there were comparatively long stretches of discourse which contained few prosodic paragraph breaks. Again, this was related to the unique pitch patterns

---

\(^9\)Word counts for the four presentations were as follows: UT, 337 words; KK, 381 words; SF, 462 words; SH, 626 words.
associated with this group of speakers. Although there was no evidence
of the kinds of pitch leaps shown in Figures 6-6 and 6-7, SH frequently
used the pitch drop pattern on final prominent syllables in conjunction
with a rising or high level tone at the end of intonational phrases which
raised the Fo contour at transaction closing boundaries. A typical
example of this pattern is shown in Figure 6-14. In this part of the
presentation, SH is reviewing the information the students must include
in their computer simulations. He discusses two topics, the equations
and the simulation statement. Following the initial high key marker and
opening phrase, 'and similarly, if the equation', SH initiates a repair and
begins a new clause, 'normally when you do the programming'.
Prominence patterns are characterized by a drop in pitch on the
prominent syllable and a rise on the non-prominent syllable. Repair
structures in the NS data are typically indicated by a pitch peak
accompanied in some cases by a short pause, (see, for example, Figure
4-5). Consequently, SH's comparatively unmarked repair is likely

Figure 6-13. Instrumental Reading of the Sharp Rising-Falling Fo
Contours from KK's Presentation.
Figure 6-13, continued.

to be difficult for AE listeners to perceive in the real-time production of the discourse. In the following tone units, prominence is frequently realized by a drop in pitch and there is a continual upward movement at the unit boundaries. This is particularly clear at the end of the discussion regarding equations, 'so doctor Schwartz asked us to cut one mark for that and similarly for this', which drops to a low key on prominent syllables and then rises on the final termination to a mid key. The Fo contour of this section is shown in Figure 6-15. The mid key termination is followed by a [1.54] second topic pause in which SH scans the students. The series of low key units prior to the mid key termination, in addition to the strategic pause boundary, suggest a transaction boundary for AE listeners which is not marked as a SC boundary because of this final rise in pitch. As shown in Figure 6-14, the topic changes to a discussion of the simulation statement at this boundary point, and SH uses a high key to announce the new topic, 'regarding the simulation statement' (although this is again
compromised by a pitch drop on the first prominent syllable). Much of SH's presentation is characterized by similar patterns which prevent SC or PS closure and provide little relief for the NS hearer.

Figure 6-14. An Example of Mid and High Termination Choices Preventing SC Closure from SH's Presentation.
Summary of Sequence Chain Structure

In summary, IE SC structure more closely approximated the patterns found in the NS discourse than that found in the NNS data set. The majority of SCs marked points of maximal disjunction, which were also indicated at other levels of discourse organization. Where boundary markers were absent, this usually coincided with interference from the paradiscourse sub-text. In terms of internal structure, however, IE SCs differed from both the NS and NNS data sets. Unique pitch characteristics resulted in a number of SCs which were either shorter or longer than those found in the NS data. While several short SCs approximated the template pattern found in the NS teaching discourse, unique pitch drop prominence patterns, in conjunction with rising or
level tones, created difficulties in interpreting prosodic paragraphing which were most evident in SH's presentation.

Pitch Sequences and Discourse Markers

In line with the previous two analyses, this section is divided into two parts. The first will focus on what evidence could be found for an interpretable system of pitch sequence (PS) structuring in the IES data compared to the NS data, and the second examines the use of discourse markers by this group of speakers.

Pitch Sequences

Pitch sequences could be identified throughout the IES data, and like sequence chain structure, PS structuring more closely resembled the patterns found in the NS group than those in the NNS data set. In the NS model, this level of structure served to distinguish main (informative) content from subsidiary material such as glosses or asides, or to divide the topic of a transaction into smaller subtopics. Pitch sequence patterning reflected the speakers' use of key to distinguish contrastive or particularized statements (high key) from additive (mid key) or equative (low key) material. There were clear parallels between the use of PS structuring for these functions in the NS and IES data sets. Several examples are given below.

Chapter 4, Figure 4-12 shows a PS from BD's presentation (NS parallel to UT) in which he explains to the students that they will learn how to draw a simple Bode plot in this class, and more complicated plots will be covered later in the semester. This PS begins with a mid key which is followed by a series of low key units as BD adds the subsidiary, parenthetical information regarding the more complicated
plots. This is followed by a rise to a mid key as he returns to the informative content. Figure 6-16 shows a roughly equivalent example from UT's presentation. Just prior to this extract, UT has explained to the students how to find the frequency response for a single frequency using the appropriate formula. The simple Bode plot is a graph of a number of frequency responses, and this is what UT is about to explain. The SC begins with a series of high to mid key units outlining this topic, 'but we're required to find $H$ of $J \omega$ for all frequencies, we don't want only for one frequency'. This is followed by a mid to low key summary statement which closes the PS, 'we want for different frequencies'. UT then produces a series of PSs which function as low key reformulations or extensions of the earlier statements and list possible frequency values, 'twenty, thirty, forty, hundred, then go on until thousand'. This subsidiary material is followed by a mid key rising confirmation marker, and UT then returns to a low key to complete the reformulation, 'then I'll go on increasing for different frequency'. This pattern is also very similar to the low key extensions used by BL, to connect a math concept to the real world, 'you want that, you want your money to grow in a bank'. The final two units in UT's extract constitute a separate PS beginning in a mid key as he returns to the main, informative content, 'so we need to draw plot'. Although examples like these clearly parallel extracts found in the NS data, it should be noted that there is some interference in the perception of this overall PS structuring due to the phonetic realization of some of the prominent syllables in this section, and unusual level changes on consecutive
words or syllables within tone unit boundaries (indicated by the use of italics).

| H ////r+ BUT// p r we're reQUİRED to FIND// [0.2] //r H of j ga// oME |
| H ///p for ALL DON'T Only for FREquencies// r p we WANT ONE FREquency// |
| H /r we WANT FOR ferent// //r+ oK// |
| L DIF //p FREQUENCIES/// //r like |
| H M |
| L TEN/// r r o TWENty THIrty FORty HUNDred// r then go ON til |
| H M //r+ oK// |
| L THOUSand/// //p then i'll go ON inCREAsing/// p for |
| H M ferent //r+ so we NEED to DRAW// |
| L DIF FREquency/// //p PLOT/// |

Figure 6-16. An Example of Pitch Sequence Structure and Main and Subsidiary Content from UT's Presentation.

Pitch sequences also marked the boundary between the main content and brief asides related to boardwork as shown in Figure 6-17 from SF’s presentation. The first PS (coextensive with a SC), introduces the graph the TA is about to write on the board, 'if you see the characteristics of an ideal diode, it's gonna be something like this'. The second PS, also coextensive with a SC, coincides with SF graphing the line of the current on the board (hence the [1.64] second pause). This is followed by an additional mid to low key tone unit, 'VI characteristics
if you SEE the RISTics of an IDEAL DIode// [0.23]

it's gonna be SOMETHing like THIS// [1.2]

/o at ZERo INput

/VOLtage// [0.09] NO// [1.64]

/o there is //p CURrent at ALL///

/p r+ i CHAracteristics these are CALLED the v

V CHAracteristics of a OK///

these are called the \( I-V \) characteristics of a diode' as SF briefly references the axes of the graph he has previously drawn on the board.\(^{10}\) This is something that should be familiar to the students, and this unit in conjunction with the following rising 'OK' marker, can be loosely glossed as, 'by the way, the names of these axes are the \( I \) and \( V \) characteristics of a diode, and we know that don't we'.

As noted in the previous section, three of the four presentations were focussed around information the TA was writing on the board, and there was a close relationship between PS boundaries and the organization of the paradiscourse sub-text. The example shown above in Figure 6-17 is similar to the "paradiscourse" units found the NS data.

---

\(^{10}\)My consultant for the electrical engineering course suggests that SF repeats the statement as these are normally referred to as 'IV' rather than 'VI' characteristics.
i.e., a unit of structure consisting virtually solely of boardwork, and highlights the necessity for a method of analysis that can show how activities outside the text may shape the text itself, and allow it to be reasonably interpreted in its situational context.

Figure 6-18 shows a short series of PSs from the opening of SF's presentation which connect the prosodic structure to breaks in the content and boardwork presentation. The presentation begins with a mid to high key statement of the topic, 'what's a diode, a diode is a two terminal device', followed by a [0.84] second pause as SF begins to draw a diagram of a diode. This is followed by a template construction 'the circuit symbol for it is...', which is completed on the board. This boardwork is reformulated in a final mid to low key unit, 'this way', which completes the first PS. The second mid key, additive pitch sequence describes the labelling of the two nodes at each end of the device, 'this node is called the anode and this terminal is called the cathode'. The final PS marks a new subtopic as SF describes the difference between a diode and a similar device the students have been working with in the previous lab which also involves an electrical current, 'it's a passive device but the difference between a diode and a resistor is that...'. This PS closes with a low key and [1.18] second pause as SF scans the students. In each case, the PS boundaries match shifts in the content as SF moves to different parts of the diagram on the board. Like the previous examples however, there is also evidence of interference in the prosodic cues from prominence realization. This is particularly evident at the boundary between the second and third PS. I have marked this as a pitch sequence boundary as it begins with
**Figure 6-18.** An Example of Pitch Sequence Structure Coextensive with Boardwork and Content Divisions from SF's Presentation.

a mid key choice realized on 'passive'; however, SF then rises to a high key termination on 'device', and he maintains this high key across the following group of tone units. This suggests a stronger SC boundary, particularly in light of the topic change. It is difficult to assess the initial key choice as the prominence on 'PAssive' is realized by a dip in the Fo contour followed by a level, mid pitch on the second syllable. It is proposed that this particular case can be reasonably interpreted by
the AE hearer(s) as either a SC or PS boundary as the prosodic break clearly matches a point of disjunction at other levels of discourse organization.

There were also PSs which could not be so easily determined due to the unique pitch patterns found in this group of speakers. Unlike the NNS data however, where disfluencies and repair caused widespread problems at the level of PS structure, these difficulties tended to be localized and directly related to phonetic patterns. Therefore, the relationship between content and prosodic "chunking" was easier to retrieve in the IES data.

A typical example from KK's extract is shown in Figure 6-19. Just prior to this extract, KK explains how the weights of the masses the students are placing on the meter stick are converted into variables for the equation they will calculate at the end of the second part of the experimental work:

This one is tau CC and this one is tau C/
this should be equal/ for the equilibrium.

This explanation closes with the low key //o SO// marker shown at the beginning of Figure 6-19. The following tone units, which begin with the mid key lexical phrase, 'for part two', are clearly a recapitulation of this information. Several of the tone units in the first PS, however, contain unusual prominence patterns which consistently drop key choice to a low key before the low termination boundary, 'and also find out the pacentage difference of tau CC and tau C'. The second PS is an

---

11 The spelling of 'percentage' reflects the incorrect prominent /a/ vowel which appears on the first syllable of this word.
'afterthought' following a strategic topic length [0.9] second pause, and consists only of the mid key additive tone unit, 'this should be equal'. Following a rising confirmation marker, KK completes the recapitulation in a series of mid to low key units that form separate PSs. This particular section is problematic as the low key terminations and pause boundaries do not match the content. The AE listener would expect: 

"in part one// this is a diagram for the part two of the experiment//. This is a repair construction similar to that shown in Figure 6-14, as KK begins with the phrase 'in part one', but then goes on to talk about part two. The low key termination on 'diagram' and [0.7] second pause make this difficult for the AE listener to interpret in the real time of the discourse. Finally, there is a clear point of maximal disjunction
indicated by the low key termination on 'experiment' accompanied by a [5.25] second pause, and a new SC begins with the lexical phrase, 'and for part three'. This extract shows KK to be making key and termination choices which, for the most part, reflect the nature of the content, i.e., mid to low key choices for the summarized material, and a return to high key when he moves to the third part of the experiment. However, low key prominence choices interfere with this overall pattern and render it less effective for the AE hearer(s).

The most consistent difficulties with the interpretation of PS structure occurred in SH's presentation. When compared to the NS data, there are far fewer clearly marked prosodic paragraph structures in SH's presentation as boundaries were affected by this TA's frequent use of rising or high, level tones on termination choices at the end of intonational contours (see for example, Figure 6-14 and 6-15). Drop-Rise patterns appear throughout the presentation at tone unit boundaries and are often further accentuated by the use of an R+ tone:

\[
\begin{align*}
H &/r+\text{ they THOUGHT it maybe a ONE//...} \\
M &\text{Minor} \\
L &\
H &/r+\text{ an tive high or an tive LOW//...} \\
M &\text{AC} \\
L &\text{AC} \\
H &\text{aSSIGNment//...} \\
M &/r+\text{ in the PIN STATEment or} \\
L &\
\end{align*}
\]

The Fo contour created by these level changes does not resemble the patterns found in NS discourse. In the NS data, a typical contour exhibits a gradually falling baseline combined with pitch peaks on
prominent syllables. In SH’s extract, these drop-rise patterns consistently return the pitch values to the same height both in prominent syllables and at the ends of tone units. The Fo reading of two such patterns are given in Figures 6-20 and 6-21. In 6-20, the Fo contour shows a downward movement toward ‘Minor’ followed by a rising
tone on the final termination which returns the pitch height to a high key. In addition to a similar upward movement at the end of Figure 6-21, there is also a very clear low to high jump in pitch on the prominent word, 'Active'. This gives a sense of a lack of completion of prosodic units which is compounded by problems in assessing tone choice.

Summary of Pitch Sequences

In summary, PS structure in the IE data more closely resembled the NS data than the NNS group. Low key boundaries were used to separate subsidiary material such as asides or other parenthetical material from the main, informative content of the presentation, and low key reformulation patterns paralleled those found in the NS discourse. The paradiscourse sub-text was a more influential organizational factor in these presentations compared to the other two groups. However, in general, the relationship between PS boundaries and paradiscourse activities paralleled that found in the NS discourse. As with SC structure, PSs were affected by the unique pitch characteristics found in this group. The pitch drop pattern found on prominent syllables interfered with low key boundaries in some instances, and this was a more consistent problem in SH's presentation.

Discourse Markers

In agreement with both the NS and NNS data sets, the IES speakers used a closed set of lexically equivalent but prosodically distinct discourse markers (SO, OK, NOW and RIGHT)\textsuperscript{12} for a variety of

\textsuperscript{12}There was also one //r+ CLEAR// token (in UT's extract) which functioned in the same manner as a //r+RIGHT// marker.
functions, i.e., as framing devices, dummy low key choices, and rising solidarity markers. The overall number of markers found in the IES data is not comparable to the other two groups, as there are fewer speakers and shorter extracts in this data set. However, a comparative analysis does show more similarities between the IES and NNS group than between the IES and NS speakers. Compared to the NS data, discourse markers in this set appeared less frequently and were very unevenly distributed among the speakers (particularly rising solidarity markers). The number and prosodic composition of the discourse markers in the IES data is shown in the table below. As the table shows, there is an overall lack of discourse markers across the data set, and particularly in SH and SF’s presentations. The only marker in SH’s presentation appears at the very end of the extract analyzed here and acts as a dummy low key choice to close the SC following a mid termination.

SH appeared to substitute non-prominent sequencing markers such as 'and' and 'so' for clearly defined discourse markers which contributed to the lack of overall structuring found in this particular presentation. In the remaining three presentations, discourse markers were divided into two groups; those realized with O and P tones, and rising solidarity markers.

Discourse markers exhibiting O and P tones appeared most frequently at retrospective transaction boundaries, or within pitch sequences, primarily at boundaries between the text and the
paradiscourse sub-text. Where they appeared, they fulfilled the same functions as O and P tones found in the NS and NNS group, although six of the eleven discourse markers were realized with prosodically weak

Table 6-5. Discourse Markers in IES Data Set

<table>
<thead>
<tr>
<th>TONE CHOICE</th>
<th>P</th>
<th>O</th>
<th>R</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>KEY</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>SH</td>
<td>1</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>SF</td>
<td></td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>KK</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>7</td>
</tr>
<tr>
<td>UT</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>14</td>
</tr>
</tbody>
</table>

O tones, and the only proclaiming tone markers appeared in a low key.

Turning now to discourse markers realized with a rising tone, as the table shows, most of these appeared in UT's extract. These tokens clearly functioned as solidarity markers in the same manner as those found in the NS data, i.e., to be asking, or to be seen to be asking for confirmation of student understanding. Two examples of //r+ oK// markers are shown above in Figure 6-16; one is followed by a [1.23] second pause in which UT scans the students, and the other with a much shorter [0.2] second pause as the TA briefly turns towards them. The ten R/R+ discourse markers in UT's presentation also included one high key frame //r+ NOW// which opened this discourse extract:

H //r+ NOW//
M [0.04] //p using the CALculator// (UT)
L
There were no examples of frames appearing in a rising tone in the NS model; however, in this case, the same general principles regarding the communicative value of the R tone appear to apply here also. The token appears after a clear SC boundary, and is followed by a barely audible [0.04] second pause as UT turns towards the students suggesting the possibility that the marker is multifunctional and operates both as a discourse frame and as an acknowledgment of student participation in the discourse (but see discussion of KK's presentation below).

There is only one example of a rising confirmation marker in SF's presentation and this is discussed in Figure 6-17. The four rising tone markers which appear in KK's extract include two R tone frames similar to the one found in UT's presentation, and two solidarity markers. One example of each is shown in Figure 6-22 below. During the initial //r NOW// mid key frame KK continues to look at the board, and it is less clear that this is oriented toward the students.

**Summary of Discourse Markers**

In summary, unlike prosodic paragraphing, discourse markers in the IES discourse more closely resembled the NNS group than the NS data set. Like the NNS TAs, the IE speakers have acquired a set of prosodically distinct discourse markers which perform a number of functions; however, the IES use fewer markers overall, and these have a weaker phonological shape than those found in the NS data. It should also be noted, however, that 0 tone markers in the IES discourse may

13 Nor can I find any in the NS classroom discourse given by Barr (1990).
be more effective than those in the NNS presentations, as there are far fewer prominent hesitation markers also realized with an 0 tone.

Figure 6-22. Two Rising Discourse Markers from KK's Presentation.

Finally, discourse markers are also unevenly distributed among the speakers. In two of the four presentations, there is a lack of solidarity markers similar to that found in the NNS group, and in comparison to the NS group, there is less evidence of these rapport building devices in the IES presentations.

**Tone Choice and Orientation**

This final section of the analysis will investigate the tone choices made by the four speakers. In line with the previous two data sets, each of the IES presentations contained a lower limit of 100 tone units, and raw counts of tone choices were converted to percentages. However, there were two important differences regarding analysis of the tonal system in the IES data that distinguished this group of speakers from the NS and NNS groups. First, unlike the previous two data sets,
the unique pitch patterns found in these data caused occasional difficulty in identifying tone choices in three of the four presentations (SF, UT, KK); and this was particularly the case with analyzing SH's extract. During the transcription process, it became clear that some tone choices could only be resolved by reference to the Fo traces, as the perception of an O, P or R tone was unclear from the acoustic analysis. As the original NS hearers clearly did not have access to this analytical tool, these tone choices were considered difficult for the target audience of AE speakers to interpret, and are marked with a question mark (?) in the transcribed examples (these will be described in more detail below).

Second, in the previous two analyses, the teaching discourse could be characterized by a projection of direct orientation (the NS group) or oblique orientation (the NNS group), and this could be generalized across all the speakers in a given data set. In the IES data however, the tonal system was subject to wide individual variation which, for the most part, made these kinds of generalizations impossible. Therefore, the four speakers were grouped based on the predominant tone choices (R, P or O or combinations thereof) found in each extract; for example, SF's extract consists primarily of oblique O and P tones, whereas UT and KK's extracts contain largely R and P tones and virtually no O tone choices. In fact, this divides the four speakers into three subgroups which parallel a division that could be made by first language (SF, Hindi-Urdu; UT and KK, Bengali; SH, Tamil). As there is an insufficient number of speakers overall to make any firm statements regarding L1 transfer, I will refer to individual speakers as opposed to L1. However,
where applicable, the analysis includes discussion of the possible contribution of L1 transfer effects, and UT and KK's presentation are discussed in the same part of the analysis. Consequently, following the breakdown of tone choices across the data set shown in Table 6-6, the analysis is divided into three parts: analysis of tone choices in SF's presentation; analysis of UT and KK's presentations, and finally, analysis of SH's extract.

Table 6-6 summarizes the percentage of tone choices found in each presentation. The final column indicates the percentage of tone choices that were difficult to interpret in each presentation.

Table 6-6. Percentage of Tone Choices in the IES Data Set

<table>
<thead>
<tr>
<th></th>
<th>TA</th>
<th>SF</th>
<th>UT</th>
<th>KK</th>
<th>SH</th>
</tr>
</thead>
<tbody>
<tr>
<td>% OF P TONES</td>
<td>58</td>
<td>36</td>
<td>27</td>
<td>27</td>
<td></td>
</tr>
<tr>
<td>% OF R TONES</td>
<td>11</td>
<td>5</td>
<td>7</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>% OF O TONES</td>
<td>31</td>
<td>4</td>
<td>10</td>
<td>42</td>
<td></td>
</tr>
</tbody>
</table>

Teaching Assistant: SF

SF's presentation contains the highest percentage of O tones found in any extract across the three data sets. In combination with comparatively few R tone choices, this creates an oblique orientation throughout much of this presentation. In addition to these tone choices which are oriented toward the language rather than the hearer(s), SF works at the board throughout this extract, uses only one rising
confirmation marker, and rarely scans the students. A typical extract from SF's presentation is shown in Figure 6-23. This figure shows a complete SC in which SF is explaining the differences between a practical and idealized diode circuit. The SC begins with a comparison between the two circuits in which SF uses an appropriate high key for the contrasted items, 'ideal' and 'practical'. However, the phonetic realization of the items reduce the effectiveness of this prosodic cue. Both items occur with the low to high Fo pattern found on many of the prominences in these presentations, and this is compounded by the perception of equal prominence on each of the syllables in 'practical'. This is shown in the Fo contours given in Figure 6-24. The Fo contour also shows a break in intonational phrasing between the falling nucleus on 'Diode' and the following phrase; however, this proclaiming tone is unclear (hence the question mark), due to the lower rising pitch on the first syllable and the sustained higher level pitch on the second syllable before the Fo fall. The following two tone units form a template construction, 'there's gonna be some current flow which is called the reverse saturation current'. Again, there are shifts between pitch levels on the prominent syllables; however, the pattern is recognizable because of the short pause and level 0 tone. SF continues to use 0 and P tones throughout the remainder of the SC. P tones rather than 0 tones were often used at points of potential completion, and P tones which marked clause final boundaries were obscured by prominence patterns. Figure 6-25 shows the Fo contour for the second problematic proclaiming tone choice which appears later in the SC, 'and the anode is grounded'. On the nucleus, 'grounded', there is a low flat
pitch on the first prominent syllable and a peak followed by a falling pitch on the non-prominent second syllable. As with the examples shown in Figure 6-24, it is difficult to interpret this pattern as one of the termination choices found in the NS model. The difficulties encountered in the recognition of tone choices on tonic syllables were further compounded by problematic tone unit boundaries. Following the template construction shown above, there is a series of tone unit boundaries which divide well-formed phrases or clauses:

That is when the cathode is connected to the positive voltage $V$ and the anode is grounded there's gonna be some reverse saturation current flowing though the diode in the reverse direction

These do not form template constructions, as the tone unit boundary in these cases is followed by the remainder of the phrase or clause rather than a single item. In addition, tone choices tend to fall on function words rather than content words; for example, such as 'connected TO' or 'through THE'. Each of these problems contributes to both difficulties in assessing tone choice, and to a reduction in the effectiveness of the tonal system for AE listeners. R tones were used infrequently by SF and made up only 11% of the tone choices. Where they did appear, they were used to refer to items that were currently 'in play' in the discourse, i.e., items that had been previously introduced into the discourse, or appeared on the board.

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14 There is one approximation of the template construction with an R+ tone similar to the pattern found in UT and KK's presentation (see Figure 6); however, this is also followed by an incomplete phrase: //r+ WHAT I'm DOING is// //I'm conNECTing some VOLTage at the cath- NEgative//...
For example, 'diode' is introduced in the opening unit of the presentation with a P tone (//p WHAT's a Diode//), and is then referred

```
H Ideal Diode there's
M //p p I for an
L NO CURRENT FLOW
H BUT
M CASE of TIICAL
L Diodes// [0.62] //p o there's gonna be
H rent FLOW which is
M some CURRENT CALLED THE// [0.05]
L
H saturation
M CURRENT// [0.62] //p THAT WHEN the// [1.52]
L //er//
H [1.0] //p CATH CON //o o POSitive
L
H VOLTage V AND THE// [0.04] ODE is
L //p AN GROUNDED// [0.84]
H //o there's gonna be some REverse SATURATION CURRENT flowing
L
H THROUGH THE// [0.73]
L //p p Diode in the reVERSE direction//
```

Figure 6-23. O and P Tone Choices from SF's Presentation.

to using a rising tone on two other occasions in the first SC (//r+ p a Diode is a Two terminal deVICE//; //r+ p the DIFFerence between a Diode and a reSistor is THAT//). As noted above in Figure 6-15, SF also used one example of a rising confirmation marker. This use of R tones closely paralleled the typical pattern found in the NNS data where
rising tones appeared as isolated occurrences scattered across the data for the same discourse functions.

Figure 6-24. Instrumental Readings of Low to High Prominence Patterns from SF’s Presentation. a) Ideal Diode; b) Practical Diodes.

Finally, in addition to O and P tone choices, the reader will recall that oblique orientation was also signalled by the use of multiple prominences within tone units. In the NS data, multiple prominence
patterns occurred as a 'citation' tone in a limited number of contexts such as in technical expressions or lexical phrases. In contrast, in the NNS group, the number of multiple prominences virtually tripled, and less than half were comparable to NS choices. It was difficult to make a precise comparison between the IES data and the NS and NNS sets because of the unique prominence patterns found in this group of speakers. However, in comparison with the NS presentations, tone units tended to be shorter and contain more prominent syllables, or syllables that exhibited problematic pitch patterns and were therefore distinguished from the surrounding material (see, for example, Figure 6-24).

This was not only a feature of SF’s presentation, however, but applied to all four speakers regardless of tone choice. Gumperz (1982) suggests that this is a prosodic convention of Indian English. In his analysis of IE data, he notes that "the sentence is divided into several
prosodic pieces corresponding to English phrase rather than clause length units...thus, at least intonationally, almost every content word is highlighted" (p. 121). Gumperz also proposes that these patterns may stem from L1 transfer. All the data used in his analysis comes from Northern Indian speakers whose L1 is Hindi, Gujerati or Punjabi, and he notes that in Hindi, a sentence is divided into "syntactic pieces", e.g., an NP or VP, each of which is realized with a "sub-contour". Each sub-contour shows a series of rises to a level pitch with no one syllable clearly indicated as a nucleus. Regarding stress patterns, he notes that there is less difference in intensity between stressed and unstressed syllables, and that stressed syllables will be high or rising in pitch. There are clearly parallels here with SF’s prosodic structure; most particularly, with the notion of sub-contours and intensity readings (see Figure 6-3). However, these patterns were also found in the speech of the three other Indian language speakers. The pattern of rising to a level pitch was found in both SF and SH’s presentations, and although there are clear rises in pitch on some prominent syllables, there are also many examples of the use of a low level pitch to indicate prominence as opposed to a high pitch. Gumperz follows this discussion with an analysis of typical IE patterns of prosody, and there are clear parallels here with all the speakers analyzed in this group. In the following sentence, for example, ‘do you want a cup of tea or do you want a cup of coffee?’ (p. 124), Gumperz suggests that the material is divided into a series of small phrasal units which exhibit a "sharp downward pitch movement" on their initial stressed syllables followed by a pitch register shift upward on the final accented syllable of each
phrase. This can be transcribed using the conventions I have adopted as:

```plaintext
// you WANT// a // of TEA//
DO CUP
```

As noted earlier, in the conclusion of his analysis, Gumperz also suggests that these features are generalizable across IE speakers regardless of first language:

There is preliminary evidence to suggest that the peculiarities of Indian English described here will hold for most native speakers of Indo-Aryan languages such as Hindi, Urdu, Punjabi and Gujerati, as well as for speakers of the genetically unrelated Dravidian languages such as Telegu. (p. 128)

The data set discussed here certainly supports this preliminary evidence.

**Summary of SF's Tone Choices**

In summary, SF’s presentation consists largely of 0 and P tones and is characterized by an oblique orientation. R tones are infrequent and with one exception, where they do appear, they mark items that are currently 'in play' in the discourse rather than marking any of the other information or social functions found in the NS data. The effect of these oblique tone choices is further compounded by tone unit boundaries which break up single propositions into short phrasal units which exhibit multiple prominences. These last characteristics regarding tone unit division apply to all four speakers in this group, and suggest that conventional choices in IE English differ from those found in American English. For the NS hearer(s), these features combine to produce a level of prosodic structure which is difficult to interpret within the parameters of the NS model.
Teaching Assistants: UT and KK

In contrast to SF’s extract, tone choices appear to be directly oriented in UT and KK’s presentations. Both speakers use few 0 tones (UT, 5%; KK, 7%), and where these do appear, they match the citation tone found in the NS data set:

1. Pause fillers: //o AND// (KK)
2. Discourse markers: //o SO// (KK) //o ok NOW// (UT)
3. Listing: //o FORty HUNdred// (UT)
4. Boardwork: //o M...// (KK)

However, more than 50% of tone choices transcribed in UT and KK’s presentations were R tones (UT, 59%; KK, 66%). These two extracts exhibited the highest percentage of R tones across all three data sets, and virtually double the highest amounts found in the NS presentations (BL, 34%; MK: 31%). In other words, although tones appeared to show a direct orientation, how and where R and P tones were used in UT and KK’s presentations differed from the NS model. Turning first to the use of R tones in the two extracts, Figure 6-26 shows a typical example of a series of R tones. The SC begins with an initial organizational phrase which forms the first PS, ‘uh as you see for, just take this example’. This is followed by a succession of minimal R+ tone units as UT describes the example written on the board. The tonal pattern in several of these units, ‘one is THE// AMplitude//’, ‘Other is THE// ANgle//’, is similar to the approximation of the template pattern shown in Figure 6-6; however, the initial unit is completed with a sharply rising, rather than falling tone. Sample Fo contours are shown below in
Figure 27. There are also two examples of the template approximation, one of which closes this SC.

H M //r r+ that PLOT is CALLED AS// AMplitude L //p the PLOT//

As noted above, these may be more readily perceived by NS hearers as finality contours based on the NS TA's use of the similar template pattern; however, this does not appear to be the guiding principle for the speaker, and this is not a reliable prosodic cue for the NS hearer(s). Immediately preceding this final closing pattern, UT uses a template approximation which closes with a low key, but is followed by an additional mid key unit:

H M //r+ it means i Plot the DIFFerent// AMplitude// plitude// L

H M freQUencies// L

A similar pattern of tonal structure is found in KK's presentation:

H /////r THIS WILL BE// M CASE// r r+ the force DOWNward //r+ this L

H MASS// r+ TIMES// M //?r+ the acceleRAtion TO// L

DUE //p GRAvity//

The initial R+ rise, 'force downward will be', is followed by three short additional R+ units before the final falling tone.

Both these presentations are also characterized by the use of extremely short tone units often consisting of only one or two prominent syllables and little unstressed material. As with SF's presentation, this creates a series of 'sub-contours', or small prosodic pieces, rather than
Figure 26. An Example of a Series of Short Rising Tone Units from UT's Presentation.
a unified contour. The break between these pieces is further amplified in UT and KK's presentations by the abrupt pitch level changes resulting from the R+ tones.

There is nothing in principle to prevent a speaker from using a series of R/R+ tones if she believes or wishes to imply that the
information is accessible to the hearer. In both the discourse samples shown above, the items are currently 'in play' in the discourse, i.e., written on the board, and there are clearly appropriate individual R tone choices such as rising confirmation markers. In addition, in UT's sample, he remains facing the students, and is clearly scanning the students during the long pauses between tone units. However, at the level of tone unit organization, there is clearly a different structure from that found in the NS data, and these samples suggest that Fo patterns used by UT and KK are not necessarily based on an understanding of how the tonal system operates in American English. Although R tone choices found here can be interpreted within the tonal system (for example, the rising tones on discourse frames in these two presentations), based on the overall tonal patterns found throughout the discourse extract, and their phonetic shape, it is equally likely that these are conventionalized patterns as opposed to meaningful tone choices.

This proposal is supported by the possible effects of first language transfer. In an article describing Bengali intonation patterns, Hayes and Lahiri (1991) describe several patterns that are similar to those found in these discourse extracts. In Bengali, Hayes and Lahiri identify a nucleus inventory of eight possible patterns. In half of these, stress is assigned to focussed constituents with a low tone, i.e., realized with a low pitch, which parallels the pitch drop pattern found here on many of the prominent syllables. Two of these patterns, which

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15 For example, Brazil (1997) suggests that story-telling often begins with this assumption: //r* a GREAT while aG0// r* while there were still Giants on the earth// (p. 92).
the authors call "downstep nuclei", consist of a rising head (i.e., the initial part of the tone unit) followed by the main stressed syllable which sounds "distinctly lower than the preceding syllable and begins a pitch fall that continues to the end of the sentence" (p. 70). This pattern sounds very similar to the template approximations found in these two presentations, and it is certainly possible that the construction may originate from this first language pattern. As further support, this downstep pattern\textsuperscript{16} is found only once in SF's presentation and does not appear in SH's discourse. However, as with patterns described in the previous section, research reported in the IE literature does suggest that downstep nuclei may be more generalizable in IE and found across both North and South Indian English. Bansal (1967: 146) includes several examples of this pattern in his discussion of IE spoken by Hindi and Telegu speakers:\textsuperscript{17}

\begin{quote} I'm learning an East African language/ that is known as/ Swahili/ (Hindi) Have you got/ a pen/ (Telegu) \end{quote}

An explanation for these findings is suggested by Bansal, who proposes that certain features may be more pronounced in speakers from different regions, presumably due to L1 effects, but that a number of consistent features will characterize Indian English speakers as a group:

\begin{quote} Indian English, even Educated Indian English, varies from region to region, but it retains certain common patterns which mark it as distinctively Indian. (p. 167) \end{quote}

\textsuperscript{16} 'Downstep' is a term taken from phonological theory, particularly theories concerned with tone languages where it refers to tonal targets. It is used here only as a descriptive label for the specific contour found in these data.

\textsuperscript{17} The diacritics are glossed as follows: \textsuperscript{16} main accentual stress or pitch prominence; \textsuperscript{16} low rising pitch; \textsuperscript{16} falling rising pitch.
As shown on Table 6-6, the predominant use of R tones in these two presentations considerably reduces the number of P tones found in these extracts in comparison to both the NS and NNS groups (UT, 36%; KK, 27%). Where P tones do appear, they are primarily used to close PS or SC boundaries, particularly as part of the downstep pattern, or can be interpreted as 'proclaiming' the information within the tone unit. In the short example shown below from UT’s transcript (also shown in Figure 6-10), the TA pronounces the new topic using successive P tones:

H
M //o ok NOW//p AM 
L PLOT//p FIRST i'll explain what IS an plitude AM
H
M
L PLOT//

The speakers’ use of low key falling tones to close prosodic units suggests an awareness of prosodic paragraph structures. In addition, the phonetic realization of final termination choices at these points in the discourse frequently differs from phonetic patterns found within SCs; for example, a tonic syllable is realized with a pitch peak on the prominent syllable followed by a fall, as opposed to a pitch drop followed by a level or rising tone.\(^\text{18}\) However, these tone patterns also differed from the NS model. In the NS data, paragraph final, low key falling tones co-occurred with a gradual declination in pitch and a falling baseline, whereas UT and KK’s final units were largely characterized by abrupt changes in pitch between key and termination.

\(^{18}\)This also applies to SF’s presentation where the typical realization of VOLTage (see Figure 1a), is reversed at the end of prosodic paragraphs.
choices. This was particularly evident in KK's extract as R+ tones could extend to 280h-300 hz which was the highest Fo value of any speaker across all three data sets. As noted above, this created a series of sub-contours which were not found in the NS data.

Summary of UT's and KK's Tone Choices

In summary, both UT and KK used directly oriented tones and primarily R tones throughout their presentations. The analysis suggested, however, that many of the choices may be conventionalized patterns as opposed to meaningful choices within the tonal system proposed in the model. This applied particularly to the use of the downstep nucleus, which may be based on a similar pattern found in the L1 of these speakers. In addition, the downstep pattern and register shifts shown on prominent syllables create a unit closing pattern which does not match declination contours found in the NS data. Finally, the majority of tone units were minimal tonic segments with multiple prominences which separated single propositions. This mismatch between information and prosodic structure, also found in SF's presentation, caused a breakdown in the organization of the discourse at this level of structure.

Teaching Assistant: SH

SH's discourse extract was distinguished from the other three presentations in this group by the number of tone choices that were difficult to interpret. 42% of the tonic syllables transcribed in this presentation (including R, P and 0 tones) were identified largely from the Fo contour produced by the instrumental analysis. One section of SH's extract that demonstrates the typical problems found in identifying
tone choice is shown in Figure 6-28. This is the opening of SH's discussion of the informative content of the lab which begins with 'these statements' as SH points to the blackboard. The Fo contour for the opening tone units is shown in Figure 6-29. As the contour shows, both syllables in 'statements' begin at the same pitch height and there is a short fall followed by a slight rise on each syllable. Although this is not the typical Fo contour found with a level tone (see, for example, the NS example in Figure 6-5), the perception of equal stress on both syllables and the slight pitch movement, most closely resemble a level tone for the hearer. The second problematic tone is also shown in Figure 6-29. This tone is heard as a probable R+ choice because of the rise on the prominent syllable, 'WRITTten'. However, R+ choices in the NS data continue the rising movement on the following non-prominent syllable, whereas here, the contour is level followed by a slight fall which makes the actual tone difficult to determine. The following three tone choices are shown in Figure 6-30. Both 'statements' and 'program' are heard as probable R tone choices because of the 'dip' in the Fo contour found on the first prominent syllable. However, this perception is confused by the mismatch of pitch and intensity found on these syllables. As the figure shows, although there a slight drop in intensity on the second syllable in 'statements', this is counteracted by the higher level pitch. In the phonetic realization of 'program' the slight drop in intensity coincides with the prominent first syllable, and the slight increase in amplitude on the second syllable contributes to the difficulty in assessing tonal movement. The third tone on 'bechaUSE' is more clearly read as an O tone due to the level pitch on the second
THESE STATEMENTS you may be familiar with but I've written certain STATEMENTS which are USED for the PAL-asm PROGRAM cause last during the semester in the exam there were certain QUESTIONS usually I think you may NOT but THERE are specific questions on it of them didn't properly that is MOST beCAUSE they THOUGHT it maybe a Minor

Figure 6-28. An Example of Problematic Tone Choices from SH's Presentation.

prominent syllable and matching increase in amplitude; however, again, there is a distinct dip in pitch that distinguishes the first non-prominent syllable from unstressed material. The following two tone choices in this section are shown in Figure 6-31. The first tone is obscured by the abrupt drop in pitch on the immediately preceding prominent word 'last' and jump upwards in pitch level for the tonic on 'semester'. The perception of an R tone comes from a drop in pitch on
the middle syllable in 'seMEster' which is not shown on the Fo contour due to the voiceless segments; however, the surrounding pitch movements undermine this movement. The P tone on 'exAM' is easier to perceive because of a clearer fall in pitch on the prominent syllable, although again, there is a drop on the first non-prominent syllable and this does not sound equivalent to unstressed syllables found in the NS data. Finally, Figure 6-32 shows the following problematic tone choice on 'QUEStions'. The difficulty in assessing this tone choice again comes from the low-high pitch pattern on the two syllables and no drop in amplitude.

As with UT and KK, these low-high patterns of stress may be at least partially the result of L1 transfer. In a discussion of word melody, Mohanan (1986) states that Dravidian languages exhibit a LH (low-high) pattern in which primary stress is indicated with a low tone. In conjunction with Hayes and Lahiri's proposals for Bengali, this suggests that both North and South Indian speakers may use this
pattern to realize prominence. Gumperz (1982) suggests that the same pattern may be found in Hind-Urdu speakers, and it is possible that this feature, stemming originally from Indian languages, has become conventionalized in Indian English. Figure 6-32 also clearly shows the 'sub-contour' patterns found in SH's discourse which matched those found in the other three speakers. Each tone unit, 'there were certain questions// usually I think// you may not//' forms a separate prosodic phrase, and these break up the structure of the sentence.

Although percentages of particular R, P and O tone choices are given for SH in Table 6-6, the problems described above applied to virtually half the tonic syllables transcribed in this presentation as compared to 10% or less in the discourse extracts of the other three speakers. Based on these difficulties of interpretation, it is unlikely that they are perceived by the hearer(s) as meaningful tone choices. It is also assumed, however, that the hearer(s) will attempt to make sense of the prosodic structure within the parameters of the NS model in much the same way as I have done in the transcripts shown here. In this case, prosodic cues will hinder rather than assist comprehension of the discourse structure.

With this caveat in mind, across the discourse extract, there were more approximations of R and O tones, than falling P tones (O and R tones made up 73% of choices). When combined with the lack of prosodic paragraph boundaries found in this presentation and discussed earlier in the analysis, there was little sense of clear unit closing boundaries in the prosodic system and the hierarchical organizational structure found in the NS data was very difficult to identify in this
Figure 6-30. Instrumental Readings of Problematic Tone Choices from SH's Presentation. a) Pitch Pattern; b) Amplitude Pattern.

Figure 6-30, continued.

presentation. There was some evidence to show that SH used tonal patterns for functions similar to those found in the other speakers in this group and the NS group. In the two examples shown below, SH is referring to items written on the board using (approximate) R tone choices:
//?r+ so HERE i HIGHLIGHTed them/>

//?r o ?r+ HERE for exAMple Pin TWO is INput/>

Figure 6-31. Instrumental Reading of the Fo Contour of Problematic Tone Choices from SH's Presentation.

Figure 6-32. Instrumental Readings of a Problematic Tone Choice and Sub-Contour Patterns in SH's Presentation.
 a) Pitch Pattern; b) Amplitude Pattern.

However, these examples are often ineffective due to the phonetic realization of surrounding syllables. In the example given below, every
content word in the tone unit is made prominent, and the LH prominence patterns on 'INput' and 'OUTput' and 'Active' detract from the final tonic syllable.

H M //r+ SPECified the put or put is an tive LOW// L IN OUT AC

Summary of SH's Tone Choices

In summary, almost half of the tone choices in SH's presentation are difficult to interpret due to the manner of phonetic realization. Prominence was primarily realized with a LH pattern that resulted in abrupt shifts between pitch levels. Termination and key choices often exhibited a level or slight rising movement on the final non-prominent syllable rather than a continuation of the Fo contour in the direction of the tonal movement. In addition, mismatches between pitch and amplitude confused prominent and non-prominent syllables. As tone choices were so difficult to determine, it was difficult to identify meaningful choices within the tonal system proposed in the model.
However, overall, there were more approximations of R and O tones which contributed to the sense of a lack of clear unit boundaries.

Conclusion

Gumperz (1982) suggests that IES speakers have their own systematic conventions of prosody, and the analysis presented here supports that proposal for a number of prosodic features. The IES group frequently use a LH word melody rather than a pitch peak on prominent syllables, and shifts in pitch register rather than tonal movement on tonic syllables. Another feature common to all the speakers in this group is a break up of clausal units into short phrases which are matched by intonational 'sub-contours'. In agreement with Bansal (1967) and Gumperz, I suggest that these characteristics form part of General Indian English prosodic conventions which stemmed originally from contact between English and Indian languages. These features now characterize this indigenized variety through a process of 'nativization' described by Kachru (1985).

As the final section of this analysis shows, these data also show individual variation between speakers. The downstep nuclei found in UT and KK's discourse do not appear in SH's presentation, and the substantial difficulty noted in assessing tone choices found in SH's presentation was not the case with the other three speakers. As noted earlier, the explanation may lie at least partially in the effects of L1 transfer. This was particularly the case for the downstep pattern found in UT and KK's presentation, as a similar pattern is described by Hayes & Lahiri (1991) in Bengali. The authors suggest that this pattern is used as a finality contour in Bengali, and it is also possible that these
speakers have adapted the template pattern they have heard in NS teaching discourse by 'mapping' their roughly equivalent first language pattern onto this construction.

Throughout the analysis, SH has been distinguished from the other three speakers. There is less evidence of prosodic paragraphing in this presentation, and considerable problems with tone choice. He is also the only South Indian speaker in this group, whose first language is part of the Dravidian language group. Research into the prosodic structure of South Indian languages is relatively scarce and occasionally contradictory. The two analyses I have found of Tamil contradict each other and the data found here. Balasubramanian (1972) suggests there is no stress in Tamil, and Ravinsankar (1994) states that stress in Tamil is realized in the same manner as in English in all contexts except where an emphatic or contrastive pattern is used. This accent does have the same LH pattern as that found on contrasted items in SH's presentation, for example:

\[
\begin{array}{ll}
\text{put} & \text{or} & \text{put} \\
\text{IN} & \text{OUT}
\end{array}
\]

however, it also appears in non-contrastive contexts throughout SH's discourse. The difficulty, of course, is that only one Dravidian speaker is analyzed here, and the particular features found in this discourse extract may be idiosyncratic. Variation may also be the result of a different proficiency level for this particular speaker. Kachru (1985) points out that English proficiency in India is subject to a "cline of bilingualism" (p. 70), and individual speakers may show varying ability. Although these four speakers have similar backgrounds and all
completed their secondary and undergraduate education in English medium schools, teachers and regional varieties of English may have varied widely (Sridhar & Sridhar, 1992).

Despite these unique characteristics, three of the four speakers organized higher level prosodic structures in much the same way as the NS group, demonstrating some familiarity with this particular aspect of the prosodic system in English. Prosodic paragraphs usually marked points of maximal disjunction at other levels of discourse organization, or activities outside the text itself. For the most part, this also marked the difference between the NNS and IES speakers in terms of familiarity with the language itself. There was no evidence in the IES discourse of the consistent disfluencies and difficulties in online verbal production found in the NNS data which seriously disrupted these prosodic units of organization.

Even with this closer approximation of the NS model, however, prosodic cues in the IES data, particularly at the level of tone unit structure, were less reliable, less explicit, and therefore less effective in this group compared to the NS discourse extracts. It is difficult to assess the precise effect of these features on discourse comprehensibility; however, it is clear that prosodic cues did not match listener expectations in terms of the NS model, and created a unique profile of prosodic composition. Bansal (1967: 92) suggests that the rising tones used at the ends of statements, found particularly in UT, KK and SH's presentations, will sound "unusual" to NS hearer(s). Gumperz (1982: 121) describes IE as sounding either "full of stress and staccato, or droning and monotonous", both of which imply difficulties in
assessing information structure. Discussions of comprehensibility in the Indian English literature are often obscured by the researcher's own position regarding the perceived 'value' of indigenized varieties of English. In an analysis of certain features of IE, for example, Parasher (1992) concludes that "it is in deviant lexical and stylistic usage of Indian English that its most characteristic features lie" (p. 163). In the same volume, Sridhar & Sridhar (1992: 45) state that comparisons with NS varieties of English are "irrelevant and misleading", presumably in reaction to the kinds of comments made by Parasher and others. Ultimately, intelligibility of IVES or any non-native variety must be based on listener expectation. Smith and Nelson (1985: 333) suggest that "intelligibility is not speaker or listener-centered but is interactional between speaker and hearer". Nelson (1985: 59) further states:

Being intelligible means being understood by an interlocutor at a given time in a given situation. This definition presumes participants, people who may not be from the same community...The extent to which their languages share phonological and grammatical features will determine the degree to which they are "intelligible".

In this case, it is these differences that affect the comprehensibility of the discourse extracts analyzed here. NS hearer(s) will attempt to interpret prosodic patterns within their understanding of the system. This may be further compounded by the fact that IE speakers do, in some cases, use more familiar patterns than non-native speakers. However, analysis of tone unit structure and tone choice particularly, show that these patterns are not easily interpretable within an NS model and presumably for the NS hearer(s). In addition, Nelson suggests that intelligibility includes not only the linguistic aspects of
competence, but also social aspects. In these data, the IES TAs more closely resembled the NNS group in the lack of solidarity marking and rapport-building devices found in their presentations. This further contributes to a lack of negotiation between these TAs and their students in a context where the hearer(s) would expect a direct orientation in discourse structuring.
CHAPTER 7
CONCLUSION

Summary of the Analyses

This study has compared the prosodic structure of 16 parallel extracts from the lecture discourse of three groups of speakers of English: native speakers, nonnative speakers (Chinese), and speakers of an indigenized variety (Indian English). A qualitative, interpretative design was chosen in order to conduct a microanalysis of the complete pitch and pause structure of each of the discourse extracts recorded for this study. The data were analyzed using both instrumental and auditory techniques, and interpreted using an existing model of intonation in discourse (Brazil, 1997). This analysis was set within a larger framework of cross-cultural interaction based primarily on Gumperz (1982). Prosodic structure is interpreted as one layer of discourse organization, which combines with lexical, syntactic, and nonverbal information to create the communicative value of the discourse as a whole. The results of the analysis of the NS data reported in Chapter 4 support the hierarchical model of prosodic units proposed by Brazil (1997) and Barr (1990). Speakers systematically used key and tone choices to organize the discourse at both the paragraph and sentential level. The interpretation of these choices also provided comprehensive and purposeful explanations for the intonation patterns found in the data, and define a role for intonation as a device used both to structure
the content of the discourse and to build rapport between discourse participants.

The results of the comparative analyses of the NNS and IES speakers reported in Chapters 5 and 6 showed that neither group of speakers consistently produced the same prosodic patterns as those found in the NS group. Despite individual variation among speakers within groups, each group could be characterized by a typical prosodic profile which marked speakers as deviating from a native speaker standard. Analysis of key and tone choices highlighted precisely where these differences occurred, and interpretation within the larger context of the discourse revealed why these differences both reduced discourse comprehensibility for the AE hearer(s), and negatively affected rapport-building between NS-NNS participants. The remainder of this chapter is divided into five parts. In the next three sections, I will briefly summarize the important findings of each of the analyses and their implications for each group of speakers. Following this, I will discuss the role of prosodic structure in the comprehensibility of L2 discourse and possible implications for ESL teaching. Finally, I will suggest possible areas of future research.

Results of the NS Analysis

Two of the most important findings from the NS analysis concern prosodic paragraphing and tone choice. Each of the data extracts was divided into a series of sequence chains marked by a high key and low termination at their boundaries. Within sequence chains, pitch sequence boundaries marked with either a mid or low key at their opening and a closing low termination created smaller prosodic paragraphing
structures. These findings contribute directly to the discussion of prosodic paragraphing in the literature discussed in Chapter 2 of this dissertation. As research shifts towards consideration of discourse structure as well as the intonational phrase, more and more researchers in both discourse analysis and speech perception recognize the major paratone, or sequence chain, as a valid unit of prosodic structure (Yule, 1980; Couper-Kuhlen, 1986; Wennerstrom, 1997). As a result of their analyses, some investigators have also suggested the possibility of a minor paratone, or internal paragraphing unit which would be consistent with the pitch sequence structure shown here (Yule, 1980; Couper-Kuhlen, 1986). This analysis depends on the recognition of key or a relative onset level. Using this system, the speaker can distinguish internal paragraphing boundaries following a low key from points of maximal disjunction indicated by high key sequence chain boundaries.

The analysis of both sequence chain and pitch sequence boundaries is supported by organizational units at other levels of the discourse structure. Over 80% of the sequence chains found in the NS data either coincided with changes in the area of attention of the discourse, or were also marked as transaction structures identified using non-intonational criteria, such as lexicalized framing moves and non-verbal signals. Pitch sequence boundaries coincided with breaks in the discourse related to the paradiscourse subtext or with subdivisions in the substantive content of the lectures themselves. The results of this integrated analysis offer clear support for a multiple cuing system operating concurrently at different levels of the discourse structure. By interpreting these signals within the situational context of the
interaction, the hearer(s) identify manageable "chunks" of related information and maximal breaks between them.

Turning now to tone choice, these data both confirm previous findings regarding the use of the tonal system, and add a new contribution with the discussion of solidarity marking by the teaching assistants. In agreement with recent analyses given in Hewings (1995) and Thompson (1994), rising tones were used by speakers in these data to indicate information already assumed to be accessible to the hearer(s). This function is described by Nevalainen (1992: 420) as the use of the R tone as a "deictic cohesive device," and it is defined by Thompson as follows:

The deictic function of the rise leaves it to the listener to locate the material, entities and relations referred to and to infer the contextually relevant contribution made by its use. (p. 72)

In these data, speakers used the deictic function of the rise to refer to experiences shared by these participants in previous labs, as well as to items currently 'in play' in the discourse. In fact, this particular use of the rising tone separated the six presentations into two groups based on the speakers' assumptions of presumed shared knowledge between themselves and the students. The results of the analysis also highlighted the social function of the rising tone, particularly in the use of what I have called 'solidarity marking'. Throughout the NS data, the teachers combined typical lexical markers such as 'right' and 'ok' with a rising tone to affirm the hearer(s) participation in the discourse. These findings provide clear evidence for the multifunctional nature of these lexical markers when their prosodic composition is taken into consideration.
The significance of both the deictic and social function of rising tones is to support a view of discourse as a co-operative achievement between participants regardless of whether the hearer is able to verbally respond to the message or not. Interpretation of R/P tones point directly toward an assumption on the part of the native speakers of an on-going negotiation between themselves and the hearer(s). Deictic reference, for example, requires the hearer(s) to "fill in the gaps," and solidarity markers were frequently not followed by a wait-time sufficiently long enough for the hearers to respond, yet fulfilled the same social function as those that were. This interactional approach to spoken genres which have been traditionally considered as monologic has significant implications for the notion of discourse comprehensibility, which will be discussed in more detail in below.

Results of the NNS Analysis

The NNS data set consisted of six discourse extracts, parallel to those in the NS group, given by Chinese speakers of English. In all respects, these ITAs needed to communicate the same information to their students as their NS counterparts. Prosodic choices were analyzed within this situational context and compared to the NS data. Analysis of the NNS data showed that these speakers were able to approximate prosodic patterns, but unable to consistently use key and tone choices to create the units of organization found in the NS discourse. When prosodic analysis was integrated with transaction structure and the paradiscourse subtext, for example, only 41% of sequence chains were comparable to those found in the NS data.
Individual variation between speakers in this group was largely concentrated at the higher levels of prosodic structure. Both BL and SM's presentations, for example, consisted largely of mid or low key choices, while KE showed a marked preference for high or mid key choices. In KE's presentation, this virtually excluded a pitch sequence structure and prevented sequence chain closure. On the whole, these speakers showed a limited ability to manipulate the key system, and prosodic cues were phonetically less distinct than those found in the NS data due to a narrower overall pitch range. At the lower levels of the prosodic model, all six presentations demonstrated a typical prosodic composition consisting of minimal tonic segments, an overuse of prominence, and lengthened unit internal pauses.

The speakers were also characterized as a group by their use of the tonal system. The NNS presentations consisted almost entirely of 0 or P tone choices regardless of the information value contained within the tone unit, and speakers demonstrated little or no use of the social function of the R tone. This is exemplified in the lack of solidarity marking found in this data set (8 rising markers compared to 26 in the NS data).

As noted in Chapter 5, it is probable that several factors contribute to this overall prosodic profile. The most immediate is the likelihood of L1 transfer. As Mandarin Chinese is a tone language, pitch variation is used to distinguish lexical tones on individual syllables. However, Chinese linguists have also consistently recognized the imposition of an intonation structure on tonal movement (Chao, 1933; Ho, 1976; Tao, 1996). Originally, this was thought to cause a successive
change to the Fo value of individual tones; for example, phrase final rising tones will rise higher and falling tones fall lower (Chao, 1933). However, more recent investigations using instrumental analysis suggest that the change in Fo is cumulative rather than successive; for example, a falling tone may fall less sharply in an interrogative environment, while a rising tone may flatten slightly in a declarative sentence (Ho, 1976; Shen, 1988). As this cumulative change produces only marginal changes in pitch movement on phrase final syllables, Mandarin Chinese speakers may have more difficulty producing nuclear stress on the tonic syllable in English. In addition, Eady (1982) suggests that in contrast to the one or two prominent Fo peaks in each tone unit in English, the lexical tones in Mandarin Chinese result in a greater number of local pitch movements within intonational phrases. These typical pitch movements in the L1 may contribute to the overuse of prominence in the nonnative data, and to the consequent difficulty for the NS analyst in distinguishing key and termination syllables.

Both Ho (1976) and Shen (1988) also found that grammatical contrasts in Chinese were signalled by changes in pitch register rather than tonal movement, i.e., interrogative sentences had a higher overall pitch level than declarative sentences. However, Tao (1996) found no similar contrast in his investigation of natural data and suggests that these pitch register changes may be an artifice of the decontextualized data used in these experimental designs. Tao found phrases beginning in a high register in non-interrogative environments and suggests researchers should investigate interactional discourse functions similar to those discussed in this study. There is a danger in applying the
possibility of L1 transfer too widely to L2 discourse, particularly when research in L1 natural data is scarce, and without reference to other important factors involved in L2 development. Chun (1987), for example, suggests that Chinese speakers of English will probably use a wider pitch range based on the register changes proposed in the grammatical intonation studies of Mandarin Chinese. This possible interlanguage feature was not found in the NNS speech; in fact, the opposite effect was found throughout most of these data.

In addition to L1 transfer, there is evidence that a second factor contributing to the particular prosodic patterns found in these data is on-line verbal planning. This can be addressed using cognitive accounts of second language development such as Anderson's (1983) Adaptive Control of Thought (ACT) model. Anderson proposes two basic types of knowledge, declarative and procedural. Declarative knowledge is essentially a series of facts which can only be activated with acquisition of the required procedural knowledge or skill. This involves the "development of procedures that transform declarative knowledge into a form that makes for easy or efficient performance" (Ellis, 1994: 338). Anderson proposes that procedural knowledge will occur gradually in an associative stage of development which will lead ultimately, given practice, to a final autonomous stage. As declarative and procedural knowledge are independent of each other in the sense that gains in the former do not necessarily lead to equal gain in the latter, L2 learners

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1 This is taken from the discussion of Anderson's model in Ellis (1994: 388). As Ellis points out, the ACT model is complex. A full description is not attempted here as the purpose is only to point out possible contributing factors to prosodic development.
may remain in an associative stage which may affect actual language production. Researchers have looked particularly at temporal aspects of production such as speech rate, hesitation markers, and pause structure for evidence of speech planning, or development of procedural skill (Raupach, 1983; Lennon, 1989). In these data, typical characteristics found across the group such as minimal units bounded by long pauses, use of a level tone, or even drops to a low key which are unmotivated by topic structure, may be the result of this associative stage of development. These particular characteristics were also found in a roughly equivalent group of Chinese speakers investigated in Wennerstrom (1998), and importantly, in a group of Italian speakers in Pirt (1990). This suggests that these may be broad developmental features related to the acquisition of fluency in the L2, and therefore may not be the result of L1 transfer.

Finally, the results of this study, in addition to the studies noted above, suggest that while certain aspects of the prosodic system in English, such as declination or juncture features, may be universal, others, such as the tonal system, are not. While some speakers in this group, for example, approximated some uses of R tones such as rising solidarity markers, usage suggested acquisition of "formulaic chunks" as opposed to an understanding of the R/P tonal system. In current ESL practice, the intonation system is still largely taught in isolation, and priority is given to grammatical contrasts or attitudinal effects (Levis, 1999). Within the framework suggested here, intonation forms part of discourse and pragmatic competence, as well as overall linguistic competence, and when we begin to teach intonation with this in mind, we
will more able to assess the contribution of these individual factors to L2 acquisition of prosodic systems.

Results of the IVE Analysis

The Indian English (IE) data set consisted of four discourse extracts, two of which were parallel to presentations in the NS and NNS groups. The speakers themselves had similar IE backgrounds, but three different L1s: Bengali, Hindi-Urdu and Tamil. In the results of the IE analysis, there was some evidence to show that the Bengali speakers had transferred a 'downstep' pattern from their L1 in similar discourse environments, and unique pitch patterns in the Tamil speaker data may also be related to L1 patterns. Clearly, with only one or two speakers from each L1 group and the possibility of varying proficiency levels, these findings remain to be tested further. As a group, however, these speakers exhibited a number of characteristics that suggest that IES speakers have their own systematic prosodic conventions which create a typical General Indian English (GIE) prosodic profile. These results both support previous findings regarding GIE, and add a new contribution to the discussion of sub-varieties of Indian English. In agreement with the proposals made by Gumperz (1982), Bansal (1967), and others, these data show that tone units are typically shorter, phrasal units are matched by intonation 'sub-contours', and tonic syllables are frequently indicated by pitch register rather than tonal movement. In addition, all four speakers used a LH word melody rather than a pitch peak on prominent syllables. This LH pattern has previously been connected specifically to Dravidian language speakers (Mohanan, 1986); however, these data suggest that it may also be a GIE
characteristic, as it appears throughout the presentations given by the Indo-Aryan language speakers.

Prosodic paragraphing structures in the IE data were considerably clearer than those found in the NNS data, and usually marked points of maximal disjunction in the discourse organization in a manner similar to that found in the NS group. They were also subject to less disturbance, particularly from long, unit-internal pausing. If we think of these differences in terms of Anderson’s ACT model described in the previous section, they may be evidence of differences in procedural knowledge between the NNS and IES groups. The IE speakers have considerably more experience communicating in English than the Chinese speakers, and differences in temporal production features such as pausing or hesitation phenomena may reflect an autonomous stage of production. This will include, however, proceduralization of those GIE characteristics which differ from American English as is found in these data. This is clearly demonstrated in the analysis of the tonal system, which also suggested a combination of GIE characteristics such as placing prominence on phrase final function words, and individual variation possibly based on L1 patterns.

Throughout the IE literature, there is general agreement that the prosodic system reflects both GIE features, and a ‘varietal continuum’ based both on regional characteristics such as L1 or learner model (Hancin, 1991; Chaurdhary, 1989; Mohanan, 1986), and attitude towards English (Sridhar, 1996; Aggarwal, 1988; Kachru, 1982). In this sense, the NNS and IE groups of learners may approach the acquisition of features of a native standard model such as American English very differently.
Sociolinguistic studies conducted in India (Sridhar, 1996; Sahgal, 1991) suggest that speakers prefer to use a GIE model. Sahgal found that 47% of educated people in Delhi preferred an ordinary Indian English model, and Sridhar suggests that speakers who come too close to a British or American model of speech are considered to be "fundamentally suspect," "phony," "affected," or "snobbish". Whether this identification with the local reference group changes when learners move to America, as is the case with the group of speakers studied here, is an open question. However, as most of the IE ITAs will ultimately return to India, and may have an ambivalent attitude toward adopting a native model, this may also affect their language production.

The Role of Prosodic Structure in the Comprehensibility of L2 Discourse

Traditionally, comprehensibility was considered to be synonymous with intelligibility, i.e., the ability of the hearer(s) to recognize individual words or utterances. More recently, however, the term has been used to describe intelligibility and interpretability of the discourse message (Gallego, 1990; Smith & Nelson, 1985; Nelson, 1982). Interpretability refers to the illocutionary force of the message and subsumes pragmatic, discourse and linguistic competence as they apply to the context of a given interaction (Nelson, 1982). In line with changing definitions of discourse as 'co-constructed' between participants, comprehensibility is also viewed by many as interactional between speaker and hearer(s).

Smith & Nelson (1985), for example, suggest that a listener who expects

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2 Only 2% of IE speakers chose American English as their preferred model.
to understand a speaker will be more likely to find that speaker comprehensible than one who does not.

In light of the NS analysis given in this study, prosodic structure clearly plays a crucial role in interpretability. In terms of discourse competence, the systematic use of prosodic paragraphing devices contributes directly to the coherence of the discourse message, and unit internal choices of key and tone create cohesive ties between related propositions. At the pragmatic level, choices in the prosodic system are used to build rapport between speaker and hearer(s), and most importantly, to directly orient the discourse toward the hearer(s) by taking into account the specific context of the interaction. When this analysis was integrated with co-occurring non-prosodic criteria, it was clear that prosodic cues worked in conjunction with lexico-grammatical information to create a multi-layered discourse organization. For Thompson (1994), this multiple-cuing system suggests that speakers may choose between linguistic systems and 'pick' the one most likely to benefit the hearer(s):

Speakers can draw on some or all of these systems in order to help them in creating monologues which trigger a coherent representation of text in listeners mind. (p. 65)

However, for two important reasons, it is probably more productive to think of cues at different levels of discourse organization as operating independently but equally for the hearer(s). First, prosody is an integral part of spoken discourse. The speaker will use pitch variation of some kind, and assuming Grice's (1975) co-operative principle, these movements will presumably be interpreted as 'choices' by the hearer(s) within their understanding of the system. Therefore,
it is more likely that the hearer(s) will attempt to reconcile cues in the prosodic system to those given at other levels of discourse organization and interpret the message as best they can, rather than assign less weight to this particular system. Second, a multiple-cuing system creates a certain amount of redundancy in message transmission that many researchers now believe to be an essential element in successful communication. Wright, Frisch & Pisoni (1997) for example, suggest that a reduction in redundancy will "increase the processing load and greatly increase the potential for unrecoverable error on the part of the hearer." (p. 4). The reader will recall the body of experimental work cited in Chapter 1 from both discourse analysis and speech perception that defines a role for prosodic cues in listener perception of organizational features of discourse structure such as boundary marking and information flow.

If we now view the analyses given here of the NNS and IES data in light of this discussion, it is clear that prosodic characteristics found in these presentations will detrimentally affect discourse comprehensibility. In the NNS data, for example, sequence chain boundaries frequently did not match topic boundaries, and points of maximal disjunction were difficult to recognize. NNS use of P (falling) tones frequently divided related propositions, and an overuse of prominence blurred the distinction between content words selected from a paradigm and those the hearer(s) could predict. In the IES data, tone unit boundaries frequently broke up syntactically related units, making it more difficult to parse the information contained within them. In addition, shifts in pitch register suggested a contrastive or
particularized value where none was present, and the phonetic realization of prominence and in some cases, tone choice, was difficult to interpret.

These characteristics constitute a series of miscues that will increase the processing load for the hearer(s). They violate listener expectation and require the hearer(s) to make continual adjustments to their representation of the text and predictions as to what will follow. There is a loss of redundancy and explicitness in the discourse that increases the chance of error in message transmission which neither the hearer(s) nor speaker may be aware of. Even when the hearers are aware of comprehensibility problems, they may not take any immediate action to resolve the misunderstanding, particularly in the context of a classroom situation where students will most often report, rather than address, such difficulties. The comments shown below, for example, are taken from student evaluations of an Indian ITA teaching a physics lab:³

³ This ITA is not one of the speakers used in this study; however, the evaluations are representative of typical undergraduate reactions to comprehensibility problems.

I often have a hard time understanding what he's saying. I have to really concentrate to get 75%-90% of what he's saying

I can understand about fifty percent of what he's saying, speak more clearly or express that on the chalkboard

I concentrate on trying to understand his English rather than trying to understand the concept of what he is saying

In addition to problems with information flow, both groups of L2 speakers under-utilized the pragmatic functions of the intonation system
such as the use of rapport-building devices, and showed little or no evidence of negotiation with the hearer(s). The NNS discourse particularly, was characterized by an oblique orientation that is incongruent with this particular situational context, and may signal to the hearer(s) that the TA is disinterested and uninvolved. This further distances the message from the participants, who frequently then also withdraw from the interaction and begin to talk among themselves or read newspapers while the ITA is speaking. Ineffective use of prosodic cues is particularly important in this respect, as NS participants are unable to compensate for miscues in the same way they may be able to for grammatical or lexical errors. A consistent use of abruptly falling tones in combination with a lack of solidarity marking is more likely to lead to negative personality judgements about the speaker than to a recognition of limited language proficiency.

In light of this and similar studies investigating the role of prosodic structure in discourse, most current materials in use in ESL programs are extremely limited in their approach to teaching suprasegmentals. Most texts focus exclusively on grammatical or attitudinal aspects of the intonation system, and include no discussion of discourse functions. As most texts also include mainly sentence repetition exercises or short dialogues, students are not shown how the prosodic system operates in discourse nor encouraged to practice longer stretches of speech. This, of course, presents a particular problem for nonnative teachers. While materials designed specifically for ITAs do tend to include subject based paragraph readings for students to practice (see, for example, Smith, Meyers & Burkhalter, 1992), there is
no accompanying explanation of what the students are aiming toward, i.e. how the system works. There is also little or no discussion of how prosody typically interacts with other discourse features. For example, NS TAs used lexically equivalent but prosodically distinct discourse markers to indicate topic initiation or completion, or to acknowledge student participation in the interaction. With little or no input in a formal context, students are not given the tools they need to develop this aspect of their communicative competence. It is particularly important for ITAs that we develop materials which reflect native speaker use of prosodic structure in this situational context. An awareness of how the system works should lead to improved discourse competence, a more effective teaching style, and improved classroom management.

**Suggestions for Future Research**

Investigation of the discourse functions of prosodic structure is a relatively new area of discourse analysis. Based on this study, areas that merit future study include prosodic paragraphing, tone choice, interaction between different levels of discourse organization, discourse markers and rapport building devices between participants. An additional area of investigation concerning NS discourse is the use of key and termination choices by the speakers to cue backgrounded or foregrounded information\(^4\). Characteristic uses of pitch level by the NS speakers suggested a relationship between high key and termination choice and foregrounded material (i.e., the informative content of the

\(^4\) This area of future investigation only took shape after the analysis of the data was complete.
presentation or directives), and low key and termination choice and background information (i.e., subsidiary information such as glosses, asides, or repetitions).

As an initial test, extracts from four of the NS presentations used in this study (MK, SN, KN, BL) were converted into written text divided into pause based units. Three linguistically trained raters who had not seen the videotapes coded the information in the text as either background or foreground material. The results of the coding were then compared to the key and termination choices made by the speakers in each unit. The results of the testing are shown in Table 7.1 below. A chi-square test \( (N = 80.46, X^2 = 13.816, 2df, p < .001) \) shows that this result is significantly different from chance, and suggests that there is a relationship between the speakers' choice of pitch level and the status of the information in terms of foreground and background. It was also the case, however, that all three raters agreed only 63% of the time, and as this discourse genre consists primarily of foregrounded, substantive content, raters found a relatively small amount of background information. Although these initial ratings are not as strong as one might wish, the initial intuition is supported, and warrants further investigation.

Regarding L2 discourse analysis, variation between the NNS and IES groups suggests that both L1 transfer and developmental aspects of second language acquisition will be productive areas of future study. This study was set within a framework that focussed exclusively on pitch and pause analysis; however, the method of data collection allows
further comparative analysis of additional prosodic parameters such as length and amplitude in NS and L2 discourse. In light of the LH word

Table 7.1. The Relationship between Foreground and Background Material and NS TAs Choice of Key and Termination

<table>
<thead>
<tr>
<th></th>
<th>HIGH KEY OR TERMINATION</th>
<th>MID KEY OR TERMINATION</th>
<th>LOW KEY OR TERMINATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>FOREGROUNDED</td>
<td>76</td>
<td>103</td>
<td>14</td>
</tr>
<tr>
<td>(193 units)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BACKGROUNDED</td>
<td>2</td>
<td>17</td>
<td>30</td>
</tr>
<tr>
<td>(49 units)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total number of pause based units contained in the sample: 383
Total number of units agreed upon by all three raters: 242

melody pattern found across the IE group, for example, in Pickering & Wiltshire (in preparation) we further investigate the effect of different first languages on the production of stress in IES discourse. Regarding developmental patterns, at least one previous study, (Pirt, 1990), suggests that as learners gain fluency in the L2, tone units will become longer and there will less overuse of prominence on content words. There is clearly a need for studies which test a larger population of learners drawn from different proficiency levels in order to investigate the development of this aspect of linguistic competence.

While this study focussed on only one discourse genre, research into the prosodic features of conversation (e.g., Wennerstrom, 1997; Couper-Kuhlen & Selting, 1996), shows that intonational cues are used by native speakers for a number of 'interactional' functions such as indicating turn completion, turn yielding or holding the floor. L2 data from the lecture discourse and conversational discourse of the same speakers should be analyzed in order to see if their use of the prosodic
system in English varied across genres. Factors such as how individual ITAs view their teaching role (i.e., as a facilitator or a traditional lecturer) may affect their language production. This kind of research would give us more insight into how L2 learners may develop competence in relation to prosody, and also suggest ways we may approach teaching the intonation system in ESL. Finally, there is the issue of native speaker perception of prosodic structure in nonnative speaker discourse. This is a difficult problem to address, as the researcher needs to find a way to separate perceptions of suprasegmentals from other features in the discourse, and find an objective measure to assess the intonation structure. Previous studies have disagreed on the importance of prosodic structure in the perception of NNS discourse. In a study in which native speakers rated various components of NNS discourse for comprehensibility, Gallego (1990) suggests that intonation made up only 4.5% of pronunciation errors. Similar comprehensibility studies by a number of other researchers (Anderson-Hsieh, Johnson & Koehler, 1992; Anderson-Hsieh & Koehler, 1988; Johansson, 1978) reach the opposite conclusion and suggest that prosodic structure is the most significant pronunciation variable in incomprehensibility in extended speech.

It is probable that these different findings are at least partially the result of using impressionistic measures of intonation. The largely tacit nature of intonational cues, for example, may make them less salient for some raters. In addition, researchers used different methods of rating. Gallego looked primarily at intelligibility, and asked untrained raters to stop the tape every time they did not understand a word or
utterance; these points in the discourse were then coded by trained raters for linguistic error. Anderson-Hsieh, Johnson & Koehler asked trained raters to listen to the entire tape and rate only the pronunciation.

Generalizations are difficult to make in light of methodological differences and varying definitions of comprehensibility. Where prosodic structure is rated impressionistically, this leads to unreplicable results. Perhaps more importantly, none of these studies consider listener variables in terms of situational context. In these experimental studies, listeners have nothing to gain or lose. This contrasts significantly with the situation on university campuses where undergraduate students are concerned with their ultimate success in the class. Models of intonation such as the one used in the present analysis can help resolve some of these problems by providing an objective measure of intonation structure. Once the discourse has been transcribed for intonation structure, an approach similar to Gallego's may be more effective in highlighting where ineffective prosodic patterns are contributing to listener confusion. It should be remembered, however, that prosodic structure will always be perceived by the listener in a particular situational context, and in combination with other discourse cues. Therefore, a combination of both experimental and qualitative contextualized studies are needed to improve our understanding of how prosody is used by both speaker and hearer in a discourse context.

In a recent book on cross-cultural communication, Scollon & Scollon (1995) state that "spoken English makes relatively little use of pitch alone to make meaningful differences" (p. 71). Statements such as this
reflect the continued currency of outdated models of prosodic structure which treat intonation within sentence grammar. When pitch movement is tied virtually exclusively to grammatical categories, it is difficult to see its relevance to the broader communicative competence of nonnative speakers. In this dissertation, I have used innovative models of discourse prosody and cross-cultural communication to establish the relevance of pitch movement and pause structure to successful communication between interlocutors.

Intonation clearly has a crucial pragmatic function in discourse, and plays an important role in discourse comprehensibility. As this dissertation demonstrates, it is only possible to gain these insights when the role of prosodics is systematically investigated as part of discourse structure. This dissertation has also emphasized that prosodic structure reflects the underlying nature of discourse as a mutually constructed system of communication between participants. In other words, hearers assume that linguistic choices are made in light of the situational context of the interaction and interpret them accordingly. In lecture discourse, this responsibility lies with the primary speaker and is realized partially through intonation choices which acknowledge the participation of the other party in the interaction. In cross-cultural interaction, participants use different conventionalized prosodic systems to communicate this acknowledgment and as these assumptions are largely of a tacit nature, when they are violated, this is invariably not recognized as linguistic error. Rather, prosodic miscues can negatively effect listener perceptions of the speaker's intellectual ability, intentions, and personality. Continued research using a pragmatic,
discourse approach to prosodic structure such as the one demonstrated here, offers a practical method to assess and improve this critical component of L2 discourse competence.
APPENDIX A
SAMPLE MATHEMATICS TRANSCRIPTS

BL's Transcript (NS)

H //p oK// [0.7] //p EXponential
M         GROWTH and [3.4]//p oK//
L  deCAY//

H
M [0.32] //p this is EXponential //p oK// [1.0]
L  GROWTH/// [1.57]

H //p p P is the
M         aMOUNT you have to START //r+ oK// [1.68]
L  WITH// [0.65]

H
M //p r+ WHATever it COULD be MOney// [0.05]//r MAYbe it's GROWing//
L

H
M [0.2] //r+ p r+ p r+ you have INterest or it COULD be bacTERia
L

H A is the aMOUNT you end
M they're DOubling or whatEVER UP WITH//
L

H
M ///p and R's what's
L  oK// [0.27] //r END aMOUNT// [3.37]

H
M //p it's a GROWTH //r if r's POSitive the THING's
L  CONstant/// [1.78]

H BIGger// [0.35]
M //r you're getting MORE MOney// [0.3] //r+ RIGHT//
L

H
M L //you WANT// [0.26] //r r+ you WANT THAT/// you want your money
to GROW in a BANK/ // [0.04] // p p p you're getting more bacTERia
NEgative the STUFF is getting SMALLer it's
whatever if R is
deCAYing you have
THINGS like// [0.22] // p radioactive THINGS/// [0.1]
// p o p r so FAR as POSitive it's GROWing it's
// r oK/// [0.3]
NEgative it's exponential deCAY// [0.44]
EXponential GROWTH as far as
// pp WHAT’s the STARting amount how much does
// o yipPEE/// [0.5]
/// DOLLar// [1.2]
HOW much DOES
BREAD cost NOW/// [0.93]
BREAD cost// [0.3] // p LAter// [1.67] // p do they give us a
CENT so that’s
RATE// [2.0] // p p p SIX per WHAT as a
DEcimal/// [1.5]
AND we wanna know how many years it'll take
BREAD to get to
/// ? p oK// [1.0] // p p r+ uh what do we DO
THREE DOLLars// [1.13]
ONE TIMES it DIFFerence// [1.5] // o can i
DOESN'T make much of a
H //r+ LOG// [0.2]
M reWRITE this THING as a// [0.2] //r p oK so i get
L WHAT//

H NATural log of
M ////r r+ i get THREE Equals// [0.2] //p point ZEro SIX
L

H M T// [0.8]
L //r+ THIS you can PLUG into the //r r+

H M IS it's
L whatEVer it NATural log of THREE/// [0.9] //p p o and i'll

H M NATural log of three is
L diVIDE it POINT zero SIX aBOUT// [0.8] //r+

H M HEAD// [2.0]
L i DON'T know off the top of my //r+ r+ ONE point oh nine

H M //r+ gives me
L eight SIX/// [0.16] //r+ diVIDed by POINT oh SIX// [1.9]

H YEARS// [3.0]
M aBOUT eighteen //p EIGHteen YEARS come back and TELL me

H M
L if BREAD is three DOLLars//

SM's Transcript (NNS)

H //FIND the HALF life
M THREE/// [5.83] //p oK// [0.05]
L //QUEstion

H M of uh// [0.66] //p RAdium// [0.3] //p TWO hundred twenty six which
L

H M deCAYS according to the FUNCTION// [0.45] //p A T the FUNCTION
Student Response

**H**

**M** is A T// [1.0] //p Equal// [0.05] //p A ZErO// [1.16] //E to the//

**L**

**H**

**M** //p NEgative// [0.15] //p ZErO POINT// [0.1] //p ZErO ZErO// [1.16]

**L**

**H**

**M** ZErO point four three T// [0.96] /////p p find the

**L**

///p oK/// [1.25]

**H**

**M** LIFE of

**L**

RADium WHAT's that mean LIFE// [5.65] //p WHAT's that

**H**

**M**

**L** MEAN//

Student Response

**H**

**M**

**L** //p oK// [1.25] //o HALF of THE///

Student Response

**H**

**M**

**L** //p yeah that's RIGHT// [0.26] //p so that's mean A

**H**

**M**

**L** ZErO// [0.9] //r+ equal A /////E to the/// [1.7] //p four

**H**

**M**

**L**

ERASE THIS we

///p

**H**

**M**

**L**

three T// [0.85] //p p so here you HAVE// [0.1]

**H**

**M**

**L**

///p EQual/// [0.53] //o E// [4.48]

**H**

**M** uh we TAKE uh// [1.7]

**L**

///o wh- WHAT we do NEXT//

Student Response
H M //so TAKE the// [0.16] //p p NATural
L //p THAT'S RIGHT/// [0.26] LOG
H M WHAT'S THIS //p what's THIS
L BOTH SIDE HERE what's SIDE// [3.0] SIDE
H M
L Equal//

Student Response

H M L //p p THAT'S RIGHT i its Equal the exponent// [1.7] //p p p so Equal
H M L NEGative ZERO point ZERO ZERO four three T/// [1.0]
H M T will //THIS uh// [0.18] //p uh NATural NATural
L BE just uh// [0.7]
H M LOG// [0.09] //p ONE HALF// [0.42] //p divide by THIS
L NEgative
H M
L NUMBER// [0.47] //o SO// [1.3] //p OK//
APPENDIX B
SAMPLE ELECTRICAL ENGINEERING TRANSCRIPTS

UT's Transcript (IVE)

H //r+ NOW// [0.04] FIND//
M //p using the CALculator// [0.3] //r+ you can
L

H
M [0.09] //r the VAlue// [0.7] //r+ which COMES out BE// [11.36]
L
to

H
M //p CALCulations you’ll get of J TEN// [0.3] //r+ r+ is SEven two
L

H EIGHT// [0.4]
M //p ANgle ten point //roK// //p
L FIVE// [2.5] [0.33]

H MEANS// [0.86] //r+ AT// [1.4] //p TEN
M RAdians per SEcond// [0.86]
L

H litude MUCH// [1.4]
M //r+ the AMP is THIS //r+ MAGnitude// [0.33]
L

H IS POINT// [0.24] /////r+ BUT
M //r+ r+ and the ANgle TEN
L //p FIVE// [1.54]

H reQUiRED
M [0.28] //p r we’re to FIND// [0.2] //r H of j o ga // [0.62] //p
L ME

H ALL DON’T ONLY for
M FREquencies/ [0.86] //r p we WANT ONE //
L

H
M [0.62] //r we WANT FOR ferent// [0.24]
L DIF //p FREQUENCIES// [1.1]
r 2íc r s 2ar sc 2r sc 2r sc 2r: sc 2a: r sc 2r sc 2r: a 791x1956 //r like TEN// [0.42] //r r o TWENty THIRty FORty HUNDred//

H M //r+ oK// [0.2]
L //r then go ON til THOUSand// [1.0] //p then i'll go

H M //p for ferent // [0.63] //r+ so we
L inCREASing// [0.1] DIF FREquency

H M to DRAW// [0.2] PLOT// [0.37] //r+ p ?r
L //p PLOT// [1.9] //p ok and NOW a

H SENTS
M which REpre H of j oMEga for DIFFerent FREQUENCIES//[0.63]/p
L
H M CALLED// [4.52] //r+ oK// [0.74]
L //p a BOde PLOT// [3.45]

H THIS IS CALLED
M [0.3] //p p VAalue h of J TEN// [0.81] //r+ THE// [7.58]
L
H quency SPONSE
M //r FRE re // [2.0] //r+ AT// [0.3] //r+ oMEga qual TO//
L F

H M //r+ TEN// [0.92] //p Radian per
L SEcond// [0.1] //because// [0.2] //r+ p

H M POINT //o but WE would LIKE to
L at THIS oMEga is TEN// [0.92] HAVE

H M [0.4] //r+ frequency reSPONSE at DIFFerent// [0.1]
L //p FREQUENCIES://

H M //r+ so we GO FOR// [0.6] //r+ oK// [0.4]
L //p BODE PLOTS// [0.92]

H TWO types of
M //o r NOW there are BODE PLOTS// [1.33] //o ONE is//
L
L AM IS PLOT//

H M [3.58] //o ok NOW// [0.06] //p FIRST i'll
L [0.1]

H M what IS anplitude //uh as you SEE for// [0.04] //p JUST
L AM PLOT// [1.6]

H M THIS // [2.26] //r+ THIS is THE FREquency reSPONSE// [0.5]
L exAMple

H //r+ at quency// [0.36]
M FRE //r+ TEN RAdians per SEcond// [0.46] //r+ it HAS
L

H TWO ponents// [0.92] THE plitude
M COM //r+ ONE is // [0.32] //r+ AM //
L

H THE gle
M //r+ Other is // [0.32] //r+ AN // [0.97] //r+ RIGHT// [0.13] //r
L

H IF I PLOT// [1.52]
M the PHASE// [1.24] //p now //p IF i PLOT// [1.57]
L

H //?r AMplitude// [1.46] //p VERSUS// [1.36] //?p p FREQUENCy or say
L

H //r+ it means i PLOT the DIF ferent // [0.1] //p AM
L oMEga// [1.3]

H THAT PLOT
M [0.7] //p at DIFFerent freQUENCIES [0.48] //r r+ is CALLED AS//
L

H M [0.87] AMplitude MEANING //r+ i'll be PLOT // [0.6]
L ///r+ the PLOT// [1.36]

H TEN
M //r+ the AMplitude at say // [0.43] //r+ then the AMplitude at say
L
H\ TWENMy\[0.43\]//p amplitude at THIRty\[0.05\]//p \ ONLY \ the AMplitude//
L
H\ [0.05]//p I PLOT //r+ ?r if I PLOT the plitude \ JUST \ AMplitude//
L\ BOTH\[0.6\]
H\ at DIFFerent FRE\[0.92\]//r+ it is CALLED \ A
L
H\ SIMilarly WHAT PHASE will be PLOT//
L\ PLOT// [1.1]//p oK// [0.43]

Student response
H\ //p GOOD// [1.42]//r+ you PLOT// [1.0] //r the PHASE// [1.72] VERSUS
L
H\ FRE //r+ THAT is you'll be JUST PLOTting//
L\ [0.7]//p the QUENcy\[0.2\] //r+ the QUENcy//
L
H\ //p THIS \ PART// [1.0] //o WHAT is a AMplitude //
L
H\ PLOT //r+ any QUESTions
L\ //r and WHAT is a PHASE // [1.62]//r+ RIGHT// [7.72]
H\ NOW // [5.38] FINE //r+ it's // [1.0] //p oK//
L

BD's Transcript (NS)
H\ //p NOW I'll show you how to do the BOde PLOT// [42.8]//p p oK SO// [1.3]
L
H\ BOde PLOT's just a PLOT of the // [0.9] LOG/
L\ //p p the PLOT of the//
H\ reSPONSE// [1.0]
M\ //r of the MAgnitude of the frequency //p aAGAINST oMEga//
L
H M [0.25] //r the FREquency// [1.0] //p o SO THIS is in dBS// [1.35] L

H M //p the FREquency is in// [0.54] //p o RADians per SEcond

H M //p HERTZ if you //p SO// [2.32] //p so toDAY//

H M //p we're just gonna LEARN how to PLOT// [0.14] //p SIMple// [0.9]

H M //p SIMple// [0.5] //p er BOde plots of the FREquency response//

H M L/pppp and THEN you can LEARN about the Other KIND in your

H M L CLASS//p that are a little bit MORE COMplicated//[0.34] //p NOT //

H M [0.44] //p p for this LAB THIS'll //p SO// [0.3]

H M //but// [2.18] //p DO// [2.0]

H M //o r+ in WRITE H oMEga// [0.6]

H M //o AS// [1.58]

H M L //p EM let's SEE///[45.0 -boardwork] //p oK//

H M YOU find the TRANSfer FUNctIon of a//[0.7]//o CIRcuit/[0.6]//p you

H M always put it into THIS FORM// [0.3]

H M L //p ONE way or the Other// [1.7]

H M L //p ONE way or the Other// [1.7] //o p AND so once you get it into a
H M that looks like THIS// [0.4] //p you SEE you HAVE the// [0.52]

H M J omega TAU// [0.72] //p and then TAU// [2.6] //p TAU’s called IS// [0.63]

H M //p ONE over omega C// [0.7] //p and oMEga C// [0.97] //r is called

//r oK// [2.76]

H M //p p p the REAson that they have the LOG times the MAGnitude

H M the FUNCTION is// [0.28] //p p beCAUSE whenever you take the LOG

H M SOMething//[0.92] //p inSTEAD of MULtiplying// [0.28] //r+ you can

H M ADD// [0.63] //r+ RIGHT// [0.86] //p p o so if you TAKE
//o SO// [3.6]

H TWENty
LOG of the MAGnitude of both
//o ok SO// [1.8]

H M TWENty
///p p p TWENty
LOG of the MAGnitude
//so if you TAKE the mag-// [0.2]

H M BOTH sides of THIS//[1.0] //eQUAtion then you just GET// [1.24] //p

H M TWENty LOG of K ZErO// [0.17] //p inSTEAD of
//p and THEN// [1.0]

H M MULtiplying// [0.46] //p o whenever you take the
LOG you just ADD//
you just ADD [0.6] TWENty LOG [1.0] the MAGnitude of THIS [0.9] p plus TWENty LOG the MAGnitude of THAT one [0.83] r+ RIGHT [1.0]

p and just KEEP on going all the way UP [0.23] p unTIL you get to the BOTtom [0.95] p and then you subTRACT [0.83] r+ so you start subTRACTing minus TWENty LOG of the MAGnitude of EACH of each of the TERMS [6.24] p SO [0.35] p if you PLOT a [0.4] p BOde PLOT [0.7] PLOT [0.4] p you can just one of these SEParate TERMS [0.47] p SEParately [1.0] / o p and ADD em all UP [0.35] p p p on a DIFFerent GRAPH SO like in our exAMple above [1.48]

let's SEE [10.0] SO in our exAMple you r p p OK

PLOT [1.74] uh [1.0] r+ TWENty log ONE [8.84] r p oK SO

so our exAMple above we just plot ONE [0.3] p which is THIS

BE just a ZErO [1.64] / p all the way OUT and THEN [0.1] / p we
THIS ONE// [1.43] //p o on aNOther SHEET of paper //so
AND// [1.13]


[0.82] //p SO// [1.54] //p p p and then to GET the

Total you just

DO it THAT way// [0.1]

all add em BOTH UP// [2.46] //p so you can

you can DO it the EASY way// [0.8] //p which i'll

SHOW you how to do

NOW//

SH's Transcript (IVE)

LAB TWO this is
deSIGNED //r+ to HAVE an iDEA

UH// [0.45]

about PAIasm//[0.4]//rp and for the exAMple which you are TAken

HAVE wri- i

deCOder// [0.5] //p o i
THINK all of you have

?r+a BcD

YOU who have not

prePARED with the PRElabs// [0.05] //?r+ o r+ and THOSE of

SUBmitted your rePORTS for the previous LAB you PLEASE keep it

[0.3]//o?r+ that's the NORmal procedure like when you COME for the
H M just KEEP your class re- rePORTs// [0.55] //o and the LAB LAST
H // p PRELABS// [0.1] // ?r+ o r+ r+ you can KEEP it READY AND uh when i
L
H M to YOU just i'll what have you IF at ALL//
L SEE DONE it ABOUT// [0.4]
H M if you are not prePARED for the PRELABS it's ok as i TOLD you LAST
H M CLASS/[0.43] // p but try to come prePARED for // ?o THESE
L ALL the LABS// [1.57]
H STATEMENTS// [0.13] // ?r+ you may be fa-
L familiar with but i've WRITTEN//
H M // ?r?ro CERTain STATEments which are USED for the PALasm PROgram
L
H // [0.43] // ?r p last during seMESTer in the
L beCAUSE ?LAST exAM //
H M // ?r+ there were certain QUESTions// [0.26] // p usually i THINK//
L H M // you may NOT// [0.26] [0.4] // o but THERE
L // ?r BOther much ABOUT it //
H specIfic questions on THIS which of them didn't// [0.72]
M MOST
L
H it PROperly that is beCAUSE they THOUGHT it maybe a ONE
M MInor //
H //r+ so HERE //?r+?r+ WHEN you make
M 1 hi- HIGHLIGHTed them like// [0.1]
L

H aSSIGNment about the
M INputs or OUTputs// [0.72] //o p r+ it's uh in
L THIS
M exAM or even in LAB it is SPEcified like that INput should be an tive
L AC
H high or an tive LOW//[0.38]//o that you NORmally DO/[0.16]//o r+ in
M AC
L
H aSSIGNment/[0.44]//?r o HERE for PIN TWO is//
M pin STATEment or exAMple
L
H //?r+ INput/[0.16]
M //?r which is SPEcified in the common- COMment STATEment
L
H //?p ?p THAT is tive HIGH AC beCAUSE there is
M [0.55] //and// [0.18]
L
H //o ?p and THIS
M SLASH that i HIGHLIGHTed
L
H NORmally everyone has
M DONE during LAB but// [0.09] //o r+ when it
L LAST
H tive LOW SIGnal it should be SPEcified with a SLASH// [0.6]
M an AC
L
H OF the PERSONS have not so you should be ful about it when
L DONE CARE
H
M [0.38] //r+ SPEcified the put or put is an tive LOW IN OUT AC
L
H SURE
M should make that it's an tive AC LOW// [0.47]
Similarly, make the \(// r^+ r^+ \) and if the equation's normally

when you do the \( // o r \) the equation's will

\( PRO \) the \( E \) \( PART \)

\(\text{READY}\) cified in

PAL-asm program you are not going to do \( THAT\)\n
\(\text{TIME}\)

when there was a \( QUEST\)ion like they

\(\text{LAST}\)

\(\text{QUATIONS}\)

that are \( \text{QUIRED} \) but they didn't

\(\text{RE}\)

\(\text{anything about the eQUA}\)tions\(// [0.42]/\)\(? p ? r^+ o r^+ \) so \( DOctor\)

SCHWARTZ ASKED

\(\text{CUT}\) one mark for \( THAT\) and \( SIM\)ilarly for

\(\text{THIS}\)\(// [1.54]/\)\(\text{and// [0.16]}\)

\(\text{p o o p SIM}\)ulation also comes out in the

PALasm \(\text{PRO}\)gram but in the \( exAM\)

\(\text{supposed if it's ASKED you are supposed to write THIS simulation for}\)

\(\text{THIS TOO we CUT one}\)

\(\text{MARK LAST TIME}\)\(// [0.58]\)

\(\text{TRACE ON}/\)\( [0.28]/\)\(\text{p and}\)

\(\text{TRACE OFF}/\)\( [0.77]\)

\(\text{SAME question may COME for THIS}\)\(// [0.24]\)

\(\text{TOO but// o exAM for your exam}\)
SS Question: I have a question about the check statement, what-

H //p ?r o ?r+ yeah IT's uh the STATEment is CHECK NORMally Given in

L

H SIMulation PART like you SET some INput and OUTputs//[1.0]//p ?r+

L

H THEN you uh SORry uh y- IN for the eQUAtions which

L

H ready FINE// [0.28] //?r+ THEN you are CHECKing them WHAT//

L AL

H //?r+ will be the put you // [0.52] //p to HAVE accORDing to

L OUT WANT

H

M eQUAtions//

SS Question: it won't do anything if you don't put a check statement?

H //o ?r+ NO actually BASically it is LY//[0.08] //?r+ to SEE whether ON

L

H nals that// [0.16] //?p you to // [0.28] //is// [0.16]

L SIG WHAT WANT HAVE

H //p ?r accORDing to the eQUAtions which are ten //THAT

L WRIT THERE// [1.8]
H M will be \textit{reFLECTed} on// [0.1] // in the \textit{ulation PART//} [0.1] SIM
L
H M //?r+ when you see the \textit{put//}[0.63]/p o r and if there is any
L \textit{OUT}
H M \textsc{STATE}ment then when you \textit{SEE the put of THAT(?)} in the HIS\textsc{tory}
L \textit{OUT}
H M TRACE \textsc{FILE//} [0.36] //o r+ then if it's \textit{WRONG} it's not if it's NOT in
L \textsc{eQUAtion}
H M a\textsc{CCORd}ance with the // [0.33] //p THEN it will give a \textit{QUEStion}
L
H M //?r+ any other \textit{QUEStions//} [1.96]
L \textsc{MARK//} [1.63] //p oK//
APPENDIX C
SAMPLE PHYSICS TRANSCRIPTS

XG's Transcript (NNS)

H //? o/p we can START// o/p good MORning// o SO UM// o/p to
L

H M um// p use the METer STICK as a BAlance// ?
L

H M //p o meter STICK as a BAlance //p p to DO some exPERiment
L TO// [1.0]

H M TORQUE// [0.3] //p p the PHYsics PRINciple
L about the //o SO// [0.09]

H M is QUITE EAsy it's JUST the ler// [0.63] //o p the TORQUE ONE Equal
L

H M TORQUE TWO// [0.82] //p p PHYsics PRINciple just
L TO// [1.0]

H M //o in Other words it MEANS the// [0.38]
L TORQUE TWO// [0.38]

H //p the COUNter
M CLOkwise// [0.34] //p should Equal the CLOkwise
L

H M TORQUE// [0.77] //p WHEN// [0.04] //p o the MEter stick is in
L

H M BAlance TORQUE one is// [0.8] //so you JUST try to// [0.18]
L SO
H //o p p p CALculate torque
L ONE// and CALculate torque

H MAKE then Equal and you can //p p MEASURE some
L FIND SOME// [0.14]

H //p i DON'T think YOU
L VARIables BASED on THIS// [0.9] //o UM// [0.7]

H will have any PROBLEM// [0.32] //EXCEPT in a// [1.5]
L //o WELL in A//

H [2.16] //p o in a FinAl
L AND// [0.98] //er// [0.18]

H CASE is that //BASeically you
M YOU ARE// [1.0]
L ALWAYS have the CENTER//

H [0.82] //p METEr stick CENTER// [0.92]
L //o to BE THE// [0.2]

H //p the PIvot POINT but er// [0.34] //p p
L //o to BE THE// [0.35]

H in in the LAST CASE in the comprehENsion QUESTION// [0.53]

H //r+ FIVE// [0.92] //p r+ the METEr STICK CENTER is
L NOT// [0.34]
H //p in the CENTER// [0.68]

H [0.43] //p p TORQUE GIVEN by the// [0.67] //p WEIGHT of this METEr
L

H STICK// [1.0]
L //r+ DO you have ANY IDEA// [5.8]
L //the// [0.62]
H //p r+ p p p IF the CENter
M IF the of this MEter STICK is NOT at
L
H the PIVotal POINT PIVotal POINT everybody
M knows we DON’T need to consider this //p it’s JUST
L TORQUE// [0.33]
H //p but if it’s NOT at the CENter what// [0.52]
L ZEro// [0.43]
H
M //p HOW do you
L CALculate//

Student Response

H M //o SO you THINK THE// [0.16] //p the FORces act on the
L CENter//
H M [0.48]
L //o and ER// [0.2] //p p r+ the LEVEL arm is the DISTance
H M GOOD GUESS//
L from the CENter RIGHT// [1.34] //p yeah that’s a
H M [1.58] //p it’s RIGHT// [0.6] //o but EM// [0.48] //p p
L
H it STILL needs
M someTHING in matheMATical
L PROVEment like// [0.28]
H GRAvity// [0.7] //p p is ANYwhere
M beCAUSE the
L ON this MEter
H STICK// [0.93] //p p p p so YOU have
L FORCE HERE you have FORCE
HERE you have FORCE HERE and you ALSO have FORCE HERE// [0.6]

PROOF// [0.8]

IF YOU// [0.09] do some mathematical

BASICALLY all the WHOLE effect of this FORCE can be

REPRESENTED by THIS// [0.09] only

GRAVITY FORCE ACT on this and ACTing on the CENTER

JUST use this ONE TORQUE// [0.15]

to REPRESENT the WHOLE effect// [0.6] so// [0.36]

it's the SAME thing like in kila- kilaMetrics we can

EASY to SEE

but it STILL need some PROOF// [0.46] um// [0.92] you

just remember [0.2] remember this em//

there is any IN WAY just REMEMBER this RESULT// [0.3]

comprehension question ALSO

ONE we// [0.46] p p you can
H M use this KNOWledge to
L aNALyze the comprehension question ONE//

KN's Transcript (NS)
H ANYbody know what the EquiLiBrium
M //p o does
L condItion IS// [0.4] //r+

H er roTAtion// [2.44] //p p p the equilibrium condItion is when the
L
H M of the TORQUES is
L Equal to ZErO// [0.7] //r ok// [0.2] //o so

H HAVE
L
H M [0.5] //r ok and it's got a CEN ter of MASS// [0.9] //p and preTEND
L
H M that's VERtical// [1.42] //o and if you HANG// [0.5] //p like a GRAM//
L
H M //r mass from THIS SIDE// [3.67] //p FIVE centimeters from the Pivot//
L
H M //p r+ and this is the CEN ter of
L MASS aGAIN// [0.5] //o UM// [2.0]

H if you were to HANG SOMething TEN CENtimeters
M L aWAY// [1.0] //o p how

H M MASS would you have to HANG so that THAT would be in roTAtional
L equiLiBriuum//

H M [2.85] //r+ does anybody KNOW//
L

Student response: 5 grams
REason that IS// FIVE GRAMS// [0.8] //p RIGHT// [1.0] //p and the

this TEN GRAM is beCAUSE// [0.98] //p p MASS// [0.28] //P EXerts

a TORQUE// [0.5]

about this POINT HERE// [0.75] //p p r+ oK and

TORQUE is of MAgnitude the FORCE// [0.65] //p times the DIStance

the PIvot//

FIFTy// M [0.6] //p oK SO// [0.28] //p the TORQUE//

[1.27] //r in THIS
diRECtion// [0.37] //r oK// [0.32] //o and SO//

[0.98] //p THAT'S gotta Equal// [0.42] //p p the TORQUE that's trying
to rotate in the Other direction in other words THIS TORQUE is trying
to rotate it// [0.46] //o COUNTER clock //o p and so it's

WISE// [0.4]
gonna be BAlanced with the TORQUE that's

gonna rotate it CLOCK //p o so it's just gonna

WISE// [0.63]

equal TEN// [0.46] //p TIMES X// [0.52]

//p and OBviously// //X//
//p VERY SIMply// //p

what you guys are gonna be DOing in this LAB//

THINGS CAN get a little more

COMplicated if YOU// [1.0] //r+ r+ r+ if the

is NOT at the CENter of MASS of the MEter stick [0.4] //p CUS// [0.34]

//p p BASically what you guys are gonna be DOing is you’re gonna

this MEter STICK// [0.63] //r p and you’re gonna FIND the center of

HANG it// [0.52]

MASS and you’re gonna //p p from the KNIFE EDGE by the CENter

of MASS// [0.73] //p and then you’re gonna be ADDing MASSES//

//p to EACH SIDE of it// [0.23] //p at DIFFerent distances aWAY//

//p and you’re BASically gonna SHOW that// [0.27] //p p p the SUM

the TORQUE is equal to ZEro and that’s when it

BAlances// [0.7] //r oK//

//p so that’s the BASic gist of the // [0.32] //p toward the

END of

lab THOUGH// [0.23] //o UM// [0.6] //p p you’re gonna be doing
SOMETHING a LITTLE bit again you have your METER STICK DIFFERENT [5.6]

[0.26] and LET’s SAY [0.97] p the METER stick WEIGHTS FIFTY

// p ok BY the WAY ANY time you HAVE [0.2] an OBJECT

// and you see how it’s NOT [0.4] r+r it’s distributed over

LENGTH of the METER STICK the MASS IS [0.45] you can

all MASS to be at it’s CENTER of

MASS [0.65] p ok as far as the

TORQUE is // p now LET’s say you // p by

CONCERNED [0.45]

HERE [0.65] p ok which is [0.84] TEN CENTimeters [0.97]

from the CENTER let’s say this is AT [0.4] p FIFTY CENTimeters

along the METER STICK THAT’s the CENTER [0.37] p and you HANG it

at SIXTY [0.65] r ok [0.7] o NOW [0.98]

a NOther

had a r FIFTY gram MASS [1.36] p where THIS DISTANCE

[0.47] p r was ALso TEN CENTimeters [0.75] r ok [1.5] H OW
much MASS would you have to ADD// [3.57] //p distance

away from this Pivot// [2.27] //p i mean to MAKE that BAlance// [1.6]

it’s the SAME PROBlem basically// [0.9] //p p it SEEMS like it’s a

more confUSing because

NOW// [0.34] //p THIS mass is the MEter stick/

[0.73] //p p and you’re gonna RUN into this LAter and it’s gonna be

THINK of it as another

confUsing LAter// [0.4] //p p BUT just MASS// [0.73] //p r

the SUM of the TORQUES on SIDE of the Pivot// [0.22] //o ARE/

//p FIFty// [0.68] //r TIMES TEN// [3.3] //p PLUS FIFty// [1.64] //r

TIMES TWENty// [1.2] //p Equals//[0.54] //o TEN//[0.5]/p TIMES M/

//r+ oK// [0.54] //so it’s JUST// [0.5] //r p FIFty plus a hundred a

and FIFty// [0.54] //p o divided by TEN so M is gonna BE// [0.4] //p

HUNDred and FIFty

GRAMS// [0.88] //r oK// [5.0]
KK's Transcript (IVE)

H //TWO// [3.67] //r say this is the //r in PART //r+ this susPENded like //r+ ME //o and //o+ THIS// [0.14] //this the //r+ posItion// //r of this MEter

H M [1.54] //this uh// [0.2] //r+ this susPENded like //r+ this ONE is// [1.45] //r part three this one is

H L

M [0.62] //and// [0.58] //this ONE is// [1.45] //r part three this one is

H L

M NOUGHT// [0.82] //p you see THIS one STARTS at

H L

M ///ZERo// [1.64] //p for

H L

M PART ONE //r+ thirty FIVE// [0.4] //two say PART two this is at// [0.58]

H L

M //?r+ centiMEter// [1.0] //o AND// [0.94] //p this one X

H L

M TWO //p is a sixty FIVE CENti MEter// [0.82] //this is the//

H L

M HANGer// [0.28] //r+ r+ CLAMP plus the //r+ r+ CLAMP plus the GRAMS// [2.9]

H L

M //r+ r+ and you PUT some MASS here this one TWO hundred

H L

M //r+ you have to FIND this MASS// [0.16] //o M// [0.99] //r+ ONE//

H L

M BE //r+r+ total MASS will M// [0.4] //r+ one Total WILL BE ONE//
H M //r+ PLUS MASS of the HANGER// [0.78] //p PLUS the CLAMP// [0.57]

H M HERE// [0.05] MASS// [1.0] //r+ will be THESE two
L M //r+ the TOTAL

H hundred GRAMS// [0.72] //r+ PLUS// [0.46] HANGER//
M //r+ the MASS of the
L

H M //p PLUS //r NOW// [0.46] //p for CLAMP// [2.9]
L THIS to be in

H M EQUILIBRIUM// [0.26] //?r+ the FORCE //r+ IS//
L

H M MASS [1.77]//r+ p TIMES the acceleRAtion due to
L

H M [0.57] //r+ uh THIS
L

H M [2.0]//r+ RIGHT//[1.2] THIS
L //r CASE// [0.4]//r+ the
L //and//[0.43]

H M DOWNward //r+ this
L

H M acceleRAtion TO// [0.4]
L DUE //p GRAvity// [2.0]

H M //r for the EQUILIBRIUM//[1.0]//r+ you KNOW THAT//
L

H M //r+ p the sum of TORQUES// [1.45] //p equal to ALL
L TO is EQUAL to ZERo//

H //TORQUE// //r HERE// [0.63] THIS
L //p SO// [0.3]

H M diRECtion [2.0] //r+ r+ is this
L M MASS G// [1.4] TUM//
L M two //?r TIMES the moMEN
H Distance// [0.63] C
M //?r this is THIS //o p the distance is X Minus X
L
H ONE [3.25] //?r+ it's the ABSolute //?r+ this is should be
L VAlue// [1.16] //?r+ in THIS dIREction
H QUAL
E TO// [1.27] //the// [0.46] //the FORCE// [0.17] //?r
L
H ONE T G// [1.0] //p is TO //?r+ this ONE X MI
M //p is TO tal// [2.0] //p x // [5.95] //o this
L
H [2.0] //?r+ is TAU c //?r+ and this ONE //?r+ X MINUS // [0.2] C
M //?r+ this ONE X MI
L //p x // [5.95] //o this
H TAU c //?r+ and this ONE // [0.08] //p TAU//
L
H /p this should BE //?r+ for the equIlibri
M Equal// [0.4]
L
H TWO // [0.25] //you have to FIND out
L //o SO// [0.4] //?r for PART
H C// [0.6] //?r+ and TAU C// [0.6]
M //?r+ TAU c //?r+ and TAU
L //?r+ p and so find AL
H centage ference of TAU cc and //?r this SHOULD be
L PA DIF TAU C// [0.9]
H [2.0]//?r+ OK// [1.88] //p in PART THIS is a //?r p
M Equal ONE DIAgram// [0.7]
L
H the PART THREE// //?r and for PART
L TWO of the exPERiment// [5.25]
H //part THREE i'll NOT// [0.04]
M //?r draw the DIAgram// [1.0] //?r it is
H
M sim- something SIMilar like THIS ONE// [0.7]
L    //o AND// [0.6] //p YOU’LL
H
M
L able to DO it// [2.0] //p SO// [1.98] //?r thing MORE// [0.06] //p NO
H
M you can
L START//
APPENDIX D
SAMPLE CHEMISTRY TRANSCRIPTS

MK’s Transcript (NS)

beGIN about
toDAY i’m just gonna go over our

unknown aNALysis SCHEME/p cos it’ll BENefit anybody who’s

going to need to be WORKing on it/p so if you wanna

round i’m gonna do it up here on the HAVE ONE it’s a great BOARD/p if you

time to check to see if you p o o r uh before i START

Everybody has MADE it up to at LEAST section FOUR on lab

TWO /p exCEPT for r p section FOUR everybody’s MADE it at LEAST that FAR

RIGHT/p except for r p section FOUR everybody’s YOU/p

there GOOD/p that’s about as FAR as it’s NECESSary/

RIGHT alright

[0.5] r cos i’m BASically only gonna go over our POSitive IONS//
FOR our unKNOWN NEGative ions

we HAVE em// [1.7]/r SEven ions we have to TEST for//[13.4]/p r+

just gonna COver our POSitive ions the SODium poTAssium and

that was the FIRST thing we did in lab TWO so everybody

should have FINished that and everybody should be faMIIlar with L

i’m gonna TALK about// [0.66] //um// [0.73] FIRST things

we did was a flame TEST// [1.3] //p and that would be an OBvious place

start OUT with// [0.8] //and// [0.7] // DUE to//[0.12] // there’s a

that// [0.48] //r p p your unknown will have a SODium imPUrity and if

DOES it’s gonna look like it has SOdium in there no matter what you

EASILY //p p o p you can TELL that when you do

a FLAME test on your SOLID cos if you reMEMber when you burned

sodium chloride SOLid your flame lasted forEVer and you had to cut
DO a flame test on your solid unKNOWN WIRE off// [0.73]// r p well if you
gonna last forEVER if it’s SOdium there// [0.36]// pp and you’ll HAVE to
CUT your wire off or TURN it around and use the other
END// [0.6] // p p so
TELL for SURE if it’s SOdium it’ll be Orange forEVER// [0.36]
how you
// r o r+ but if you do your FLAME test on your SOlid and your Orange FLAME
SEConds// [0.9]
FLAME only lasts for maybe FIFteen // p THAT’s just a TRACE//
/ ppp and THEREFORE you DON’T wanna USE it PUT that down on
unKNOWN//[0.44] // r+ that make
TRACES// o r+ p if it’s Orange and only lasts for FIFteen SEConds
DON’T put it on your unknown // p p p it IS SOdium but it’s NOT CARD// [0.6]
really supposed to
BE there it’s JUST a a TRACE// [1.3] // r HERE we
// o r+ r+ now of COURSE er you remember poTAssium
Orange// [2.0]
PURple gave a PURple or a VIOlel flame// [0.76]// r you MIGHT see that
as WELL/[0.57]/p and THAT helps you in TWO different ways/[0.5]

PURple flame you know there's

if you see a poTAssium/[0.5] //p but you

know there CAN'T be ammon- or er SOdium/[0.44]/o because SOdium

would have BEEN/[0.44] //p bright //r+ and the THIRD possibility

Orange// [1.0]

is that there be no color at ALL/[1.0]/p o r and if there's no color

ALL there CAN'T be SOdium there can't be poTAssium/[0.7]/p p the

POSitive ion you could possibly HAVE is //r p and THAT may

amMOonium// [2.0]

or may not HAPpen you might get LUCky and have that

HAPpen// [0.88]

//op and if that DOES you probably should still CHECK to make sure

SHOULD have at least one

HAVE ammonium/[0.76]/p p i mean you* POSitive

it's great to double check your

SELF// [2.43]

SEcond set of

TESTS we did was that cobaltNiTRate

TEST// [4.9]

reiMEMber

that's RIGHT// [0.55] //er// [0.66]
when you did that it was a it formed a yellow precipitate for both er
ammmonium so if you did that at this step in potassium and

game or may not tell you anything so if you did that at this step

in potassium and game or may not tell you anything

so potassium there it's certainly gonna change

it doesn't tell you anything about ammonium so it's definitely

not a good way to second step then right so instead

that what could we try any suggestions

attention will everybody please

so potassium would you please yeah pay

attention to if you want to go

this or um

to assignment three these or two questions uh may be

have problem with look at the board if you

this so you just er
H unKNOWN// [0.04]
M [0.57] // p er for // o UM// [0.6] // p p o
L QUESTions//

H IONS // p r POSSibly
M conTAIned in the SAMple
L ARE// [0.57] // o ER// [0.57]

H EIGHT IONS// [0.3] // p er THREE CATions and er// [0.52] // er
L FIVE ANions//

H WHEN you reCEIVE
M [0.77]// o SO// [0.2]// o p o UM // o p p o UM // o ER// [0.18] // p an unKNOWN
L

H SAMple what’s the FIRST STEP you// [0.48] // p you WANT to TAKE//
L

Student response: Flame test

H FLAME TEST // p o BY FLAME
M TEST
L // o p p ER // o p p ER // o ER// [0.26] // o p p ER // o p p ER // [0.48]

H ER// [0.3]// p what ION can you CHECK OUT by// [0.13]// p SIMply by
L

H M FLAME TEST//
L

Student response: Na

H // p THIS ONE// [0.98] // p HOW about THIS one/
L

Student response: multiple responses

H // r you CAN// [1.0] // p oK// [0.92] GOOD// [0.52] // p so for
L // p p oK

H MIXture//[0.23]// p ONLY//// o when THERE is NO// [0.65]// p SODium//
M L
Student response: It depends on if you have Na in the sample or not in the flame test. If you have Na then you can't tell if you have potassium so you have to do a solution test for potassium.

H //r+ r+ dIRECTly THEN//[0.09]// you MEAN//[0.2]//pr+ HERE you want

M prePARE soLUtion RIGHT//
L NOW

Student response: Yeah (silent beat, flat tone)

H M DO THAT// [1.2] //o SO
L //o p p UH OK you can

Student response: It depends on if you have Na in the sample or not in the flame test. If you have Na then you can't tell if you have potassium so you have to do a solution test for potassium.

H //r+ r+ dIRECTly THEN//[0.09]// you MEAN//[0.2]//pr+ HERE you want

M prePARE soLUtion RIGHT//
L NOW

Student response: Yeah (silent beat, flat tone)
HOW to make //p WHAT's

VOLUME// [0.26] //p you want to MAKE//

Student response

ANYbody ELSE//[0.42]//r+ has any IDEA//[3.78]
    //p oK//

USually you USE// [0.07] //o TEN to// [0.3]

fifTEEN milliliters of WATER// [0.63] //o USE//

TWO THIRDS// [0.15] //p of your SAMPLE// [0.9] //KEEP another

THIRD//[0.23]//p to GIVE you aNOther CHANCE//[0.4]//ppr+ in CASE

you make any misTAKES you CAN yeah do it aGAIN RIGHT////o SO//

p p but beFORE you make a- MAKE soLUTION YOU can do aMMONium

test// [0.35] SEcond STEP you// [0.57]

FIRST// [0.13] //r just the

just between THESE// [0.13] //o aMMONium TEST//
//o you can DO// [0.2]

[0.6] //SIMply by// [0.08]

ADDing// [0.4] //o sodium hydrox- hyDROxide
to IT // [0.66] // p and use the LITmus PAPER // [0.14] // yeah // [0.36]  

// p to CHECK out THIS one // [0.47] // beCAUSE // [0.23] // pp by checking  

THIS FIRST you can  
KNOW that // [0.52] // p in the SEcond // [0.14] // p in  

// p IF you need to BURN // [0.32]  
FOLLOWing part // [0.6]  
// p or NOT  

soLUtion //  
// r+ RIGHT // [1.26]  
// p oK //
REFERENCES


Lucy Pickering was born July 6, 1966, in Essex, England. She completed her B.A. (Hons) in Related Arts at the West Sussex Institute of Higher Education in 1988. Between 1990 and 1992 she taught English as a Foreign Language in Hungary and England. She began her master of arts at the University of Florida in the fall of 1992. At that time, she also worked as a teaching assistant at the English Language Institute. She began her doctor of philosophy in applied linguistics in 1995, and she worked as an instructor for the International Teaching Assistant Program at the University of Florida.
I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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This dissertation was submitted to the Graduate Faculty of the Program in Linguistics in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

August 1999

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