THE ORGANIZATION OF JAPANESE PROSODY

HARUO KUBOZONO

DOCTOR OF PHILOSOPHY

UNIVERSITY OF EDINBURGH

1987
Declaration

I declare that this thesis has been composed by myself and that the research reported therein has been conducted by myself unless otherwise indicated.

Nagoya, 14 November 1987

HARUO KUBOZONO

HARUO KUBOZONO
Acknowledgements:

p.(iii) line 2 from bottom: like thank  \rightarrow \text{like to thank}

Chapter 1

p.24 line 2: Pulleybank  \rightarrow \text{Pulleyblank}
p.40 (19b): kake  \rightarrow \text{kaki}
p.40 line 2 from bottom: selected  \rightarrow \text{selected}
p.41 line 4 from bottom: Minimal  \rightarrow \text{Minimal}
p.67 bottom line: semantically  \rightarrow \text{semantically}

Chapter 2:

p.77 line 6: UHHLLL  \rightarrow \text{UHHLLL}
p.77 line 7: seido  \rightarrow \text{seisaku}
p.90 line 8: devoiced  \rightarrow \text{voiced}
p.97 line 1: give  \rightarrow \text{given}
p.97 establishedness  \rightarrow \text{establishedness}
p.97 line 8: omit it
p.97 line 2 from bottom: omit indefinite article a
p.98 (17): 1. 2. 3. 4.  \rightarrow 1. 2. 3. 4. 5.
p.98 line 6 from bottom: ..\text{ha}'huzyaku}  \rightarrow \text{..\text{ha}'kuzyaku}
p.99 line 10: to \rightarrow \text{with}
p.101 line 10: section 2.3.5  \rightarrow \text{section 3.6}
p.101 bottom line: section 2.3.2  \rightarrow \text{section 3.3}
p.123 line 2: omit the
p.130 line 9 from bottom: fail  \rightarrow \text{failg}
p.133 (46h) line 2: ..."self-sufficiency"  
\rightarrow \text{..."self-sufficiency" "economy"}
p.136 bottom 2 lines: second element  
\rightarrow \text{second and third elements}
p.140 line 7 from bottom: bunkaki'kai  \rightarrow \text{bunkaki'kan}
p.141 line 5 from bottom: permit  \rightarrow \text{permits}
p.160 line 6: (74c)  \rightarrow (74iii)
p.160 line 10: (74c)  \rightarrow (74iii)
p.166 line 3: phrases  \rightarrow \text{processes}
p.169 line 4 from bottom: (60)  \rightarrow (61)
p.172 line 3 from bottom: monophrasal  \rightarrow \text{biphrasal}
p.172 line 2 from bottom: biphrasal  \rightarrow \text{monophrasal}
p.174 line 4 from bottom: units  \rightarrow \text{unit}
p.175 line 4: (1)  \rightarrow (85i)
p.176 (89) line 2: kyookai  \rightarrow \text{kyookai 11}
p.178 line 9 from bottom: 3.6  \rightarrow 3.4
p.192 fn.9: undergoes the compounding process while that of \([\text{given name} + \text{family name}]\) fails to do so  
\rightarrow \text{fails to undergo the compounding process while that of \([\text{given name} + \text{family name}]\) undergoes it.}
p.194 fn.23: River Thames  \rightarrow \text{River THAMES}
Chapter 3:

p.213  lines 8–9: sections 1.2.1 and 1.3  
→ sections 2.1 and 3.1

p.226  line 3 from bottom: for the only sake  
→ merely for the sake

Chapter 4:

p.298  line 4: phrase → process
p.298  line 12: Four → Five
p.345  line 7: (40b) → (40a)

p.346  bottom line: preceding → following
p.347  line 8: loweing → lowering
p.348  line 2 from bottom: fagctors → factors
p.349  line 1: to eliminated  → to be eliminated
p.354  (46a): yunomi ] → yunomi ]

p.355  line 3 from bottom: pharasing  → phrasing
p.360  line 5 from bottom: accent in  → accent type in

p.386  (68a) line 2: (= (55b,c), → (= (55b,c)),

p.393  fn.32 line 3: lowering that  → lowering than

Chapter 5:

p.425  line 6: ... course ...  → ... course of ...

p.429  line 6: but experimental  → but the experimental
p.435  line 3 from bottom: (7).  → (7)_

p.436  (9): (2a) (2b) (2c) → (6a) (6b) (6c)

p.448  line 3 from bottom: un accented  → an unaccented

p.452  line 4: Tables 10 and 11  → Tables 10-12

p.458  line 10: higher  → lower

p.468  line 4: summarize  → summarize

p.479  line 4 from bottom: Figure 5.29  → Figure 5.20

p.490  line 11 from bottom: contribute  → contribute to

p.517  (60a): e.g. [[[ ma'rikoga no'nda ] [ wa'inno nio'i ]

→ [[[ ma'rikoga no'nda ] wa'inno ] nio'i ]

p.523  line 11: (63)  → (63a)

p.525  (65a): yunomi ] → yunomi ]

p.525  (65c): naomono  → naomino

REFERENCES:

p.583: Eric Fudge  → Erik Fudge
p.583: (Hatch and Farhady): Newburh  → Newbury
p.584: (Hyman 1977): —— (ed.) 1977 Studies ...

p.585: (Liberman and Prince) Linguistics Inquiry  
→ Linguistic Inquiry

p.586: (Pierrehumbert): Pierrehumbert, Janet B.

Appendix I:

p.590  Dataset II, line 4: phrase  → frame
p.592  Dataset IV, line 3: phrases. but  → phrases but
p.597  (3a): 'warena  → a'warena

p.599  Dataset IX, line 5: as a some  → as some

p.600  Dataset X, line 2: phrase  → phrases
Acknowledgements

This thesis has been completed with the help of many people. First and foremost, I would like to thank Bob Ladd, who has guided me ever since January 1985 when he accepted my request to be my supervisor on his arrival in Edinburgh. I truly enjoyed the weekly discussions with him through which I always left feeling academically 'condensed' and 'refreshed.' His persistent guidance has also helped me a great deal over the past year when I was writing this thesis back in Japan. Without his valuable suggestions and encouragement throughout these periods, this work would not have been completed.

For introducing me to the world of phonetics, I am grateful to John Laver and other phoneticians in the Department of Linguistics of Edinburgh, notably Alan Kemp, Sandy Hutchison, Jody Higgs, Betty Uldall, Steve Hiller and Jonathan Harrington.

I owe thanks to many people in carrying out the experiments reported in this work. First, I would like to thank Jeff Dodds and other technicians at the Phonetics Laboratory in Edinburgh. Equally important were the subjects and informants of the experiments, especially Teruo Yokoyama, my principal informant. While in Edinburgh, I benefited from the seminars held around George Square and Buccleuch Place. I would like thank the people who academically stimulated me there.
Outside Edinburgh, I am most indebted to Nanzan University and my colleagues there, who agreed to send me to Britain for as long as three years. I owe a great deal to Nanzan University, which supported me financially throughout the period I was in Edinburgh. Its Pache Research Grant (Pache IA, 1987) has helped me a great deal too. The work reported in this thesis was also partly supported by U.K. Overseas Research Student (ORS) Awards (1985/86).

Finally, I thank my wife, Keiko, who has 'produced' our first offspring out of her own labour at the same time that I produced this work. Without her persistent encouragement and mental support, I could not have possibly continued the research reported here.
ABSTRACT

This thesis is an experimental phonological study of pitch in Tokyo Japanese. It comprises five chapters all discussing prosodic processes and phenomena relating to accent, tone or intonation on the basis of experimental evidence. The discussion in each chapter is developed essentially in the following three steps: (i) a critical review or overview of the past work on the subject discussed in the chapter or section; (ii) presentation of new evidence mostly from instrumental experiments; (iii) a discussion of the experimental evidence in theoretical contexts.

After outlining the nature and function of word accent in Chapter One, I discuss in Chapter Two the prosodic compound formation process which has traditionally been described as an accent (re)assignment process. I analyze the linguistic structures of those compounds which are not subject to the compound accent rules, and propose several factors which constrain the prosodic compound formation process, defining them as the linguistic conditions on the process.

Chapters Three through Five deal with word accent in a wider context of speech, discussing its roles, behavior and phonetic realization in phrase or sentence perspective. Chapter Three discusses the phonetics and phonology of 'accentual fall,' 'accentual boost' and 'accent clash,' for each of which the fallacies underlying the impressionistic descriptions in the literature are demonstrated.
Chapter Four discusses various problems relating to intonational phrases and phrasing. The first part of the chapter focuses on the definition of the two intonational phrases, 'major phrase' and 'minor phrase' while the second part of the chapter explores the linguistic conditions on 'minor phrase formation,' the intonational phrasing process whereby two or more syntactic/morphological units are combined to form one minor intonational phrase.

Chapter Five examines the linguistic structure of 'downtrend,' the phenomenon whereby pitch declines during the course of utterances. It is shown in the first part of the chapter that Poser's 'catathesis' (downstep) model is a largely adequate model of the intonational phenomenon. After confirming that the trigger of the downtrend phenomenon is largely attributable to accent, it is shown in the second part of the chapter that this accent-triggered process varies considerably depending on the syntactic structure of the phrase or sentence involved, or, in other words, that the configuration of downstep serves to disambiguate otherwise ambiguous syntactic structures.

In the course of discussing the specific topics just mentioned, several more general theoretical issues are addressed, including the following four topics: the relation between syntactic structure and phonological structure; the organization of rhythmic structure; the abstractness of phonological (tonal) representation; and the nature of phonetic realization rules.
TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledgements</td>
<td>iii</td>
</tr>
<tr>
<td>Abstract</td>
<td>v</td>
</tr>
<tr>
<td>Table of Contents</td>
<td>vii</td>
</tr>
<tr>
<td>Introduction</td>
<td>1</td>
</tr>
<tr>
<td>1. Goals</td>
<td>1</td>
</tr>
<tr>
<td>2. Methodology: Experimental Design</td>
<td>8</td>
</tr>
<tr>
<td>2.1. Non-Instrumental Experiments</td>
<td>8</td>
</tr>
<tr>
<td>2.2. Instrumental Experiments</td>
<td>10</td>
</tr>
<tr>
<td>2.2.1. Subject</td>
<td>10</td>
</tr>
<tr>
<td>2.2.2. Recording Procedure</td>
<td>11</td>
</tr>
<tr>
<td>2.2.3. Recorded Materials</td>
<td>11</td>
</tr>
<tr>
<td>2.2.4. Editing the Recordings and Measurements</td>
<td>12</td>
</tr>
<tr>
<td>2.2.5. Statistical Considerations</td>
<td>13</td>
</tr>
<tr>
<td>Notes to Introduction</td>
<td>14</td>
</tr>
<tr>
<td>Chapter One</td>
<td></td>
</tr>
<tr>
<td>Accent and Tone</td>
<td>16</td>
</tr>
<tr>
<td>1. Basic Notion of Accent and Tone in Japanese</td>
<td>16</td>
</tr>
<tr>
<td>1.1. Accentual vs. Tonal Hypothesis</td>
<td>17</td>
</tr>
<tr>
<td>1.2. Three Levels of Derivation</td>
<td>22</td>
</tr>
<tr>
<td>1.3. Linked-Tone Analysis</td>
<td>23</td>
</tr>
<tr>
<td>2.1. Pitch Accent</td>
<td>28</td>
</tr>
<tr>
<td>2.2. Accent and Syllable</td>
<td>31</td>
</tr>
<tr>
<td>2.3. Culminative Function and Unaccented Words</td>
<td>33</td>
</tr>
<tr>
<td>2.3.1. Culminative Function</td>
<td>33</td>
</tr>
<tr>
<td>2.3.2. Unaccented Words</td>
<td>34</td>
</tr>
<tr>
<td>2.3.3. Theoretical Implications</td>
<td>36</td>
</tr>
<tr>
<td>2.4. Free Accent and Distinctive Function</td>
<td>40</td>
</tr>
<tr>
<td>3. Abstractness of Tonal Representation</td>
<td>43</td>
</tr>
<tr>
<td>3.1. Tonal Levels</td>
<td>43</td>
</tr>
<tr>
<td>3.2. Other Related Problems</td>
<td>46</td>
</tr>
<tr>
<td>4. Tonal Derivation</td>
<td>49</td>
</tr>
<tr>
<td>4.1. Where They Agree</td>
<td>49</td>
</tr>
<tr>
<td>4.2. McCawley's Pitch Assignment Model</td>
<td>52</td>
</tr>
<tr>
<td>4.3. Haraguchi's Autosegmental Model</td>
<td>53</td>
</tr>
<tr>
<td>4.4. Where They Differ</td>
<td>57</td>
</tr>
<tr>
<td>5. Word Accent And Syntax</td>
<td>58</td>
</tr>
<tr>
<td>5.1. Deaccenting Morphemes</td>
<td>60</td>
</tr>
<tr>
<td>5.2. Syntactic Condition on Deaccenting Rule</td>
<td>63</td>
</tr>
<tr>
<td>5.3. Evidence</td>
<td>65</td>
</tr>
<tr>
<td>5.4. Summary</td>
<td>66</td>
</tr>
<tr>
<td>Notes to Chapter One</td>
<td>68</td>
</tr>
</tbody>
</table>
Chapter Four

5. On Initial Lowering
6. On Minor Phrase Formation
   6.1. Minor Phrase Formation Redefined
   6.2. Accentual Condition on MPF
   6.3. Branching Condition on MPF
      6.3.1. Evidence for the BC Hypothesis
         6.3.1.1. Dataset VII
         6.3.1.2. Dataset IV
         6.3.1.3. Summary
      6.3.2. Evidence Against the PSA Hypothesis
         6.3.2.1. Dataset IV
         6.3.2.2. Evidence Against Reanalysis
         6.3.2.3. Summary and Theoretical Implications
   6.4. Rhythmic Condition on MPF

Notes to Chapter Four
List of Figures

Chapter Five

Dynamics of Intonation: Downtrend

1. Review of Past Work
   1.1. Overview
   1.2. Fujisaki's Contour Interaction Model
   1.3. Phonological Interpretations of Downtrend
      1.3.1. Accent Reduction Model
      1.3.2. Catathesis Model

2. Tonal Aspect of Downstep
   2.1. Accent and Downstep
      2.1.1. Trigger and Effect of Downstep
      2.1.2. Chaining of Downstep
         2.1.2.1. Right-Branching Phrases
         2.1.2.2. Left-Branching Phrases
      2.1.3. Representation of Downstep
      2.1.4. Where Previous Models Fail
   2.2. Other Tonal Effects on Downstep
      2.2.1. Two Competing Hypotheses
      2.2.2. Data
      2.2.3. Discussion
         2.2.3.1. Inter-Peak Differences
         2.2.3.2. Peak Levels

3. Metrical Aspect of Downstep
   3.1. Evidence
      3.1.1. Dataset VIII
      3.1.2. Dataset VII
   3.2. Arguments for Metrical Boost
   3.3. Further Evidence for Metrical Boost
      3.3.1. Dataset IX
      3.3.2. Dataset X
1. Goals

This thesis is an experimental phonological study of pitch in Tokyo Japanese.\(^1\) It comprises five chapters all discussing prosodic processes and phenomena relating to accent, tone or intonation on the basis of experimental evidence.

The first chapter discusses the nature and function of word accent in Japanese while giving a critical review of the literature on the subject. It also constitutes an introduction to the topics to be discussed in the remaining chapters by outlining the organization of Japanese prosody and the major problems concerning pitch phenomena in the language.

Chapter Two discusses the prosodic compound formation process, which has traditionally been described as an accent (re)assignment process. Rather than exploring the accentual changes characterizing this process, which has been one of the most-discussed topics in the prosodic research of Japanese, I will concentrate on those compounds which are not subject to the compound accent rules. I will analyze, on the basis of my own corpus of data, the linguistic structure of 'complex compounds' (compounds made up of three or more elements) on which little light has been shed in the literature. I will propose several factors which constrain the prosodic compound formation process, defining them as the linguistic conditions on the process.

While the first two chapters center around the discussion of
the nature of word accent within the word, the next three chapters — Chapter Three to Chapter Five — deal with word accent in a wider context of speech, discussing its roles, behavior and phonetic realization in phrase or sentence perspective. Previous accounts of word accent point out two main roles which word accent plays in this domain: what I term 'accentual boost' and 'accentual fall.' 'Accentual boost' refers to a boost in pitch height of the elements which bear the accent whereas 'accentual fall' represents a sudden drop in pitch which has been claimed in the literature to be the primary phonetic correlate of Japanese word accent. The latter pitch phenomenon forms an integral part of a larger intonational phenomenon called 'catathesis' or downstep (Poser, 1984; Beckman & Pierrehumbert, 1986) whereby the pitch range of subsequent phrases is lowered.

In Chapter Three, I will first discuss the phonetics and phonology of 'accentual fall' and 'accentual boost.' As for 'accentual fall,' I will show that the sudden pitch drop takes place not simply between the accented mora and the next mora, as has been assumed in the past, but continues at a constant rate over the sequence of unaccented morae following the accented mora. As for 'accentual boost,' I will demonstrate that accent raises not just the peak of the element involved, as has previously been assumed, but the entire pitch level at which the element is phonetically realized. This is followed by a discussion of 'accent clash,' or the reduction of one accent in the vicinity of another. Experimental evidence will be
presented to show that what have been described as 'unrealized accents' are often realized at the lower pitch level, and that the realization or non-realization of accent is to be characterized as phonetic variation. On the basis of this evidence, I will propose a phonetic account of the accent reduction phenomenon while casting doubt on the traditional phonological treatment (accent deletion or tonal masking).

Chapter Four discusses various problems regarding intonational phrases and phrasing. The first part of the chapter focuses on the fallacies found in the literature concerning the definition of the two intonational phrases, 'major phrase' and 'minor phrase.' The second part of the chapter explores the linguistic conditions on 'minor phrase formation (MPF),' the intonational phrasing process whereby two or more syntactic/morphological units are combined to form one minor intonational phrase. Specifically, experimental evidence will be presented to settle major controversies in the literature concerning the accentual and syntactic factors influencing the variation in intonational phrasing.

The last chapter of the thesis, Chapter Five, examines the linguistic structure of 'downtrend,' the phenomenon whereby pitch declines during the course of utterances. In the first part of the chapter, it will be shown that Poser's downstep model is a largely adequate model of this phenomenon. After confirming that the trigger of the downtrend phenomenon is largely attributable to accent, I will show in the second part of the
chapter that this accent-triggered process varies considerably depending on the syntactic structure of the phrase or sentence involved. I will demonstrate, in other words, that the configuration of downstep serves to disambiguate otherwise ambiguous syntactic structures.

Of the five chapters just outlined, the discussions in Chapters Two through Five are developed essentially in the following three steps: (i) a critical review or overview of the past work on the subject discussed in the chapter or section; (ii) presentation of new evidence mostly from instrumental experiments to be outlined in the next section; (iii) a discussion of the experimental evidence in theoretical contexts.

The theoretical issues to be discussed in this thesis include the following four topics. The first and most important issue will be one of the relation between syntactic structure and phonological (prosodic) structure. I will make the following three points about this issue. First, through the discussion of the syntactic (branching) conditions on the processes of prosodic compound formation and minor phrase formation, I claim that the right-branching structure represents a marked structure in Japanese phonology in general. Second, I will claim through the same discussion that phonological structures of Japanese (accentual and intonational structures, to be exact) show systematic discrepancies from syntactic structure, as typically illustrated below ('/' denotes a prosodic phrase boundary, i.e. accent phrase boundary or minor intonational phrase boundary).
On the basis of this and other lines of evidence, I cast doubt on the principle of 'cyclicity,' or the hypothesis that phonological rules all apply cyclically from a smaller syntactic domain to a larger domain. Instead, I suggest that some phonological rules of Japanese apply linearly, between two given terminal elements adjacent to each other.

The third and most important point I would like to make about the relation between syntax and phonology in Japanese is that phonological structures are hierarchically organized. I will show that prosodic rules in Japanese such as prosodic compound formation, minor phrase formation and downstep make reference to the information as to the syntactic hierarchy of phrases and sentences. The fact that the syntactic hierarchy is essential for an adequate characterization of such prosodic processes suggests that prosodic structures themselves (accentual structure and intonational structure, to be specific) involve a hierarchical organization just like the syntactic structure.

A second theoretical issue I would like to address in this thesis concerns the rhythmic structure of Japanese. I will show that the principle of rhythmic alternation (PRA) constrains the prosodic processes just mentioned, thereby yielding an alternating pattern out of otherwise 'monotonous' sequences of
linguistic elements. In the process of downstep, for example, left-branching phrases made up of four accented elements exhibit an FO pattern as in (2a), in which the third element receives an extra boost in pitch, rather than the pattern in (2b) which is predicted by the tonal structure of the phrases.

(2) a) b)

As is well known, Japanese has generally been characterized as a 'syllable (mora)-timed' language (cf. Abercrombie, 1967; McCawley, 1978; Hoequist, 1983a, b), or a language characterized by the 'rhythm of succession' as opposed to the 'rhythm of alternation' (Allen, 1975). The fact that prosodic processes of Japanese are constrained by the PRA implies that 'rhythm of alternation' and 'rhythm of succession' are not mutually exclusive, as has traditionally been assumed, but can coexist in a single phonological system as independent rhythmic principles.

A third theoretical topic to be discussed in this thesis concerns the relation between phonetic representation and phonological representation, or in other words, the abstractness of phonological representation. It has been tacitly assumed in the literature, for instance, that tonal representation is a somewhat abstract representation which does (or need) not involve every detail of phonetic facts. However, it has remained
unanswered how abstract the tonal representation should/can be, or in other words, where one should draw a line between the phonetic facts to be tonally represented and those which are purely phonetically represented. I will attempt to tackle this question, though in passing, through the discussion of accent-induced pitch phenomena such as accentual boost, accentual fall and downstep.

Lastly, I will consider the nature of phonetic realization rules (PRRs),<sup>6</sup> the rules which serve to interpret the tonal representation into the FO contours as observable at the phonetic output of speech. The main question I will address is one of whether the PRRs look ahead and, if they do, to what extent they do so. On the basis of the evidence concerning accentual boost and other pitch phenomena, I will suggest that the PRRs do look ahead within the domain of the minor phrase.
2. METHODOLOGY

The experiments reported in this thesis fall into two types, instrumental experiments and non-instrumental experiments. Instrumental experiments are computer-aided experiments conducted for the phonetic and phonological descriptions of pitch phenomena in Tokyo Japanese. The results of these experiments are discussed throughout this thesis, specifically in Chapters Three through Five. Non-instrumental experiments, by contrast, were conducted to explore the (word) accentual patterns which phrases and compounds show in Tokyo Japanese. The results of these experiments are discussed in Chapter One (Section 4.1) and Chapter Two.

2.1. Non-Instrumental Experiments

Most of the analyses of word accent patterns developed in this thesis were made by reference to the traditional accent dictionaries (e.g. NHK and Sansendo) as well as the phonological descriptions by Akinaga (1966), McCawley (1968) and others. These previous descriptions, however, are not satisfactory in their analysis of some particular accentual processes or rules. The pre-no deaccenting rule, for instance, is not much discussed in the literature, and there has been no empirical work which supports the syntactic condition on the rule as proposed by McCawley (1968) and Poser (1984). To examine the empirical validity of this condition, therefore, I was obliged to carry out my own analysis. To do this, I made up some original test phrases
and referred them to four native speakers of Tokyo Japanese to see if the deaccenting rule is really subject to the syntactic condition as McCawley and Poser claim (cf. Chapter One, section 5).

Another area in which previous analyses of word accent do not provide sufficient data is in the description of the phonological structure of complex compounds and compounds which fail to undergo compound accent rules (cf. Chapter Two). In fact, previous phonological studies pay little or no attention to this issue and, hence, I was obliged to make my own analysis virtually 'from scratch'. The first thing I did was to gather as many compound expressions as possible. From newspapers, magazines, TV programs, etc., I gathered nearly seven hundred compound nouns, including about three hundred complex compound nouns. The remaining expressions are 'simplex' (i.e. two-component) compounds of which about two hundred turned out to be those which fail to undergo the compound accent rules.

The compound expressions collected in this way were referred to five native speakers of Tokyo Japanese (including the four speakers just mentioned). I conducted two informal experiments to understand the phonological (accidental) structure of the compound expressions. In one and major experiment, I wrote down the expressions on cards and asked the informants to read them. The informants generally agreed in their judgement of the accentual patterns (both accentual phrasing pattern and accentuation) of the test words. There were quite a few compound expressions, however, for which the informants showed an intra-
personal variation or inconsistency in his/her judgement. In such a case, I additionally conducted a simple listening test in which I myself read the expressions to the informant in several ways. Hearing how I pronounced, the informant was asked to make his/her judgement on the naturalness of the pronunciations. While repeating this listening test for all the ambiguous test expressions, I attempted to explore the factors underlying the intra-personal variation.

2.2. Instrumental Experiments: Experimental Design

2.2.1. Subject

All the data from instrumental experiments reported in this thesis were obtained from a single subject, a male native speaker of Tokyo Japanese in his mid-thirties. He was born in Tokyo and lived there until he was about thirty. He had been living in Britain for a few months at the time of the recording.

Needless to say, it is desirable to sample and analyze data from more than one speaker. Considering the time-consuming nature of the experiments and the limited time available, however, I chose, following Poser (1984) and others, to analyze reasonably detailed and comprehensive data from a single speaker rather than to make scattered observation with many speakers' speech.
2.2.2. Recording Procedure

All the recordings were made in several different recording sessions in the sound-proof recording studio of the Phonetics Laboratory at Edinburgh University. All the materials were recorded on high-quality tapes. The subject was not informed of the exact purpose of the experiments but was simply asked to read the test sentences at normal speed. After the recordings were made, the individual utterances were edited onto separate files for subsequent analyses.

2.2.3. Recorded Materials

Materials recorded and analyzed in the methods just outlined fall into ten groups each of which I call 'dataset.' The reason for using the term 'dataset' rather than 'experiment' is that the data from each dataset are used for more than one purpose. The individual datasets, which are summarized in Appendix I, were recorded at different times and each of them constitutes an independent experiment on its own. Procedures were improved over the course of all the experiments, which is one major reason why the method (e.g. number of test phrases, number of repetitions, presence or absence of dummy phrases and a practice session, etc.) varies slightly from one dataset to another.

The materials recorded were constructed entirely from voiced non-obstruents at least in the regions of interest. This is to reduce perturbations of the actual F0 which might be caused by obstruents.
The sentence frame in which test phrases were put is sorewa... desu "It-Topic" "is" = "It is ....". In datasets in which test sentences (not phrases) were to be measured, however, different sentence frames were adopted to avoid semantic anomalies. In listing the test phrases and sentences below, particles (and other function words analogous to particles) are hyphenated to the word (or phrase) which immediately precedes them (cf. Dataset IV). This is because particles do not necessarily belong to the same syntactic phrase as the word they attach, but rather they attach to the right-most word of the constituent to which they belong, both syntactically and prosodically. (3) illustrates this with the phrase naomi-no ane-no yunomi "Naomi's sister's teacup" (no is a genitive particle).

(3)

\[
\text{naomi no ane no yunomi}
\]

"Naomi" "Gen" "sister" "Gen" "teacup"

\[\Rightarrow\]

naomi-no ane-no yunomi "Naomi's sister's teacup"

2.2.4. Editing the Recordings and Measurements

All the analyses also were made in the Phonetics Laboratory at Edinburgh University. The facilities for real-time digitization and real-time playback of speech wave forms were implemented on a Digital Equipment Corporation PDP11/40 computer, a machine which had an LPS11 laboratory peripheral system. The Interactive Laboratory System package (ILS), produced by
Signal Technology Inc., was used for waveform storage and display.\(^8\)

The speech analysis required a more powerful computer than the PDP11/40. Therefore, digitized waveforms were transferred to the Digital Equipment Corporation VAX/VMS 11/750 computer system. This machine is also equipped with the ILS which was used to analyze the waveforms. The ILS on both machines included the ILS Speech programs specifically designed for speech feature extraction.

All graphic display was done on Tektronix 4010-compatible terminals while hard-copies of graphics were produced on a Tektronix 4611. The listing of numeric values of pitch was done on a VAX Line-printer.

2.2.5. Statistical Interpretation

It is essential to give a sound statistical interpretation of experimental data in order to use them as relevant evidence for a given hypothesis or claim. The statistical procedure to be used throughout this thesis is \(t\)-test, which is used for the comparison of two means. As commonly done, P values less than .05 in two-tailed tests are regarded as the minimum level of significance.\(^9\)
NOTES TO INTRODUCTION

1. In this thesis, I use the two terms, 'pitch' and 'FO' interchangeably. The dialect I will analyze in this thesis is Tokyo Japanese, or the dialect which is often loosely identified as the standard Japanese. I mean Tokyo Japanese, therefore, whenever I simply say 'Japanese' in what follows. The phonological structure of other dialects are discussed in this thesis only in relation to this dialect.

2. Poser and Beckman & Pierrehumbert use the term 'catathesis' instead of 'downstep' apparently because they are not sure whether the intonational phenomenon in Japanese (and English) is or is not equivalent to the arguably lexical phenomenon in various African languages reported in the literature. In the absence of evidence that the two phenomena are different from each other, I will take the opposite position and retain the term 'downstep' to describe the phonologically conditioned pitch phenomenon in Japanese. It should be understood, therefore, that what I call 'downstep' in this thesis is essentially equivalent to what Poser and Beckman & Pierrehumbert refer to as 'catathesis'.

3. Strictly speaking, the term 'accented mora' is not correct. The unit to which the accent is assigned is not the mora but the syllable, as was convincingly shown by McCawley (1978). 'Accented mora' should then be interpreted as the 'syllabic (i.e. first) mora' of the accented syllable. From here on, I will use the term 'accented mora' in this sense.

4. There is some confusion about the use of the two terms, 'syllable' and 'mora' in Japanese phonology. If we distinguish between the two terms, as I shall do in this thesis, Tokyo Japanese should be called a 'mora-timed' language rather than a 'syllable-timed' language. See the discussion in Chapter One for the distinction of these terms in Japanese phonology. See also McCawley (1978) and Vance (1987) for introductory accounts.

5. There is independent evidence to suppose that the sequences of Japanese morae form a hierarchical structure, in which they are constrained by the principle of rhythmic alternation. Han (1962) points out, for instance, that the process of devoicing tends to avoid yielding sequences of morae each vowel of which is devoiced, in favor of an alternating pattern between an devoiced mora and an 'undevoiced' mora. Thus, the onomatopoeic word pukupuku, of which each vowel is in principle subject to devoicing, yields the patterns in (a) in preference to the patterns in (b) below:

(a) [pukupuku], [pukupuku]

(b) [pukupuku], [pukupuku], [pukupuku]
[pukupuku], [pukupuku],
Similarly, Kubozono (1986) (see Appendix III) proposes the notion of 'syllabic rhythm' whereby long (i.e. bimoraic) syllables yield a syllable-internal alternation between the 'syllabic mora' and 'non-syllabic mora.' See Kubozono (in preparation) for further information of the hierarchical organization of morae sequences and the role of the principle of rhythmic alternation therein.

6. What I term 'phonetic realization rules' seems to roughly correspond to what Pierrehumbert (1980) calls 'tonal realization rules.'

7. Analogue speech waveforms were digitized to a 12-bit resolution, by an LPSAD-12 module, with sample rate controlled by an LPSKW programmable clock. Digital-to-analogue conversion for speech playback used an LPSDR parallel digital output module controlled by the programmable clock. The clock was connected to an external 12-bit digital-to-analogue converter.

8. The real-time sampling and playback used the extensions to this software. Sampling was from analogue tape recordings, played on a Revox tape recorder, using a Barr and Stroud variable filter to low-pass the frequencies below the Nyquist frequency for the selected sampling rate (in the present experiment, 10kHz).

9. For more detailed information on statistical procedures, see Hatch & Farhady (1982) or other introductory textbooks on statistics, where concrete formula and tables should be found.
The study of accent and tone has been the focus of attention in Japanese phonetics and phonology and has produced a variety of work from various disciplines. This includes the work by experimental phoneticians (e.g. Fujisaki & Sudo, 1971), experimental physiologists (e.g. Sawashima et al., 1973) and theoretical phonologists (e.g. McCawley, 1968; Haraguchi, 1977) as well as many "philological phonologists" who have provided an enormous amount of empirical data, mostly on their impressionistic observations. This long and diverse tradition has yielded many controversies regarding the phonetics and phonology of Japanese accent and tone. Some of these controversies concern the empirical facts of what is actually happening in the language while others crucially bear upon the theoretical framework in which the empirical facts are described.

The goal of this chapter is to give a critical review of the past work from various viewpoints, thereby outlining some of the controversial points in detail. This sketch of the literature constitutes an introduction to the discussions developed in the remaining part of the thesis.

1. The Basic Notion of Accent and Tone in Japanese

Previous treatments of Japanese accent and tone fall into two groups: those proposed on the "tonemic hypothesis" and those on the "accentual hypothesis". The tonemic hypothesis views
tones (or "tonemes") as being primitive in Japanese phonology which, as in tone languages like Chinese, are assigned to each syllable or mora in the lexicon (cf. Sakuma, 1919; Kindaichi, 1967). The accentual hypothesis, on the other hand, posits a level more abstract than the tonal one on the assumption that tonal representations are derived by phonological (tonal) rules from the underlying accentual representations. The accentual hypothesis is adopted by most of the recent phonologists including Hattori (1973), Kawakami (1973), McCawley (1968) and Haraguchi (1977), while the tonemic analysis appears to be a sort of "relic" of past work.

1.1. Accentual vs. Tonal Hypothesis

The reasons for rejecting the tonemic hypothesis in favor of the accentual one are essentially two-fold. The first and often cited reason is that the tonemic hypothesis fails to account for the tonal redundancies in tonal representations, or the rule-governed nature of Japanese tonology. To illustrate this, let us consider the tonal representations in (1) which putatively describe the tonal patterns exhaustively which four-mora phrases of the language can possibly take (ga is a nominative particle).

\[
\begin{array}{cccc}
\text{inoti-ga} & \text{kokoro-ga} & \text{otoko-ga} & \text{nezumi-ga} \\
H & L & L & L \\
\text{HLL} & \text{LHL} & \text{LHH} & \text{LHH} \\
'life' & 'heart' & 'man' & 'mouse'
\end{array}
\]

Supposing, as do many phonologists, that Japanese words and phrases can be fully described in terms of the two tones, High
and Low, this means that only four tonal patterns are permitted in Tokyo Japanese among the many others, illustrated below, which would equally be possible in a pure tone system.

(2) a) LHHH LHLH LLLH LLLH
   HHHH HHHH HHHL HHHL

   b) HHLH HLHH HHHH LHLH

The fact that the tonal patterns in (2) are not permissible in Tokyo Japanese can be attributed to two types of constraints at work to limit the surface tonal shapes of words and phrases. First, the initial two morae must differ in tonal value: the initial Low tone must be followed by a High tone, and vice versa. The tonal patterns in (2a) are to be excluded because of this constraint. The other constraint, which precludes the tonal possibilities in (2b), concerns the occurrence of High tones in non-initial positions. That is, once a High tone is followed by a Low tone, it can never again appear in the post-Low position within the same word or phrase. In acoustic terms, this means that FO is allowed to rise only once, in the phrase-initial position.

While the systematic restriction on the tonal patterning in Tokyo Japanese remains unaccounted for under the tonemic hypothesis, the accentual hypothesis is capable of handling this tonal redundancy in a satisfactory manner. Under this hypothesis, it is claimed that the only essential information as regards the FO features of words and phrases is the location, if any, where FO drops, and that the other kinds of tonal
information can be predicted by rule. Calling the mora immediately preceding the first low-toned mora 'accented' mora and marking the accent by an apostrophe ('), the relation between the accentual and tonal representations can be illustrated as in (3) and summed up as in (4) (cf. McCawley, 1968:137):

(3) i'notiga koko'roga otoko'ga nezumiga
   H L L L L H L L L H H L L H H H

(4) Everything up to the accented mora is high toned (pitched), and everything after it is on a low tone, except that the first mora of a phrase will be low toned unless it itself is accented.

As we shall see shortly, different people postulate different tonal representations and, possibly, different systems of tonal rules. Despite these differences, however, most of the analyses put forward in the past commonly adopt the accentual view of Japanese tones, that is, the view that tonal structures of Tokyo Japanese are rule governed except for the location of the underlying word accent, or the location of a sudden FO drop.

In addition to the tonal redundancy, there is one more reason for favoring the accentual hypothesis over the tonemic one, although it tends to be overlooked in the literature. This concerns the fact that Japanese exhibits a certain number of phonological processes which are better described as accentual changes than as tonal changes. Compound Accent Rule (CAR) is one such process, which can be illustrated by the examples given in (5):
(5) CAR

a) sya'kai se'ido → syakaise'ido
   'society' 'system' 'social system'

b) sya'kai mondai → syakaimo'ndai
   'society' 'problem' 'social problem'

c) kyooiku se'ido → kyooikuse'ido
   'education' 'system' 'education system'

d) kyooiku mondai → kyooikumono'dai
   'education' 'problem' 'educational problem'

As (5) shows, CAR has the effect of deaccenting the first element if it is accented and accenting the second element if it is unaccented. The unitary nature of the process is all too clear: it has the total effect of yielding, by way of accenting and deaccenting, one long phonological unit ('accentual phrase'), which is accented on the first mora of the second component word. The outputs of the accentual process in (5) then undergo the tone assignment rule (4) just as simplex words and phrases do, and thereby yield correct and uniform tonal patterns for the compound expressions:

(6) Tone Assignment in Compounds

a) syakaise'ido → LHHLLL

b) syakaimono'dai → LHHLLL

c) kyooikuse'ido → LHHLLL

d) kyooikumono'dai → LHHLLL
While the accentual hypothesis can thus provide a plausible account of the compounding process, the purely tonal hypothesis provides, at best, a rather awkward treatment of the process. Under the tonal hypothesis, the compounding process in (5) would look like (7).

(7) Tonal Treatment of Compounding Process

a) HLL + HLL → LH Hole
b) HLL + UHH → LH Hole
c) UHH + HLL → LH Hole
d) UHH + UHH → LH Hole

The tonal changes in (7) would require apparently awkward tonal rules as in (8), which have the effect of assigning a uniform tonal string to the compounds, undoing most, if not all, of the tonal effects which the tonal rule (4) previously exerted on each component word.

(8) Compound Tone Rules

(i) Assign the tonal string #HHi, to the first element of the compound.

(ii) Assign the tonal string (#)HLL, to the second element of the compound.

As we shall see in Chapter Two, accentual changes involved in the compound formation are a little more complicated than the one illustrated in (5). However, the apparent supremacy of the accentual account of the prosodic process over the tonal one should be sufficient evidence to justify the independent treatment of accentual processes from tonal processes in general, and hence, the rejection of the tonemic (purely tonal) hypothesis.
in favor of the accentual hypothesis.

1.2. Three Levels of Derivation

We have seen the two reasons for favoring the accentual hypothesis in preference to the tonemic one. Although it has not always been explicitly stated in the literature, the accentual hypothesis implies three separate levels of derivation within the prosodic system of Japanese.

(9) Accentual Level  [Accent Assignment Rules]

\[\Downarrow\]

Tonal Level  [Tone Assignment Rules]

\[\Downarrow\]

Phonetic Level  [Phonetic Realization Rules]

(Phonetic Output)

Of these three levels, the accentual level involves the assignment (i.e. placement, addition, deletion, etc.) of abstract accents. The compound accent rule just outlined is defined at this level as well as many other 'morphoaccentual rules' dealing with the assignment of word accents (cf. Poser, 1984). The output of this level is to be tonally interpreted at the second level on the basis of the accentual structure thus derived. It is at this level that tone assignment rules, including the one in (4), are defined. The relation between the accentual and tonal levels is stated explicitly by McCawley (1976:128): ³
A pitch-accent system becomes a tonal system at the point of the derivation at which rules apply assigning pitches to specific syllables and morae as the realization of accent.

While both the accentual and tonal components play the role of defining phonological rules (accentual and tonal rules) and yielding phonological representations (accentual and tonal), the phonetic component plays the role of interpreting the output of the second representation phonetically, thereby implementing the tonal strings into F0 contours as observed at the output of speech. The literature discusses very little about this last stage of prosodic derivation and, accordingly, very little is known about the nature of the phonetic realization rules (PRRs) in comparison with accentual and tonal rules. Although the lack of research in this area may obscure the distinction between the relevant levels, which, in fact, leads to a few controversies as we shall see below, the fact remains that previous analyses put forward along the line of the accentual hypothesis generally assume, whether explicitly or implicitly, the three-level system in (9) as a standard model of Japanese accent and tone.

1.3. Linked-Tone Analysis

Having seen the supremacy of the accentual hypothesis over the tonemic one as well as the overall picture of the phonological system under the former hypothesis, it may be worth spending a few paragraphs to briefly sketch a new approach to the description of Japanese accent and tone, which I call "linked-tone analysis (LTA)". This proposal holds that it is a linked
tone, not an abstract accent, that is given in the lexicon (cf. Meeussen, 1972; Pulleybank, 1983; Poser, 1984). The four phrases in (3), for instance, are represented as in (10) below, where the accents are denoted by a High tone rather than by an apostrophe or whatever might represent an abstract accent.

(10) inotiga kokoroga otokoga nezumiga
|   |   |
H   H   H

LTA differs from the accentual analysis in that it dispenses with the concept of accent, and like the tonemic analysis, views the Japanese accentual system as a merely tonal one with tones as primitive units of description. What have been described as accent assignment rules under the traditional 'diacritic accentual analysis' (Poser, 1984) then are described as rules manipulating the underlyingly-given linked tones. Although LTA thus dispenses with the notion of abstract accent, it crucially resembles the accentual analysis (and differs from the tonemic analysis) in assigning all the tones other than the lexically linked High tones by rules and conventions at later stages of phonological derivation, thereby accounting for the rule-governed nature of Japanese tonology.

LTA seems to be descriptively as adequate as the accentual analysis since, as Poser (p. 30) puts it, it "appears always to be possible to translate accentual analyses into analyses under the linked tone theory". Moreover, LTA seems superior to the accentual analysis in view of the fact that what has been described as accent in Japanese phonology is phonetically
interpreted into pitch features and nothing else.

Despite this apparent advantage of LTA over the accentual analysis, there are a couple of reasons that speak for the latter analysis in preference to the former. It can be argued, for instance, that LTA fails to capture the difference between the accent assignment rules (i.e. rules manipulating accent-related High tones) and tone assignment rules (i.e. rules manipulating other tones.)

This shows up in Poser's own rule system where the traditional accent assignment rules are classified into three types according to the level or domain in which they apply. The first type of rules, which he calls 'morphoaccentual processes,' deals with the assignment of accents (or his 'linked High tones') in the domain of the lexical item while the second type of accent assignment rules apply when a lexical item is combined with one or more particles to form what Poser calls a 'phonological word' or 'minimal minor phrase.' And the third type of accent assignment rules involves the deletion of accents at the level where two or more minimal minor phrases are combined to form a larger minor phrase.

While the assignment of linked High tones are thus described as applying at three steps in Poser's model, the insertion and association of all other tones are supposed to take place only in the last domain, that is, in the domain of larger minor phrases. In other words, what has been described as tone assignment rules under the accentual analysis are all defined as rules that apply
to the output of the linked-High-tone assignment rules. Given this, it is clear that the two kinds of rules — rules assigning linked High tones and rules assigning other tones — differ in formal property.

The two types of rules differ in yet another respect. As has been mentioned, assignment of linked High tones is partly rule-governed and partly arbitrary: Accentual properties of nouns (except complex nouns such as compound nouns and nouns formed with typical affixes) are essentially unpredictable and must be specified in the lexicon. By contrast, assignment of tones other than the linked High tones is all predictable by rule, as shown in section 1.1. This may provide additional support for the view that the two types of rules are crucially different and should, therefore, be clearly distinguished from each other. As long as one adopts the linked tone theory, however, one fails to account for these formal differences in any reasonable way.

While the linked-tone hypothesis may thus involve not a few problems, it can be an alternative hypothesis to the traditional accentual hypothesis. In fact, it appears to be increasingly supported in the literature (e.g. Beckman & Pierrehumbert, 1986; Pierrehumbert & Beckman, forthcoming), and is probably worth exploring in more depth in the future. In the present thesis, however, I will develop my discussions mostly on the traditional hypothesis for the following three reasons. First, one of the major goals of this thesis is to provide new empirical data and evidence for the prosodic phenomena in Japanese, and the
difference in the theoretical framework does not directly affect the main line of arguments. Second, the accentual hypothesis is adopted by virtually all of the previous theoretical accounts of prosodic phenomena (including the intonational phenomena to be discussed in Chapters Three through Five). Since I intend to criticize these accounts in theoretical contexts, it seems that most readers, who are used to the accentual hypothesis, will be able to follow the discussions based on it more easily. And third, the linked-tone hypothesis itself admits of two or more competing tonal analyses, and the actual characterization of a particular phenomenon seems to vary considerably from one analysis to another (see Note 4). For these reasons, I will discuss various topics in Japanese prosody with the accentual hypothesis as a working hypothesis, referring to the linked-tone hypothesis only when it seems to provide a different insight from the traditional hypothesis.


Having overviewed the notion of accent and tone in Japanese phonology, let us consider the basic characteristics of Japanese accent in a special comparison with English stress. McCawley (1968:113) characterizes Japanese accent in the following short statement, which nicely sums up its main features.

(11) In standard Japanese, the only distinctive melodic characteristic of a phrase is the location of the syllable, if any, where the pitch drops.

This statement can be decomposed into the following five
propositions, each of which enjoys considerable agreement in the literature.

(12)

1. The primary phonetic feature of the accent is a sudden drop in pitch.
2. The accent-bearing unit, or the unit to which the accent is assigned, is the syllable, and not the mora or any other prosodic unit.
3. There is at most one accent per word or phrase.
4. The location of the accent is unpredictable.
5. Given the location of the accent, however, other pitch features of words and phrases are predictable.

Having discussed the fifth point in section 1 above, let us examine the other four points and see what they imply about the nature of Japanese accent.

2.1. Pitch Accent

The first proposition in (12) suggests that the primary acoustic cue of the accent is a change in F0, or to be more specific, a sudden drop in F0. This acoustic characterization of Japanese accent is widely accepted in the literature, and has been the basis for characterizing the accent as 'pitch accent' or the language as a 'pitch-accent language' (cf. Shibata, 1961/77; Kindaichi, 1957/77). Despite this widespread belief, it must be noted that the literature provides only indirect or fragmentary experimental evidence to substantiate it.

Previous work generally holds, either explicitly or
implicitly, that what is called 'accent' in Japanese does not directly relate to acoustic features other than FO, e.g. amplitude or duration. But most of the experimental studies which putatively support this view identify the accent as high pitch (tone) as opposed to low pitch (tone), and simply demonstrate that what is perceived as a change in pitch is most characteristically realized as a change in FO at the physical level while changes in other acoustic features take place only concomitantly (cf. Han, 1962; Hoequist, 1983; Beckman, 1984). This kind of experimental evidence cannot be taken as direct evidence to identify pitch as the primary feature of the underlying accent since, as the representations in (3) clearly show, surface high pitch does not correspond to the underlying accent: unaccented morae in accented words can bear a high pitch (tone) and, for that matter, even unaccented words can have a high pitch.

Mitsuya & Sugito (1978) is, to the best of my knowledge, the only experimental work in which the concept of the accent is not confused with that of the high tone/pitch defined at the tonal/phonetic levels. It has only shown, however, that the accent does not directly correlate with the acoustic feature of duration, and therefore, the evidence it provides is far from being conclusive.

Just as there is little experimental evidence to uniquely relate the underlying accent with the feature of surface pitch, very little experimental evidence can be found for the conventional claim that the primary acoustic cue of the
underlying accent is a drop in pitch and not other types of pitch features. It is abundantly clear that the Japanese accent is realized as a sudden drop in pitch — this is supported not only by our impressionistic observation but also by a lot of experimental data including my own. However, when it comes to the argument that the drop in pitch is the primary acoustic cue of the accent, it must be said that there is very little evidence to support it in the literature.

As is known to many phoneticians (e.g. Fujisaki & Sudo, 1971; Poser, 1984) and some phonologists (e.g. Sakuma, 1919), accented words differ from unaccented counterparts not only in involving a drop in pitch but in having a higher pitch (i.e. pitch peak) as well. However, the literature provides no experimental evidence, excepting the one from a preliminary experiment by Han (1962),<sup>5</sup> to believe that a drop in pitch is the more significant correlate of the underlying accent than the extra boost in pitch. This fact suggests that the conventional hypothesis leaves room for skepticism and full justification. In this present thesis, however, I will not address this issue.
2.2. Syllable as the Accent-Bearing Unit

The second proposition in (12), namely, that the syllable is the bearer of the accent, may be taken as a matter of course in discussing the word accent of English and other languages. In discussing Japanese accentology, however, this proposition deserves special consideration since the mora is believed to play a more important role than the syllable in the prosodic system of the language in general.

That the mora is a relevant unit in the accentual system of Japanese can be readily demonstrated by the fact that it is the unit of 'phonological distance.' Thus, the antepenultimate accent rule for recently borrowed words puts an accent on the third from the last mora. ('S' and 'M' stand for a syllable and a mora, respectively):

\[
\begin{array}{cccccccccc}
\mid & \mid & \mid & \mid & \mid & \mid & \mid & \mid & \mid & \mid \\
M & M & M & M & M & M & M & M & M & M \\
\mid & \mid & \mid & \mid & \mid & \mid & \mid & \mid & \mid & \mid \\
do'rama & poke'tto & reko'odo & sutora'iki & poora'ndo \\
\end{array}
\]

'drama' 'pocket' 'record' 'strike' 'Poland'

While the phonological distance in assigning the accent is thus measured in morae, there is evidence to believe that the unit to which the accent is assigned is not the mora but the syllable. Consider the borrowed words in (14) below, where the accent moves onto the fourth mora from the end if the antepenultimate mora happens to be the second mora (i.e. 'non-
syllabic mora') of long (bimoraic) syllables.

\[(14)\]

\[
\begin{array}{cccccccc}
S & S & S & S & S & S & S & S \\
\_ & \_ & \_ & \_ & \_ & \_ & \_ & \_ \\
M & M & M & M & M & M & M & M \\
\_ & \_ & \_ & \_ & \_ & \_ & \_ & \_ \\
\text{wasi'nton} & \text{suto'orii} & \text{dera'kkusu} & \text{sura'idaa} \\
\end{array}
\]

'Washington' 'story' 'deluxe' 'slider' (baseball)

The only way to generalize the accentual phenomena in (13) and (14) is to define the syllable as the accent-bearing unit, and formulate the antepenultimate rule as a rule which puts an accent on the syllable containing the antepenultimate mora. To put it in more general terms, long syllables provide only one possible place for the accent, thus producing no contrast between (a) and (b) below: cf. Fujimura (1972); McCawley (1978).

\[(15)\]

a) \[
\begin{array}{c}
S \\
\_\_\_M' M \_\_\_ \\
\end{array}
\]

b) \[
\begin{array}{c}
S \\
\_\_\_M M' \_\_\_ \\
\end{array}
\]

The definition of the syllable as the accent-bearing unit in Japanese enables us to account for other accentual phenomena as well. Take the Pre-no deaccenting rule, for instance, which deletes the accent of finally accented words followed by the genitive particle no. This rule deaccents words which are accented on the last syllable (16b), not merely those accented on the last mora (16a): cf. Haraguchi (1977:23).
In addition to this, Japanese exhibits other accent assignment rules, including the compound accent rule to be fully discussed in Chapter Two, in which the conception of the syllable as the accent-bearing unit is crucial to making a significant generalization.

2.3. Culminative Function and Unaccented Words

2.3.1. Culminative Function

The notion that there is at most one accent per word or phrase in Japanese has two implications. It implies, on the one hand, that the language does not permit words which have more than one accent and, on the other hand, that it permits words which have no accent at all.

The fact that a single word cannot have more than one accent is not a feature specific to the Japanese accent, but is apparently a universal property of what is termed 'word accent.' In fact, if there is any common function at all which 'word accent' plays in language in general, it will be a culminative function, or the function of 'singl(ing) out one syllable of the phrase as the marked one' (McCawley, 1968:136). Stated differently, giving more than one accent per word or phrase would violate the basic function of accent to provide a
prosodic unity and identification to the grammatically and semantically identifiable unit.

The notion that Japanese accent has a culminative function as does English stress is rather common among linguists. Hyman (1977:69), for example, states:

> Because of languages such as Japanese ... where an underlying single accentual mark is translated into phonetic High and Low tone syllables or morae, it is important to emphasize that the notion of a culminative feature may yield different taxonomies depending on whether one looks at the underlying or the phonetic level. The term pitch-accent often refers to languages which have phonologically culminative accent, but phonetically non-culminative tone.

Beckman (1984:14) makes a similar remark in defining 'accent' (languages) as opposed to 'tone' (languages) and 'intonation' (languages):

> Somewhere in between these two (tone and intonation: HK), accent carries out its function: it makes one part of a word or a phrase culminatively more or less prominent than the rest, and in so doing marks out the organizational unit in an utterance.

### 2.3.2. Unaccented Words and Sentences

While the view that Japanese accent has a culminative function enjoys considerable popularity in the literature, it may be weakened by the second implication mentioned above, that is, the fact that the language permits unaccented words alongside accented ones. There appears to be a tendency in the literature
to underestimate (or even ignore) the relevance of this particular category of words, but a statistical survey by Yokoyama (1979) shows that they account for the majority of words in Japanese (at least in terms of the absolute number). To be more specific, 28,031 words (51.2%) out of 54,187 words listed in the Sanseido Dictionary have turned out to be unaccented words, or words which do not involve a sudden drop in pitch. In view of this statistical fact, unaccented words are not exceptions, as might have been supposed, but constitute an integral part of the lexicon of (Tokyo) Japanese.

It may be argued against this claim that Japanese does not have as many unaccented phrases as it has unaccented words. This may be true, since the combination of a content word and any particles, which represents the most basic phrase type in the language, results in an accented phrase if any one of the component words is accented (cf. (36)). Nevertheless, it is worth emphasizing that there is no linguistic constraint whatsoever which prohibits or even regulates the occurrence of unaccented phrases. In addition, Japanese has no phrasal rule that adds an accent in the domain larger than the word while it does have a rule that deletes it (e.g. the pre-no deaccenting rule to be discussed in section 5 below).

Given these facts, it comes as no surprise that the language should exhibit a number of long 'unaccented phrases' and even 'unaccented sentences,' which are entirely made up of unaccented words and, hence, result in a rather flat F0 contour involving no sudden F0 drop at the phonetic output. These
unaccented phrases and sentences, some examples of which are 
given below, are perfectly well-formed and virtually unlimited in 
number in Japanese.

(17) a) ano akai kutu "those red shoes"
   b) Mayumi no ane no namee "Mayumi's sister's name"
   c) Masao to issyoni asonda kodomo
       "the child who played with Masao"

(18) a) watasi wa Haruo no ane desu.
       "I am Haruo's sister."
   b) watasi wa asita Tookyoo no ane ni denwa suru 
tumori desu.
       "I intend to call my sister in Tokyo tomorrow."
   c) Amerika no zinkoo wa igirisu no zinkoo no ooyoso 
nbai desu.
       "The population of America is about double that 
of Britain."

2.3.3 Theoretical Implications

Having confirmed that unaccented words constitute an 
integral part of Japanese vocabulary, let us now consider the 
implications of this fact for the modelling of Japanese accent 
and tone. Recall first that Japanese accent is characterized as 
having a culminative function by virtue of the fact that it can 
appear only once within a word (cf. section 2.3.1). The fact 
that Japanese has a great number of unaccented words and 
sentences, however, suggests that Japanese utterances can exist 
without such 'culmination' or peak induced by accent. Viewed 
differently, it suggests that the culminative function which word
accent plays in Japanese is neither so large nor so essential as it may be in other languages.

A second implication to emerge from the existence of unaccented words is that one has to recognize two notions under the notion of 'accentuation,' i.e. 'accentedness' and 'accent location.' Generally speaking, previous studies have focused on 'accent location' while paying little attention to the other aspect of 'accentuation.' However, the distinction based on 'accentedness' enables us to make a number of generalizations in Japanese phonology. One typical example is one of the accent assignment rule of certain grammatical categories. As will be mentioned in section 2.4, for example, one need not specify the accent location of verbs and adjectives in the lexicon — it suffices to specify their accentedness, leaving the task of accent location to a redundant phonological (accent assignment) rule.

Similarly, the distinction in "accentedness" is relevant in the description of several phrasal (intonational) processes to be discussed later on. In brief, unaccented phrases form a natural class as against accented phrases as regards such prosodic rules as 'accentual boost' (cf. Chapter Three, section 2; Chapter Four, section 6), the intonational phrasing process (i.e. Minor Phrase Formation, cf. Chapter Four) and 'downstep' (cf. Chapter Five). All in all, the distinction between 'accented' and 'unaccented' is crucial in the phrasal prosody of Japanese, whereas the notion of accent location is relevant mostly in defining accent
assignment rules, which are word-level processes.

Given these generalizations, it should be clear that the distinction based upon 'accentedness' is not only desirable but is indeed essential in the description of Japanese prosody. This leads to a third implication about the nature of accent, namely, that Japanese accent is not just a property of a particular syllable (cf. Section 2.2), but a property given to a particular class of words as against others. In other words, accent in Japanese is a property of the word by which words possessing the feature (i.e. accented words) distinguish themselves from those without it (i.e. unaccented words). This characterization of Japanese accent receives additional support from the evidence about accentual boost, which will be discussed in Chapter Three (section 2).

Lastly, let us consider the relevance of unaccented words in relation to the accent-tone derivation. As has been repeatedly cited, the only tonal feature distinguishing between accented and unaccented words in the orthodox model of Japanese tonology is the presence or absence of post-High Low tones, i.e. Low tones other than the word-initial Low: cf. (3). What this means is that High tones should be assigned to the two classes of words alike, irrespective of the difference in the underlying accentedness. If this is the case, it then follows that High tones in the tonal representation are not to be directly related to the accent(edness) in the accentual representation, or vice versa.
This consequence has two implications for the modelling of Japanese accent. One implication is that it is wrong to derive High tones on the basis of the accent information. That is, it is inappropriate to identify the High tone as the tonal correlate of the abstract accent. This clearly constitutes evidence against Haraguchi's tonal analysis whereby the High tone is directly associated with the underlying accent or the accented mora (cf. section 4.3). Instead, it supports McCawley's tonal analysis whereby High tones are assigned by a principle independent of the underlying accent both in accented and unaccented words, while the accent plays a part in deriving Low tones in post-High positions (cf. sections 4.2. and 4.4.).

Besides this, the notion that the High tones in tonal representation are not to be directly related to the underlying accent implies that the accent does not involve 'tonal prominence.' That is, given the common idea that the High tone is more prominent than the Low tone, it follows that unaccented words are as tonally prominent as accented counterparts in involving not fewer High tones than the latter. Having said this, I must hasten to add that this does not mean that the underlying accent exerts no prominence, or that accented words are not more prominent than unaccented words in every sense of the term. In Chapter Three (section 2), I shall argue that the underlying accent involves phonetic prominence and that accented words are, therefore, more prominent than their unaccented counterparts in phonetic terms, if not in tonal terms.
2.4. Free Accent and Distinctive Function

Let us finally consider the fourth proposition in (12), i.e. that the location of the accent is not predictable from linguistic information such as segmental composition or semantic content of words and phrases. What this proposition implies in the first place is that the accent has a distinctive function. This, in fact, is true not only among accented words but also between the two classes of words, accented and unaccented. Thus, one finds a number of minimal pairs of words which only differ either in accentedness or in accent location. (19) illustrates this with minimal pairs of nouns.

(19) Minimal Pairs of Nouns

a) Accentedness

<table>
<thead>
<tr>
<th>Accentedness</th>
<th>Unaccented</th>
</tr>
</thead>
<tbody>
<tr>
<td>hi' &quot;fire&quot;</td>
<td>hi &quot;sun&quot;</td>
</tr>
<tr>
<td>ne' &quot;root&quot;</td>
<td>ne &quot;price&quot;</td>
</tr>
<tr>
<td>a'zi &quot;saurel&quot;</td>
<td>azi &quot;taste&quot;</td>
</tr>
<tr>
<td>ka'ki &quot;oyster&quot;</td>
<td>kaki &quot;persimmon&quot;</td>
</tr>
<tr>
<td>kaki' &quot;hedge&quot;</td>
<td>kaki &quot;persimmon&quot;</td>
</tr>
<tr>
<td>ikari' &quot;anger&quot;</td>
<td>ikari &quot;anchor&quot;</td>
</tr>
<tr>
<td>i'on &quot;ion&quot;</td>
<td>ion &quot;allophone&quot;</td>
</tr>
<tr>
<td>hanniti' &quot;half day&quot;</td>
<td>hanniti &quot;anti-Japan&quot;</td>
</tr>
</tbody>
</table>

b) Accent location

<table>
<thead>
<tr>
<th>Accent location</th>
<th>Unaccented</th>
</tr>
</thead>
<tbody>
<tr>
<td>a'sa &quot;morning&quot;</td>
<td>asa' &quot;flax&quot;</td>
</tr>
<tr>
<td>a'si &quot;reed&quot;</td>
<td>asi' &quot;leg&quot;</td>
</tr>
<tr>
<td>ka'me &quot;tortoise&quot;</td>
<td>kame' &quot;crock&quot;</td>
</tr>
<tr>
<td>ka'ki &quot;oyster&quot;</td>
<td>kake' &quot;hedge&quot;</td>
</tr>
<tr>
<td>tu'baki &quot;camellia&quot;</td>
<td>tubaki' &quot;saliva&quot;</td>
</tr>
</tbody>
</table>

In spite of the presence of these minimal pairs, it is important to emphasize that the distinctive function of the accent is not significantly large in Japanese. Miyaji (1977) has demonstrated this by analyzing arbitrarily selected 417 pairs of words which are segmentally homophonous. The result of this
analysis is that less than nine per cent of the pairs analyzed form minimal pairs in accentual terms while the rest are totally homophonous, as exemplified by the words below. (These pairs are distinguished in writing, i.e. in terms of the Chinese characters used).

(20) Totally Homophonous Pairs of Nouns

| me'    | "eye", "bud" |
| mi     | "body", "fruit" |
| ku'mo  | "spider", "cloud" |
| ikoo   | "intention", "posthumous manuscript" |
| sangai | "third floor", "disaster" |
| koosei | "welfare", "correction", "justice" |

Miyaji's report not only justifies the view that the distinctive function of the accent is rather small, but also suggests that the accentedness and accent location of Japanese words may be subject to certain linguistic rules or constraints.

One can find at least three types of such constraints reported in the literature. One of them concerns the grammatical category of words. Verbs and adjectives, for instance, do not show any contrast in terms of accent location, since all accented verbs and adjectives are, at least in their uninflected forms, accented on their penultimate syllables. Consequently, the only type of accentual minimal pairs one can find with these classes of words contrast in accentedness, as illustrated by the following examples.

(21) (Near-)Minimal Pairs

a) Verbs

| i'ru | "to shoot" | iru | "to be, exist" |
| na'ru | "to come true" | naru | "to ring" |

41
hare'ru "to clear up" — hareru "to swell up"
nara'u "to learn" — arau "to wash"
sirabe'ru "to examine" — kuraberu "to compare"

b) Adjectives

atu'i "hot" — atui "thick"
ao'i "blue" — akai "red"
uma'i "tasty" — amai "sweet"

The antepenultimate accent rule sketched in (13)-(14) is another example in which accentuation is constrained by linguistic factors. This rule will reduce potential accentual contrasts in borrowed words, yielding several homophonous pairs which might otherwise contrast in accentuation: e.g. reko'odo (< REcord, reCORD).

A third linguistic condition which constrains the accent property of words in Japanese is one of word length. While accentedness and accent location of nouns are unpredictable in principle, words show a noticeable tendency to prefer a given accent pattern according to the number of morae they contain. This has been demonstrated by the statistical work by Yokoyama (1979), which shows that four-mora words, which account for nearly fifty per cent of the lexical items of the language, tend to be unaccented. As for accented words, it has been revealed that they prefer antepenultimate accent: accented words which are less than four morae long tend to be initially accented; accented words made up of four morae tend to bear the accent on (the syllable containing) the second mora; and accented words made up of more than four morae tend to attract the accent on (the syllable containing) the third mora from the last.
3. Abstractness of Tonal Representation

3.1. Tonal Levels

Let us next consider the issue of the tonal representation per se, which has aroused quite a few controversies in the literature. One of the classical controversies in this area concerns the number of distinctive tones or tone levels. Previous studies fall into two groups in this regard, those which posit two levels, High and Low, and those postulating three levels, High, Low and Mid. Generally speaking, the two-level hypothesis is predominant in the literature, adopted by all the supporters of the accentual hypothesis (e.g. Miyata, 1927; Hattori, 1973; Kawakami, 1973; Haraguchi, 1977) as well as some proponents of the tonemic hypothesis (e.g. Kindaichi, 1967). The three-level hypothesis, by contrast, is adopted only by some early phonologists who held the tonemic hypothesis (e.g. Sakuma, 1919).

By way of illustration, let us compare Sakuma (1919)'s analysis in (22a) with the modern, orthodox one in (22b) (= (1)).

(22)

<table>
<thead>
<tr>
<th>i'noti ga</th>
<th>koko'ro ga</th>
<th>otoko' ga</th>
<th>nezumi ga</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) H M M M</td>
<td>L H M M</td>
<td>L H H M</td>
<td>L M M M</td>
</tr>
<tr>
<td>b) H L L L</td>
<td>L H L L</td>
<td>L H H L</td>
<td>L H H H</td>
</tr>
</tbody>
</table>
The three-level analysis differs from the two-level analysis in two ways. First, it assigns post-accentual morae Mid tones instead of Low tones. What underlies this treatment is the putative observation that post-accentual morae are realized at a higher FO level than word-initial Low-toned morae: e.g. kokoroga vs. kokoroga, inotiga vs. kokoroga. The other point in which the three-level analysis differs from the two-level counterpart concerns the representation of the high-pitched morae of unaccented words: the three-level analysis postulates Mid tones for unaccented words as against High tones for accented words. This interpretation is based on the claim that the high FO stretch of unaccented words is lower than that of accented words, and that this phonetic difference should be incorporated into the tonal representations.

Of the two points just given, the first cannot be empirically justified. According to the experimental data by Poser (1984), for instance, the second no of nomi'mono, which is represented as 21HM2 under the three-level analysis, is realized lower in pitch than the first no of the same word. Poser's observation is confirmed by the data from my own experiments, which show that the lowest point in the post-accentual position is always lower than the lowest point in the word-initial position. It must be said, therefore, that it is wrong to
analyze post-accentual morae as having Mid tones while assigning Low tones to word-initial morae.

Meanwhile, the claim that unaccented words have a lower FO peak than accented words appears to be empirically justified. Poser (1984), for example, corroborates this by comparing the height of such pairs as uma'i and amai put in phrases (cf. Table 1). The same result has been obtained in the experiments conducted by myself, which reveal that accented words and phrases invariably have a higher FO peak than unaccented counterparts, irrespective of such factors as the location of the accent, the length of the word, and the phonological structure of neighboring words (cf. Chapter Three, section 2).

<table>
<thead>
<tr>
<th>Phrase Pair</th>
<th>Mean (Hz)</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>uma'i mi'ruku</td>
<td>175.9</td>
<td>2.89</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>amai mi'ruku</td>
<td>171.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>u'mai mirin</td>
<td>174.0</td>
<td>6.46</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>amai mirin</td>
<td>166.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

While the three-level analysis is essentially correct in assuming that accented words have a higher peak than their unaccented counterparts, it does not follow that it should therefore be favored over the two-level analysis. For it can be claimed under the two-level analysis that the phonetic difference in question is a phonologically redundant one and can be handled by phonetic realization rules at the level where tonal
representations are phonetically interpreted (cf. (9)). It can be argued, in other words, that the phonetic difference does not represent a tonal difference but a difference to be defined at a level 'lower' than the tonal one.

Seen in this light, it will be understood that the controversy over the representation of the two classes of words is not an issue regarding empirical facts but an issue that hinges crucially upon the theoretical question of how abstract (or concrete) the tonal representation should be in general. As regards the problem under consideration, the three-level analysis claims that the tonal representation should be concrete enough to show the phonetic difference in pitch height whereas the two-level analysis claims that the tonal representation should be more abstract than that. This issue will be discussed in Chapter Three, where new empirical evidence is presented to support the latter approach.

3.2. Other Related Problems

Apart from the problem concerning the number of tone levels, there are two more problems which relate to the abstractness of the tonal representation. One of them concerns the tonal representation of initially accented words. Recall that the orthodox analysis assigns a High tone to the initial mora of this type of words while analyzing other types of words as beginning with a Low tone (cf. (3)). Poser (1984:195ff) argues against this, that initially accented words do involve, as do other types of words, an FO rise at the word-initial position.
He provides experimental evidence for this and claims that this phonetic fact should be incorporated straight into the tonal representation as in the following. (Poser's claim appears to be justifiable in phonetic terms, as will be discussed in Chapter Three, section 2):

\[(23)\]

\[i'noti-ga\ koko'ro-ga\ otoko'-ga\ nezumi-ga\]
\[LHLLL\ LHHHL\ LHHHL\ LHHHH\]

Although Poser's claim can thus be supported on phonetic grounds, it does not follow that the orthodox analysis should therefore be abandoned in favor of Poser's. If one holds that the tonal representation is an abstract representation, then it is arguable that the phonetic fact in question need not be represented at the tonal level. Apart from this, Poser's tonal analysis in (23) has a disadvantage as compared with the orthodox analysis in violating the general rule whereby each mora is assigned one and only one tone, although it may be superior to the orthodox one in being capable of generalizing that every word begins with a Low tone regardless of its accentuation (accentedness or accent location).

Another issue that may bear upon the abstractness of tonal representation is the treatment of post-accentual low pitch. Previous work analyzes the morae in the post-accentual position as equally bearing Low tones (cf. (3)). Although this might give an impression that all the post-accentual morae are level in F0, phonetic data show that F0 does decline within the relevant
domain. This is in evidence in Sakuma (1919)'s experimental data reported as long as seventy years ago, and is shown more clearly by a systematic experiment conducted by myself, which has revealed that other things being equal, FO tends to decline with the number of post-accentual morae (see Chapter Three, section 1 for a detailed discussion).

If one takes the position that tonal representation should reflect phonetic facts as accurately as possible, accented words would have to be represented as in (24) at the tonal level, where the number of primes represents varying degrees of 'Low-tonedness.' Since the number of post-accentual morae in a word or phrase can increase to a certain, if not unlimited, degree, this means that one would be obliged to posit multiple levels of Low tones in tonal descriptions.

(24) i'noti ga
    H L L' L"

The fact that the orthodox analysis has been preferred in the literature to the phonetically more accurate analysis as in (24) points to the assumption widely and tacitly adopted, that tonal representation need (or may) not be so concrete as to incorporate every phonetic detail about the FO characteristics of words. In other words, linguists have implicitly imposed a certain constraint on the concreteness of the tonal representation, assuming that phonetic details beyond a certain level are to be accounted for by phonetic realization rules at the phonetic level. This being the case, it remains an open
theoretical question where one should draw a boundary between 'tonal phenomena' (i.e. phonetic facts to be defined at the tonal level) and 'phonetic phenomena' (i.e. phonetic facts to be defined at the phonetic level.) The research in this area is still in the state of infancy, and one must await future work before one can sort out an appropriate answer to this question.

4. Tonal Derivation

Another controversial topic in the study of Japanese accent and tone is one of tonal derivation, that is, the way in which tonal representations are derived from accentual representations. Many problems that have arisen in this area are more or less of theoretical nature, crucially bearing upon the theoretical framework in which accentual and tonal phenomena are described, but some others reflect important differences in the theoretical interpretation of empirical facts. I will review here the two most influential theoretical accounts in the literature, i.e. McCawley's (1968) pitch assignment model and Haraguchi's (1977) autosegmental model, and in so doing, outline some major problems in this area.

4.1. Where They Agree

Both McCawley's and Haraguchi's models assume the accentual hypothesis outlined in section 1.1, and, by definition, they both assume the distinction between the accentual and tonal components. Moreover, they both hold, as do other models put forward along the same line, that underlying accents are to be phonetically realized in pitch features alone, with no direct
relation with other acoustic features at the level of phonetic realization.

In addition to these basic assumptions, the two models share the understanding of the tonal structures as illustrated in (25).

(25) (= (3) & (22b))

Accent i'noti'-ga koko'ro'-ga otoko'-ga nezumi'-ga
Tone HLLL LLLL LHHL LLLL

Both McCawley and Haraguchi posit two levels of tones, High and Low, on the apparent assumption that tonal contrasts in Japanese can be exhaustively described in terms of these two tones. Moreover, they share the view that the presence of post-accentual Low tone(s) is the only tonal indicator (or correlate) of the underlying accent: they do not concern themselves with the phonetic difference which accented and unaccented words show in pitch height, which suggests that they both regard, though tacitly, the extra FO boost in accented words as an entirely phonetic phenomenon.

Furthermore, McCawley and Haraguchi both describe initially accented words as beginning with a High tone rather than a sequence of Low and High tones, and post-accentual morae as a sequence of Low tones. This suggests that McCawley and Haraguchi implicitly take the position that both of the relevant phonetic facts (i.e. word-initial FO rise in initially accented words and the FO declination in the sequence of post-accentual morae) are to be handled by phonetic realization rules rather than by tonal
All these things considered, it can be said that McCawley and Haraguchi assume the tonal representation to be somewhat abstract, although neither of them attempt to justify their position or discuss the explicit criteria by which to draw a borderline between tonal and phonetic phenomena.

Incidentally, the fact that McCawley and Haraguchi thus adopt the same tonal interpretation of surface pitch shapes should come as no surprise. For virtually all the previous theoretical studies, not just McCawley's or Haraguchi's, are heavily dependent upon the data provided by 'philological phonologists' (e.g. Hattori, 1973; Kawakami, 1973), taking their understanding of empirical facts as a point of departure. Where the 'theoretical phonologists' crucially differ from each other, then, is in the mode of formalism with which to derive surface tonal configurations from the underlying representation of abstract accents. In other words, they differ in the manner in which they give an explicit expression of the high degree of tonal redundancy, or the rule-governed nature of Japanese tonology. With this background in mind, let us consider how McCawley's and Haraguchi's analyses differ from each other.
4.2. McCawley's Pitch Assignment Model

McCawley (1968:174) derives the tonal representations in (25) by the following ordered set of pitch assignment rules — note that McCawley's "pitch (assignment rules)" is equivalent to others' "tone (assignment rules)".

(26) McCawley's Pitch (Tone) Assignment Rules

1. Everything becomes high pitched.
2. Everything after the first mora of the accented syllable becomes low pitched.
3. The first mora of the phrase becomes low pitched if the second is high pitched.

Reinterpreting McCawley's "high pitch" and "low pitch" as "high tone" and "low tone" respectively, the tonal shapes of the phrases in (25) can now be derived as follows:

(27) McCawley's Tonal Derivation

<table>
<thead>
<tr>
<th>Accent</th>
<th>i'noti-ga</th>
<th>koko'ro-ga</th>
<th>otoko'-ga</th>
<th>nezumi-ga</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rule 1</td>
<td>H H H H</td>
<td>H H H H</td>
<td>H H H H</td>
<td>H H H H</td>
</tr>
<tr>
<td>Rule 2</td>
<td>H L L L</td>
<td>H H L L</td>
<td>H H L L</td>
<td></td>
</tr>
<tr>
<td>Rule 3</td>
<td></td>
<td>L H L L</td>
<td>L H L L</td>
<td>L H H H</td>
</tr>
<tr>
<td>Output</td>
<td>H L L L</td>
<td>L H L L</td>
<td>L H L L</td>
<td>L H H H</td>
</tr>
</tbody>
</table>

McCawley's system of pitch assignment rules embodies three points about his understanding of the accent-tone relation. First, McCawley views the High tone as a sort of default tone, or the tone that surfaces intact unless replaced with a Low tone by other rules. This shows itself in Rule 1, which uniformly assigns...
a High tone to every mora of the phrases regardless of its accentedness. What is more important about Rule 1 is that High tones are assigned equally to accented and unaccented words by a principle totally independent of the underlying accent. This clearly shows that McCawley does not identify the High tone as a tonal correlate of the accent.

How McCawley interprets the accent in tonal terms, then, is seen from the effect of Rule 2, which induces Low tones to be assigned to all the morae in the post-accentual position. This reflects McCawley's assumption that what constitutes the tonal correlate of the accent is not the accent-linked High tone but the Low tone(s) following High tone(s), i.e. LH..HLL...., or the sequence of High-Low tones, i.e. LH..HLL....

4.3. Haraguchi's Autosegmental Model

Haraguchi's model of Japanese accent and tone is developed along the line of Goldsmith's (1974) autosegmental theory of tone, which is built upon the following two premises: (a) that suprasegmental processes like those of tone should be represented independently from segmental processes; (b) suprasegmental processes should be divided into two subparts, language-universal processes and language (or dialect)-particular processes.

Following Goldsmith, Haraguchi divides the tone assignment component into two subparts: basic tone melody and tonal rules. The former is, as its name suggests, an underlying tone melody specified for each language or dialect. For Tokyo Japanese,
Haraguchi postulates [High Low] ([HL]), from which the tonal patterns of all the words and phrases are claimed to be derived correctly and exhaustively. Given a certain basic melody, it is tonal rules that play the role of associating it (or disassociating it in some cases) with the segmental tier, or tone-bearing units of each word and phrase. Tonal rules fall into two types, language-universal rules and language (dialect)-specific ones. Haraguchi formalizes the former type of rules as Universal Tone association Conventions (UTAC) as in (28) and the latter as the ordered set of tone association rules as in (29)-(31).

(28) Universal Tone Association Conventions:

(i) a. All tones should be associated with at least one tone-bearing unit, and conversely, all tone-bearing units should be associated with at least one tone in the tone melody.
   b. No association lines should cross.

(ii) To guarantee (i), perform the following processes.

a. If a domain contains only one free tone, or if it contains only one free tone to the right (or left) of a bound tone, the free tone should be associated with every free tone-bearing unit or every free tone-bearing unit on the same side of the bound tone.

b. If a domain contains no V to the right (or left) of a bound V, and if it contains at least one free tone, the free tone should be associated with the bound tone-bearing unit.

c. If a domain contains at least one V to the right (or left) of a bound tone and if there is no free tone, associate the bound tone with the remaining free tone-bearing units.
(29) Tone Association Rule

a. If a string has at least one \( \check{v} \), associate the H tone of the basic tone melody with the leftmost \( \check{v} \);

b. If it has no \( \check{v} \) (i.e., if it is unaccented), associate the H tone of the basic tone melody with the rightmost V

(30) Initial Lowering

\[
\begin{array}{ccc}
V & C_o & V \\
\downarrow & \rightarrow & \\
H & L & H
\end{array}
\]

(31) Tone Simplification Rule

\[
\begin{array}{ccc}
V & & V \\
\downarrow & \rightarrow & \\
H & L & H
\end{array}
\]

The effects of the language (dialect)-specific tone association rules as well as those of UTAC are illustrated in (32): \* denotes the syllable (or, syllabic vowel, in Haraguchi's account) bearing a 'star,' or the underlying accent specified in the lexicon.
As seen from (32), the TA rule associates the High tone in the basic melody with the segmental string, followed by UTAC, which plays the role of spreading both the High and Low tones so that each tone should be associated with at least one tone-bearing unit and vice versa. The IL rule then introduces an initial Low tone in phrases other than initially accented ones, while the TS rule disassociates Low tones to guarantee that unaccented phrases (and finally accented phrases) should not show an accentual fall.
4.4. Where They Differ

The comparison of the derivation in (32) with that in (27) reveals some crucial differences between McCawley's and Haraguchi's analyses. Note, more than anything else, that in accented phrases in (32), the High tone is directly associated with the accent (i.e. the star-bearing unit) while the Low tone is associated with the morae following the High-toned one. What this suggests is that although Haraguchi sees the basic accentual melody as High-Low, he is inclined to view the High tone (not the High-Low sequence or the Low tone) as the tonal correlate of the underlying accent. This forms a contrast with McCawley's analysis in which the underlying accent is tonally interpreted as the post-High Low tone(s) or the HL sequence.

Another point in which Haraguchi's analysis crucially differs from McCawley's is that the High tone is derived ('associated' in the autosegmental framework) in accented phrases by a different principle from in unaccented phrases: it is associated with the accent in accented phrases and with the last mora in unaccented phrases. It may be argued against this interpretation that the two processes are formulated as an apparently single rule (i.e. TS Rule). It must be noted, however, that the two subparts of the rule (i.e. (29a) and (29b)) cannot be collapsed into a single rule and cannot be said, therefore, to represent a unitary principle. This too contrasts with McCawley's analysis in which High tones are assigned to the two classes of phrases by one and the same rule, and quite independently from the underlying accent.
In sum, McCawley and Haraguchi have different assumptions about the relation between the underlying accent and the High tone: McCawley treats the two entities as unrelated to each other, while deriving the High tone by a single principle for both accented and unaccented phrases. Haraguchi, by contrast, relates the underlying accent directly with the High tone and, as a consequence of this, is obliged to derive the High tone of the two classes of phrases by means of two different principles. I will seek to provide some evidence in Chapter Three to solve the questions of how the accent should be tonally interpreted and how the High tone should be derived from the representation of accent.

5. Word Accent and Syntax

In concluding a review of the past work on Japanese accent and tone, let me briefly sketch what has been said about the behavior of word accents in sentence perspective, that is, in the domain beyond the word. In contrast to the great interest in "word accents within words," this subject has not attracted much attention in the literature. Moreover, the research done thereupon is mostly based on the researchers' impressionistic observations rather than on the results of instrumental experiments.

In spite of the lack of great interest in the subject, however, there is one general assumption which appears to be held rather widely in the literature, that is, that Japanese word accent patterns are very seldom modified by phrasal prosodic
rules. This assumption appears plausible in the light of the fact that Japanese has no phrasal rule which involves the addition or movement of word accents, and that the only type of phrasal accent rules permitted in the language are accent deletion rules. This fact compares with the case of English where word stress patterns undergo considerable modifications beyond the domain of the word.

To be more specific, Japanese word accents are entirely "free from the kinds of rhythmic effect that accompany English stress" (Prince, 1983:89). Thus, no phenomenon comparable to the English 'stress shift' takes place to avoid accent clash in Japanese (cf. (33a) vs. (33b)). Moreover, no rhythmic constraint regulates the occurrence of Japanese word accents either in the text-tune relation in music or in the metrical structure of verse (cf. Kindaichi, 1967; Prince, 1983; Hayata, 1977).

(33) Accent Clash and Solution

a) English: 'stress shift' or 'Iambic Reversal'

four'teen 'shilling → fourteen 'shilling
Dun'dee 'Marmalade → 'Dundee 'Marmalade
un'known 'land → 'unknown 'land

b) Japanese: no change

uma'i nomi'mono → *uma'i nomimo'no
"tasty drink"

uma'i zyu'usu → *uma'i zyuusu', *u'mai zyu'usu
"tasty juice"

Japanese word accents are independent not only of the rhythmic effects just outlined but of the kind of pragmatic
effects that can modify the accent patterns of English words. Thus, while an emphasis on a particular part of a word often modifies the lexically defined stress pattern in English (cf. (34)), Japanese word accents are in no way modified or overridden by such pragmatic factors (cf. (35)).

(34) a) I said 'reverse, not 'obverse.
   (in isolation, re'verse and ob'verse)
b) 'ascending and 'descending
   (in isolation, a'scending and de'scending)

(35) a) ao'i ka akai ka "(Is it) blue or red?"
   (in isolation, ao'i "blue" and akai "red")
b) na'oko to na'oki "Naoko and Naoki"
   (in isolation, na'oko and na'oki)

While it is agreed that word accent patterns of Japanese remain essentially intact at the phrasal level, the literature reports a couple of cases in which word accents are modified when words are combined into phrases. McCawley and Poser point out two such cases, one in which "deaccenting morphemes" remove the accent of the words to which they are attached, and the other in which accents are suppressed when they clash in the concatenation of two (or more) accented elements. Of these two cases, I will discuss the first case here while deferring the discussion of the second case until Chapter Three (section 3).

5.1. Deaccenting Morphemes

Let us first consider the four possible accentual combinations and the general accentual patterns that putatively
result from the sequences of a lexical item plus one (or more) particle(s), the most basic phrasal structure in Japanese. (ma'de and kara are particles meaning "to, as far as" and "from" respectively.)

\[(36)\]

a) ro'ndon ma'de → ro\textbar{}ndon\textbar{}made

b) amerika ma'de → a\textbar{}merikama\textbar{}de

c) ro'ndon kara → ro\textbar{}ndon\textbar{}kara

d) amerika kara → a\textbar{}merikakara

As will be easily seen from (36), the rule governing the accentual patterns in the phrasal constructions is considered rather simple: the accent, if any, of the lexical items is invariably realized (i.e. (36a) and (36c)), whereas the particles manifest their accent (if any) only when the preceding lexical items are unaccented (i.e. (36b)). In other words, the accent of the leftmost element generally wins, with the accent of particles putatively suppressed at the phonetic output.

This general rule, however, admits of certain exceptions, in which the accent of the lexical items is unrealized at the phonetic output. These exceptions include at least the following two cases: (a) where the lexical items are followed by what McCawley calls "predominating" particles (or enclitics), such as su'rai 'as much as' and rasi'i 'look (like),' and (b) where the phrase involves the genitive particle no. As illustrated in (37) below, the "predominating" particles and the genitive particle both override the accent of the lexical items to which they are attached (cf. McCawley, 1968:140f.).
(37) Exceptions to (36)

a) Predominating Particles

i'noti gu'rai \(\rightarrow\) i\(\overline{noti}\)gu'rai 'as much as life'
koko'ro gu'rai \(\rightarrow\) koko\(\overline{korog}\)gu'rai 'as much as heart'
otoko' gu'rai \(\rightarrow\) o\(\overline{tokog}\)gu'rai 'as much as man'
nezumi gu'rai \(\rightarrow\) ne\(\overline{zumig}\)gu'rai 'as much as mouse'

b) Genitive no

uma' no \(\rightarrow\) u\(\overline{mano}\) 'of a horse'
niho'n no \(\rightarrow\) ni\(\overline{honom}\) 'of Japan'
otoko' no \(\rightarrow\) o\(\overline{tokono}\) 'of a man'

Although both the "predominating" particles and the genitive particle exert a deaccenting effect on the preceding elements, they differ in two crucial ways. First, the genitive particle is unaccented itself and, accordingly, yields unaccented phrases, whereas the predominating particles yield accented phrases with their own accents manifested. Second, and more important to the discussion I shall develop later on, the genitive no exerts its deaccenting effect under certain limited conditions whereas the predominating particles are entirely free from such conditions. That is, the pre-no deaccenting rule applies only when the "no-phrase contains a final-accented word of at least two syllables" (Haraguchi, 1977: 23). Thus, the deaccenting does not take place in phrases where (a) the word to which the particle is attached is accented on syllables other than the last one, or (b) it is a monosyllabic word (\* denotes that it is not permissible.)
(38) a) i'noti no \rightarrow i\text{notino} \quad \text{"of life"}
   koko'ro no \rightarrow ko\text{ko}ro\text{no} \quad \text{"of heart"}

   b) ha' no \rightarrow ha\text{no} \quad \text{"of a tooth"}
   kyo'o no \rightarrow kyo\text{ono} \quad \text{"of today"}

5.2. Syntactic Condition on Deaccenting Rule

In addition to these phonological and lexical conditions, McCawley further remarks (and Poser follows\cite{16}) that the pre-no deaccenting rule is sensitive to the configuration in which the no-phrase is put. That is, the rule is blocked "if the noun has any modifiers" (McCawley, 1968:141), or in other words, if the element to which no is attached is structurally complex. (39) illustrates this syntactic condition.

(39) Syntactic Constraint
   \[ [[\text{uma}' \text{ no } \text{asi}'] \text{ no } \text{iro}'] \rightarrow \text{umano asi}'\text{no iro}' \]
   'horse' Gen 'leg' Gen 'color'
   = 'color of the horse-leg'
   cf. [asi' no iro'] \rightarrow \text{asino iro}'

McCawley adds that deaccenting is not blocked if the preceding modifier has a wide scope, that is, if it is a modifier of the head noun rather than of the noun itself. Thus, the structurally ambiguous phrase sono \text{uma}'no asi' "that-horse's-leg" is claimed to exhibit the following two different accentual patterns depending upon the syntactic (and also semantic) structure intended:
a) \([\text{sono uma'}\text{ no asi'}] \rightarrow \text{sono uma'no asi'}\)

"the leg of that horse"

b) \([\text{sono [uma' no asi']}\] \rightarrow \text{sono umano asi'}\)

"that horse-leg"

If the McCawley-Poser claim concerning the syntactic (configurational) condition on the deaccenting rule is correct, it follows that the rule, unlike any other rule manipulating the word accent, cannot be defined locally, i.e. within the minimum sequence within which the cause and effect of the rule can be defined. It follows, in other words, that the pre-no deaccenting rule is the only accent assignment rule that requires access to the information about such suprastructures as the syntax of phrases and sentences. If the McCawley-Poser claim is tenable, it also follows that the application or non-application of an accent assignment rule serves to disambiguate otherwise ambiguous syntactic structures in Japanese.

McCawley does not say anything about the source of the data for this syntactic condition on the deaccenting rule: He does not say that it is based on his own observation or on any work done by philological phonologists. As far as I know, there is not a single Japanese phonologist to report on this condition. In fact, this syntactic effect on the accent deletion rule is discussed only by Poser, who has apparently taken up McCawley's claim without testing its empirical validity.
5.3. Evidence

To see if the McCawley–Poser hypothesis is justifiable, I conducted an informal experiment in which many complex phrases containing the genitive particle no were referred to four native speakers of Tokyo Japanese. The result was, quite contrary to the previous hypothesis, that the nouns immediately preceding the particle are invariably deaccented, regardless of the syntactic structure of the phrase in which they appear. Thus, deaccenting takes place in the phrases illustrated in (41), which have the same syntactic structure as (40a). Likewise, structurally ambiguous phrases such as those in (42) invariably undergo the deaccenting rule, with the result that the structural difference is neutralized in the output accentual representation of the phrases.

(41) a) [[[uma' no asi'] no] iro'] —> umano asino iro'

'horse' Gen 'leg' Gen 'color'
= 'color of the horse-leg'

b) [[[neteiru uma'] no] kubiwa] —> neteiru umano kubiwa

'sleeping' 'horse' Gen 'collar'
= 'collar of a sleeping horse'

c) [[[ao'i iro'] no] ma'huraa] —> ao'i irono ma'huraa

'blue' 'color' Gen 'muffler' = 'blue-colored muffler'

d) [[[o'okina ie'] no] zyuunin] —> o'okina ieno zyuunin

'big' 'house' Gen 'residents'
= 'residents of a big house'

e) [[[na'oko no ie'] no] niwa] —> na'okono ieno niwa

'Naoko' Gen 'house' Gen 'garden'
= 'garden of Naoko's house'
Syntactically Ambiguous Expressions

i) sono uma' no asi'
   "that" "horse" "Gen" "leg"
   a) [[[sono uma'] no] asi'] -> sono umano asi'
      'leg of that horse'
   b) [sono [[uma' no] asi']] -> sono umano asi'
      'that horse-leg'

ii) kono uma' no kubiwa
    "this" "horse" "Gen" "collar"
    a) [[[kono uma'] no] kubiwa] -> kono umano kubiwa
       'collar of this horse'
    b) [kono [[uma' no] kubiwa]] -> kono umano kubiwa
       'this horse-collar'

iii) siro'i uma no kubiwa
     "white" "horse" "Gen" "collar"
     a) [[[siro'i uma'] no] kubiwa]
       -> siro'i umano kubiwa
       'white' 'horse' Gen 'collar'
       = 'collar of a white horse'
     b) [siro'i [[uma' no] kubiwa]]
       -> siro'i umano kubiwa
       'a white horse-collar'

5.4. Summary

In sum, the data obtained from the experiment totally contradict the McCawley-Poser hypothesis concerning the syntactic condition on the deaccenting rule. In view of the fact that this condition is reported by no phonologists other than McCawley and Poser and that no evidence for it has been yielded by the four native speakers of Tokyo Japanese in my experiment, it seems
to me that Tokyo Japanese does not impose such a condition on the deaccenting rule.

This being the case, it will follow that the pre-no deaccenting rule can be treated in the same way as other accent assignment rules. That is, one can generalize all the rules manipulating word accents as being independent of the syntactic information of the phrases and sentences in which they apply. It also follows that Japanese words accents and accent assignment rules do not serve to disambiguate syntactically ambiguous phrases. This consequence contrasts with the fact to be mentioned in the remaining parts of this thesis, that other types of prosodic rules — e.g. accent phrasing process in compound formation (cf. Chapter Two), intonational phrasing process (Chapter Four) and the process of downstep (Chapter Five) — are sensitive to the hierarchical structures of sentences, and help in one way or another to disambiguate otherwise syntactically (and sematically) ambiguous phrases and sentences.
1. Strictly speaking, the term 'accented mora' used in (4) is not correct. The unit to which the accent is assigned is not the mora but the syllable, as will be shown in section 2.2 below. 'Accented mora' should then be interpreted as the 'syllabic (i.e. first) mora' of the accented syllable. In what remains of this thesis, I will use the term 'accented mora' in this sense for the sake of simplicity.

2. In citation forms, finally accented words like *otoko* 'man' do not differ from unaccented words like *nezumi* 'mouse' at least in tonal terms: they are both described as $\underline{2}LHH\underline{2}$ in the orthodox tonal representation. The two types of words show their difference, however, when other words (i.e. so-called particles) are attached to them to form one unified tonal (intonational) string together: In phrases containing a finally accented word, FO drops over the accented word and the particle immediately following it (e.g. $\underline{2}LHH\underline{2}$), whereas no such FO drop takes place in phrases containing unaccented words (e.g. $\underline{2}LHH\underline{2}$).

3. It may be possible to take McCawley's statement as implying that the accentual level is turned directly into the phonetic level without any intermediate stage. McCawley does not discuss this point explicitly, and we cannot say for sure that he assumes the three levels of derivation as illustrated in (9). However, I will tentatively analyze McCawley's model as involving the three distinct levels, assuming that McCawley was fully aware of the fact that the 'pitch' (our 'tonal') representation does not precisely show the pitch contours as observed at the phonetic output of speech.

4. Beckman & Pierrehumbert (B&P)'s linked-tone analysis differs from Poser's in some ways. One major difference is that B&P assign the High tone to the minor (intonational) phrase per se while Poser (and many of his predecessors including McCawley and Haraguchi) assigns it to each of the high-pitched morae. Likewise, B&P deny the notion that the phrase-initial Low tone is assigned to the initial mora of the phrase, proposing instead that it is assigned to the phrase per se. These differences can be exemplified by the following tonal representations:

   a) B&P
   
   inoti-ga kokoro-ga otoko-ga nezumi-ga
   
   $L\underline{HL}\underline{LHL}\underline{LHL}LH$
   
   b) Poser (and others)
   
   inoti-ga kokoro-ga otoko-ga nezumi-ga
   
   $LLLLLLLLLLLLLLLLHHHHHHLHHL L H H H$
Both of these differences do not seem to be so great differences as B&P might suppose: Poser and most of his predecessors assume, whether explicitly or implicitly, that the minor phrase is the domain of tone assignment, and it is quite clear that they assign the initial Low and the High tone with the minor phrase as its domain. I will discuss the differences between B&P's and Poser's analyses as well as their theoretical implications in another paper.

5. Han (1962: 112-113) conducted a listening test in which she asked some native speakers of Japanese if they could hear the difference between hana' (IH) "flower" and hana (IH) "nose". These words differ in their accentedness but do not involve the accent-induced FO fall in either case when pronounced in isolation (cf. Note 2 above). The result of this experiment was that the native speakers could not identify which was "flower" and which was "nose". Han takes this result as evidence that the extra FO boost in accented words does not generally help to distinguish the words from the unaccented counterparts, which involve no such boost in pitch.

6. Haraguchi (1977:341) assumes that the syllabic vowel is the accent bearing unit. This definition of the accent-bearing unit is quite compatible with and empirically identical to our definition here: the two definitions of the unit can be translated into each other without posing any theoretical problems.

7. Having generalized in this way, there are at least a few exceptions to this. In languages like English, for instance, there are words which have a 'secondary accent' in addition to a 'primary accent.' Similarly, Japanese has a group of compound nouns and verbs which, although definable as a single unit in grammatical and/or semantic terms, exhibit two accents within them. These exceptions are examples, as will be discussed in Chapter Two, that show a discrepancy between grammatical/semantic units and prosodic units.

8. The concept of culminative can probably be dated back to Trubetzkoy (1939).

9. The same is probably true of the distinctive function of English and other languages too.

10. McCawley (1968) and Shibatani (1972) posit three levels of tones (High, Mid and Low) in their theories. This does not mean, however, that they adopt the three-level hypothesis: they both adopt the two-level hypothesis in the description of words and phrases, assuming the same tonal analysis as (22b). Where they posit the three levels of tones in their theories is in the description of what they call "accent reduction," an intonational phenomenon putatively taking place when two (or more) minor intonational phrases are concatenated (cf. Chapter Five).
11. See Note 10 above.

12. As I shall discuss in Chapters Three through Five, instrumental data show that the philological phonologists were not always right and that the new data favour one theoretical interpretation in some cases where the older impressionistic data cannot decide between two competing theories.

13. According to Pudge (1984), the rhythmic constraint on English stress patterns shows up in the assignment of secondary stress in long English words: syllables before the one with a primary accent are made more prominent than their neighboring syllables to yield "some alternation of relatively stressed and relatively unstressed syllables (p. 31); cf (a) below. By contrast, Japanese has no phenomenon comparable to the secondary stress in English (cf. McCawley, 1968), and, hence, long words attract no secondary accent or additional primary accent: cf. (b) below.

(a) alu'minium —→ ,alu'minium
    pano'rama —→ ,pano'rama
    encyclo'pedia —→ en,cyclo'pedia

(b) arumini'um "aluminium",
    syakaisyugiu'ndoo "socialism movement"
    syakaihosyoose'ido "social welfare system"

14. In music, the musical downbeat must be aligned with accented syllables in English whereas Japanese has no such rule. This difference shows up clearly in the national anthems of Japan and Britain. In the British anthem, the downbeat is aligned with accented syllables with no exception, although of course not all accented syllables align with the downbeat. In the Japanese anthem, by contrast, accented morae do not always align with the downbeat, nor is the downbeat always aligned with an accented syllable or mora.

15. There are not many experimental studies on how such pragmatic information as emphasis and contrast is acoustically realized in Japanese. As far as my impressionistic observation goes, pragmatic focus is signalled by a combinatory effect of higher pitch, longer duration and increased intensity throughout the word to be focused, and in some cases, by a pause before the focused word. This combinatory effect apparently affects accented and unaccented words alike: cf. Fujisaki & Sudo (1971), Poser (1984), Wada (1977), Inoue ed. (1983).

16. Poser does not give his own evidence but simply develops a theoretical discussion with McCawley's remark as a point of departure.

17. See Introduction for a sketch of this experiment.
CHAPTER TWO

PROSODIC COMPOUND FORMATION PROCESS

In the preceding chapter we examined the nature of Japanese accent and tone, and discussed some theoretical problems regarding the representation of accent and tone. In this chapter, I will consider the prosodic process of compound formation, the process generally described as an accent-assignment process. The goals of this chapter are three-fold. First, I will show more clearly the theoretical status of accent and accentual rules in the prosodic system of Japanese. Second, I will consider the nature of prosodic compounding and show that the process falls into two subprocesses, one of 'accentual phrasing' and one of 'accentuation' (i.e. accent assignment). A third and the most important goal is to explore, on the analysis of my own corpus of data, various conditions and factors influencing the accentual phrasing process as well as the principles governing the syntax-phonology (prosody) mapping in Japanese.

To achieve these goals, I will first review the previous phonological work done on Japanese compound nouns, thereby outlining compound accent rules (Section 1). In the second section, I will reconsider the prosodic process of compound formation in terms of compound constructions which do not undergo the compound accent rules. On the basis of this, I will claim that Japanese compounds fall into two types, "prosodically unified compounds" and "prosodically non-unified compounds". This
leads to the claim that the prosodic process of Japanese compounding involves two aspects, "accentual phrasing" and "accentuation" (accent assignment). In the last section of this chapter, I will discuss the phonological structure of "complex compound nouns," or compound nouns made up of more than two component words. A thorough investigation will be made on the constraints on the compounding process, and four factors will be proposed to account for the complicated but highly predictable nature of the process.

1. REVIEW OF PAST WORK

1.1. Overview

Prosodic compound formation (generally known as "compound accent rules") has been a much-discussed issue in the literature of Japanese phonology (e.g. Akinaga, 1966; McCawley, 1968; Otsu, 1980; Higurashi, 1983; Abe, 1986). Most of the work on this issue has centred around the analysis of two-element compounds, and has succeeded in uncovering the regularities and irregularities underlying their accentual behavior (cf. section 1.2. below). While accentual changes accompanying compound formation have thus been studied in much depth, very little attention has been paid both (i) to what I term "prosodically non-unified compounds," or those compounds which somehow fail to undergo the prosodic compound formation rule, and (ii) to the prosody of what I call 'complex compounds,' or compounds made up of three or more components.
As for the treatment of prosodically non-unified compounds, previous work falls into the following three groups. The first group excludes this special type of compounds from the category of compounds, treating them as "phrases" such as noun phrases and verb phrases (cf. Hayata, 1969) — see section 2.1.2 below. A second group recognizes prosodically non-unified compounds as 'compounds,' but put them beyond the scope of any systematic analysis (cf. Akinaga, 1966). And a third group, to which most of the previous work belongs, ignores this type of compounds completely, restricting their scope to "prosodically unified compounds," that is, those compounds which readily undergo the prosodic compounding process. As will be discussed in section 2.1 below, these positions pose a number of difficulties and hinder significant generalizations which can be readily achieved if only one sheds as much light on prosodically non-unified compounds as on ordinary prosodically unified compounds. Specifically, a deep understanding of prosodically non-unified compounds is essential for a full understanding of the accentual patterns shown by 'complex compounds' (cf. section 3).

Meanwhile, previous work on Japanese compounds fails to show adequate interest in complex compounds, too. This may be attributed to the following three reasons: (a) the low degree of establishedness of complex compound expressions in general, (b) the complicated accentual behavior which they apparently exhibit, and (c) methodological difficulties involved in their analysis.

By the 'low degree of establishedness,' I mean that complex compounds are generally much less familiar to language users.
than simplex compounds: e.g. **svakai-hukusi-mo’ndai** "social welfare problem," **svakai-hukusi-seisaku-mo’ndai** "social welfare policy problem," **svakai-hukusi-seisaku-mondai-singi’-kai** "social welfare policy problem examination board" as against **svakai-hu’kusi** "social welfare," **hukusi-mo’ndai** "welfare problem". In addition to this lesser degree of familiarity or establishedness, complex compound constructions not unusually exhibit an apparently complicated accentual behavior by yielding more than one accentual phrase and, in many cases, permitting two variant accentual patterns. This compares with largely simple and uniform accentual patterns which simplex compounds generally show.

These two factors surrounding complex compound constructions give rise to methodological difficulties, difficulties arising from the lack of any reliable primary source of data for a systematic analysis. In fact, currently available dictionaries (e.g. NHK, Kenkyusha, Sanseido) on which much of the previous work has been heavily dependent, are of very little help because of the highly limited number of complex compounds they list. As a result of this, any attempt to make a systematic phonological analysis of complex compounds must inevitably begin with the collection of the very raw data.

While the three factors just mentioned admittedly form a formidable obstacle in attempting to analyze complex compound constructions, this does not of course mean that this line of research is useless or unfruitful. On the contrary, as I discuss
below (Section 3), a systematic analysis of complex compound constructions shows that prosodic compound formation is a highly productive process in the phonology of Japanese, and that the prosodic behavior of complex compounds can be accounted for by a well-definable set of principles, irrespective of whether they are 'established' or 'unestablished' as well as no matter how complex structures they may involve. More importantly, an inquiry into the prosodic structure of complex compounds gives some crucial insight into the organization of Japanese prosody in general, especially into such problems as the relation between syntax and prosody (i.e. principles underlying syntax-prosody mapping), the principles whereby prosodic processes apply, and the existence of a hierarchical rhythmic structure in the language.

1.2. Compound Accent Rules

1.2.1. Basic Assumptions

The phonological rules underlying compound formation are rather complicated and previous treatments have shown a considerable variation in attempting to generalize them (cf. Akinaga, 1966; Chew, 1963; McCawley, 1968; Martin, 1975; Higurashi, 1983). There are, however, two basic assumptions which all the previous analyses appear to have in common. One of them is the assumption that prosodic compound formation is primarily an accent assignment process. That is, previous work generally agrees that the compounding process is to be characterized as a lexical process manipulating word accents,
that is, as 'compound accent rules (CARs),' and not as a tonal or other type of phonological phenomenon. In dealing with the compound nouns in (1), for example, it is commonly assumed that the word accent of the first element is not simply unrealized at the phonetic level or 'masked' at the tonal level but is deleted before both tonal and phonetic realization rules apply, as illustrated in (1') below (cf. Chapter One, section 1.1).

(1) sya'kai + se'ido \longrightarrow sya[kaise]ido

(pitch shape)

"society" "system" "social system"

(1') input to CAR # sya'kai # se'ido #
CAR # syakai se'ido #
Tonal Rule L H H H L L

Phonetic Output sya[kaise]ido

Likewise, the compound noun in (2), which consists of two unaccented words, is best analyzed as undergoing an addition of an accent, as shown in (2'):

Likewise, the compound noun in (2), which consists of two unaccented words, is best analyzed as undergoing an addition of an accent, as shown in (2'):
(2) kyooiku + seisaku \rightarrow \text{kyo$\text{o}$ikusei$\text{s}$aku} \\
(pitch shape) \\
"education" "policy" "educational policy"

(2') Input to CAR \# kyooiku \# seisaku \# \\
CAR \# kyooiku se'isaku \# \\
Tonal Rule L H H H H L L \\
Phonetic Output \text{kyo$\text{o}$ikusei$\text{ido}$}

The other assumption which is generally shared by the previous work is that the accentual properties (both accentedness and accent location) of the non-final elements are essentially irrelevant in determining the accent of the whole compound expressions. In the case of two-element compound nouns, which we would like to discuss now, the accentuation of the first component word plays practically no role in the process.\(^3\) The four cases in (3) illustrate this. (In what follows, "N$_1$" and "N$_2$" refer to the first and second elements of compounds, respectively):
(3)  

a) \( N_1 \) = initially accented  
\[ \text{syakai} + \text{seido} \rightarrow \text{syakaiseido} \]
"society" "system" "social system"

b) \( N_1 \) = medially accented  
\[ \text{kurisu'masu} + \text{se'eru} \rightarrow \text{kurisumasuse'eru} \]
"Christmas" "sales" "Christmas sales"

c) \( N_1 \) = finally accented  
\[ \text{niho'n} + \text{a'rupusu} \rightarrow \text{nihona'rupusu} \]
"Japan" "Alps" "Japan Alps"

d) \( N_1 \) = unaccented  
\[ \text{kyooiku} + \text{se'ido} \rightarrow \text{kyooikuse'ido} \]
"education" "system" "educational system"

Speaking of the factors determining the compound accent patterns, previous work postulates two types of factors: phonological and lexical information of the second (i.e. rightmost) element. The phonological information falls into two kinds, the phonological length of the element and its accentual properties, whereas the lexical information typically concerns the lexical status of the component words (i.e. whether they are Sino-Japanese morphemes or non-Sino-Japanese morphemes) as well as the distinction between deverbal and non-deverbal nouns.

Of these four kinds of information, that of the phonological length is believed to be the most important factor for the determination of the compound accent patterns. In principle, the longer the final element is, the more predictable is the accent of the compound of which it forms the final part. The crucial
boundary falls between compounds whose second elements are three or more morae long (henceforth "compounds with a long final element": cf. McCawley, 1968) and those whose second elements are not more than two morae long (i.e. "compounds with a short final element").

1.2.2. Compounds With a Long Final Element

Compounds with a long second element show a high degree of regularity regarding their accentual patterns. The general rule is, as mentioned in Chapter One (section 1.1), to remove the accent, if any, of the first element and place a compound accent on the first syllable of the final element. The examples in (4) illustrate this.

(4) Compound Nouns With a Long Second Element (N₂)

a) N₂ = initially accented

syā'kai + se'ido → syakaise'ido
"society" "system" "social system"
niho'n + a'rupusu → nihona'rupusu
"Japan" "Alps" "Japan Alps"

b) N₂ = finally accented

kyooiku + zyooke'n → kyooikuzyo'oken
"education" "condition" "educational conditions"
hi' + maturi' → hima'turi
"fire" "festival" "fire festival"
c) $N_2 = \text{unaccented}$

$$syakai \ + \ seisaku \ \rightarrow \ syakaise'isaku$$

"society" "policy" "social policies"

$$de'inki \ + \ airon \ \rightarrow \ denkia'iron$$

"electricity" "iron" "electric iron"

In the examples given, (4a) represents the most straightforward case: the word accent of $N_2$ is retained as the compound accent while $N_1$ is deaccented. (4b) and (4c) represent an interesting case where finally-accented words form a natural class with unaccented words in attracting a compound accent on their first syllable. It is clear, in connection with this, that 'finally-accented' must be interpreted as 'accented on the final syllable,' not 'accented on the final mora' (cf. McCawley, 1968: 161). This provides additional evidence for the claim that the syllable, not the mora, is the accent-bearing unit in Japanese (cf. Chapter One, section 2.2).

The major source of exceptions to the general rule illustrated in (4) is those compounds whose $N_2$ is medially accented when used independently. These compounds generally retain the word accent of $N_2$ as the compound accent, as illustrated in (5):
(5) Exceptions to (4)
yama' + hototo'gisu \rightarrow yamahototo'gisu
"mountain" "cuckoo" "mountain cuckoo"
iso'ppu + monoga'tari \rightarrow isoppumonoga'tari
"Aesop" "story" "Aesop Fables"
tankoo + sutora'iki \rightarrow tankosutora'iki
"coal mine" "strike" "miners' strike"

As regards these exceptions, it is important to add that they are subject to a sort of levelling process whereby the medial accent of $N_2$ is moved onto its first syllable as if to conform to the general rule illustrated in (4). This levelling process yields a couple of exceptions to (5) as well as some accentual variation, as shown in (6) and (7), respectively (cf. Akinaga, 1966; Higurashi, 1983).

(6) Exceptions to (5)
sato + koko'ro \rightarrow satogo'koro
"home" "heart" "nostalgia"
oya + koko'ro \rightarrow oyago'koro
"parent" "heart" "parental love"

(7) Accentual Variation
na'ma + tama'go \rightarrow namatama'go, namata'mago
"raw" "egg" "raw egg"
hosi + tuki'yo \rightarrow hosizuki'yo, hosizu'kiyo
"star" "moonlight night" "starlight night"

Compound accent patterns as illustrated in (4) and (5) can be generalized in the form of the ordered rules (cf. McCawley,
(8) Compound Accent Rule

In a compound noun \([N_1 \, N_2]\) where \(N_2\) is three or more morae long,

a) the accent of \(N_2\) predominates as compound accent (i.e. the accent of \(N_1\) is eliminated)

b) If \(N_2\) is either accented on its final syllable or unaccented, put the compound accent on the first syllable of \(N_2\).

1.2.3. Compounds With a Short Final Element

While compound nouns with a long second element show a more or less systematic accentual behavior, those with a short element exhibit a somewhat complicated situation. McCawley (1968: 27) divides 'short' second elements into three classes depending upon the compound accent pattern they yield: (a) "pre-accenting" morphemes (marked as [+PreAcc] in what follows), which put a compound accent on the last syllable of the first element; (b) "deaccenting" morphemes ([+DeAcc]), which yield unaccented compounds; and (c) "initial-accenting" morphemes ([+InAcc]), which take a compound accent on their first syllable. In what follows, I will call the three types of compounds thus yielded "preaccented compounds," "deaccented compounds" and "initial-accented compounds," respectively.

Of the three types of the second (final) elements, the first type appears by far the most common, followed by deaccenting morphemes and initial accenting morphemes, in that order. The examples in (9) illustrate the three types of morphemes and
compounds under discussion:

(9) Compound Nouns With a Short Second Element

a) Pre-accenting morphemes, Pre-accented compounds

ka'buto + musi \rightarrow kabuto'musi
"helmet" "insect" = "beetle"

hizyoo + kuti \rightarrow hizyōo guti
"emergency" "mouth" = "emergency exit"

kakusi' + ko \rightarrow kakusi'go
"to hide" "child" = "illegitimate child"

ne'kutai + pi'n \rightarrow nekuta'ipin
"necktie" "pin" = "tiepin"

huransu + pa'n \rightarrow huransu'pan
"France" "bread" + "French roll"

b) Deaccenting morphemes, Deaccented compounds

sya'kai + to'o \rightarrow syakaitoo
"society" "party" "Socialist Party"

huusen + tama' \rightarrow huusendama
"balloon" "ball" "balloon"

pi'nku + iro' \rightarrow pinkuiro
"pink" "color" "pink"

ro'sia + go' \rightarrow rosiago
"Russia" "language" "Russian language"

zi'nzi + ka' \rightarrow zinzika
"personnel" "department" "personnel department"

c) Initial-accenting morphemes,
Initial-accented compounds
mi'nsyu + syu'gi → minsyusyu'gi
"democracy" "principle" "democracy"

misa'iru + ki'ti → misairuki'ti
"missile" "base" "missile base"

pe'rusya + ne'ko → perusyane'ko
"Persia" "cat" "Persian Cat"

momen + i'to → momeni'to
"cotton" "thread" "cotton thread"

me'tan + ga'su → metanga'su
"methane" "gas" "methane gas"

maikuro + ba'su → maikuroba'su
"micron" "bus" "mini bus"

As may be implicit in the examples in (9), there is a broad correlation between the word accent pattern of $N_2$ and the accentual pattern of the whole compound. Chew (1963) notes that initial-accenting and deaccenting morphemes generally have the word accent on their initial and final syllables, respectively, whereas pre-accenting morphemes are unaccented when used independently. Since words consisting of up to two morae can have only three accentual possibilities, i.e. initially accented, finally accented and unaccented, Chew's claim implies the following accentual correlation (/++/ and /--/ denote the presence or absence of a possibility, respectively):
(10) Chew's Correlational Law

<table>
<thead>
<tr>
<th>compound</th>
<th>preaccented</th>
<th>deaccented</th>
<th>initial-accented</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N_2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>initial</td>
<td></td>
<td></td>
<td>+++++++</td>
</tr>
<tr>
<td>final</td>
<td></td>
<td>++++++++</td>
<td>-</td>
</tr>
<tr>
<td>unaccented</td>
<td>++++++++</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

While Chew's generalizations concerning "initial-accenting" and "deaccenting" morphemes seem to be wholly justifiable, his generalization as regards "preaccenting" morphemes admits a number of exceptions, so many so that it seems that no correlation can be established between the inherent accent pattern of the preaccenting morphemes and that of the compounds whose final member they constitute (cf. McCawley, 1968: Appendix I; Akinaga, 1966):

(11) Pre-accented Compound Nouns

a) $N_2 =$ initially accented

- seto'mono + i'ti $\rightarrow$ setomono'iti
  "china" "market" "chinaware market"
- te'rebi + kyo'ku $\rightarrow$ terebi'kyoku
  "TV" "station" "TV station"
- si'nri + ga'ku $\rightarrow$ sinri'gaku
  "psychology" "-ology" "psychology"
- kankyaku + se'ki $\rightarrow$ kankyaku'seki
  "spectator" "seat" "spectators' seats"
- suimin + ya'ku $\rightarrow$ suimi'nyaku

85
"sleep" "medicine" "sleeping pill"

b) $N_2 = \text{finally accented}$

hayari + uta' $\rightarrow$ hayari'uta

"fashion" "song" "popular song"

sotugyoo + siki' $\rightarrow$ sotugyo'osiki

"graduation" "ceremony" "graduation ceremony"

su'ihei + huku' $\rightarrow$ suie'ihuku

"sailor" "clothes" "sailor suit"

undo + kutu' $\rightarrow$ undo'ogutu

"sport" "shoes" "sport shoes"

The large number of such exceptions taken into consideration, it will be desirable to modify Chew's observation as in follows.

(12) Correlational Law (modified)

<table>
<thead>
<tr>
<th>compound</th>
<th>preaccented</th>
<th>deaccented</th>
<th>initial-accented</th>
</tr>
</thead>
<tbody>
<tr>
<td>$N_2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>initial</td>
<td>++++</td>
<td>-</td>
<td>++++</td>
</tr>
<tr>
<td>final</td>
<td>++++</td>
<td>++++</td>
<td>-</td>
</tr>
<tr>
<td>unaccented</td>
<td>++++</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The modified correlational law in (12) can be stated as follows — the proposition in (13c) can be derived as a consequence of (13a) and (13b):

(13) Correlation: Accent of $N_2$ and Compound Accent
In a compound \([N_1, N_2]\) where \(N_2\) contains not more than two morae:

a) If the compound is accented on the first syllable of \(N_2\), \(N_2\) is initially accented when used independently.

b) If the compound is unaccented, \(N_2\) is finally accented when used independently.

c) If \(N_2\) is unaccented when used independently, the compound is accented on the last syllable of \(N_1\).

Given the correlational laws in (13), it will be understood that the accentual pattern of compounds whose \(N_2\) is 'short' cannot be formulated in a straightforward manner. In fact, any previous attempt to formulate rules for these compounds assigns some diacritic features like [+pre-accenting], [+deaccenting], etc. directly to individual morphemes, thereby attributing a large part of the complicated accentual patterns in question to idiosyncratic lexical phenomena (cf. McCawley, ibid.; Higurashi, ibid.).
2. Prosodic Compound Formation Reconsidered

In the foregoing section, we have reviewed the past phonological work on Japanese compounds, confirming that they provide a descriptively adequate account of the compound accentual patterns. In spite of this descriptive adequacy, however, the previous descriptions of Japanese compound formation are far from being complete. One main reason for this is, as was suggested, that past work concentrates solely on the analysis of compound expressions which readily undergo the compound accent rules, while ignoring those compounds which fail to undergo the accentual changes.

In this section, I will first address this latter special type of construction and provide some evidence to justify its treatment as 'compounds.' The second part of the section will develop the discussion further to argue for the distinction between "accentual phrasing" and "accentual rules," which I claim constitute the two components of the prosodic compound formation in Japanese.

2.1. Two Kinds of Compounds

2.1.1. Two Types of Accent Patterns

The accentual patterns which concatenations of two simplex words take in Japanese fall into two types: (i) compound accentual patterns, and (ii) phrasal accentual patterns. By way of introduction to prosodically non-unified compounds, let us first compare the phonological structures of these two types of
constructions:

(14) Two Types of Accent Patterns

<table>
<thead>
<tr>
<th>Compound Pattern</th>
<th>Phrasal Pattern</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) aozya'sin</td>
<td>ao'i syasin</td>
</tr>
<tr>
<td></td>
<td>&quot;blue print&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;blue photograph&quot;</td>
</tr>
<tr>
<td></td>
<td>(&lt; a'o + syasin)</td>
</tr>
<tr>
<td>b) akade'nwa</td>
<td>akai denwa</td>
</tr>
<tr>
<td></td>
<td>&quot;public telephone&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;red telephone&quot;</td>
</tr>
<tr>
<td></td>
<td>(&lt; a'ka + denwa)</td>
</tr>
<tr>
<td>c) nemurigu'suri</td>
<td>nemuru kusuri (?)</td>
</tr>
<tr>
<td></td>
<td>&quot;sleeping pill&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;pill to sleep (?)&quot;</td>
</tr>
<tr>
<td></td>
<td>(&lt; nemuri + kusuri)</td>
</tr>
<tr>
<td>d) megu'suri</td>
<td>me'no kusuri</td>
</tr>
<tr>
<td></td>
<td>&quot;eye drop&quot;</td>
</tr>
<tr>
<td></td>
<td>&quot;medicine for eyes&quot;</td>
</tr>
<tr>
<td></td>
<td>(&lt; me' + kusuri)</td>
</tr>
</tbody>
</table>

A comparison of the two types of constructions in (14) reveals that compound nouns are distinct from corresponding phrasal constructions both in phonological and morphological terms. Seen from an accentual viewpoint, compound nouns differ from phrasal constructions in undergoing a modification of accent patterns of their component words, which we defined as 'compound accent rules' in the foregoing section. Phrasal constructions, on the other hand, do not generally undergo such an accentual change but keep the accent patterns of their component words intact. What this means is that phrasal accent patterns can
be defined as a default case where accent patterns of component words are not modified by any accentual rule.

In addition to these accentual differences, compound constructions differ from their phrasal counterparts in another phonological way. Compound nouns are subject to what is generally described as rendaku, or the process of "sequential voicing" (Martin, 1952: 48), whereby voiceless consonants of the second member of the combination are devoiced: e.g. *svasin* → *zvasin*, *kusuri* → *gusuri*. It must be noted, however, that this is not a very general process, but applies basically to lexicalized compound expressions whose second element is a native Japanese morphemes only (cf. Otsu, 1980). Since rendaku does not thus generally apply to compounds involving Sino-Japanese morphemes, which account for the majority of compound expressions in Japanese, it cannot be taken as a reliable index of compounds as against non-compound (phrasal) constructions.

Compound nouns show their 'one-wordness' not only by undergoing these phonological changes but by undergoing morphological changes as well. As the examples in (14) show, compound nouns involve the combination of two nominals. That is, verbs and adjectives must undergo the process of nominalization which is often accompanied by accentual changes: *go'i* → *a'o*, *akai* → *a'ka*. Noun phrases, by contrast, involve concatenation of an adjectival element followed by a head noun, with the former being either an adjective proper, e.g. (14a) and (14b), or a verb, e.g. (14c), or a noun plus the genitive particle *no*, e.g. (14d). This morphological difference helps to make a clear distinction
between the two types of constructions in question.

2.1.2. Two Lines of Definition

The discussion so far might be taken as implying that the two types of criteria, phonological and morphological, are always compatible with each other and that a clear borderline can always be drawn between the two types of constructions, compounds and phrases. This situation is made rather complicated, however, by the existence of a number of constructions which take a phrasal accent pattern but are morphologically indistinguishable from compound expressions. (15) illustrates some typical cases of these (cf. Kubozono, 1987a — see Appendix IV):

(15)  
   a) Personal Names: [Surname + Given Name]  
      mi'nami a'kira "Minami Akira"  
      kubozono haruo "Kubozono Haruo"  
   b) Coordinate Structures  
      hikaku taisyoo "comparison" "contrast"  
          = "comparison"  
      i'ppu tasai "one husband" "many wives"  
          = "polygamy"  
      i'ssin ittai "one advance" "one retreat"  
          = "ebb and flow"
c) Case Relations

i'siki humei "consciousness" "being missing"
   = "unconsciousness"

zisin soositu "self-confidence" "loss"
   = "noncompos"

ta'itoru booei "title defense"

ke'n poo kaisei "constitution(al) reform"

seikyoku hendoo "political situation" "change"
   = "political situation change"

d) [Organization + Status]

se'ihu kookan "government official"

booe'ityoo tyookan "self-Defence Agency" "chief"
   = "Self-Defence Agency Chief"

seito'kai kaityoo "student union" "president"
   = "student union president"

e) [Personal name + Status/Title]

re'egan daito'oryoo "President Reagan"

nakasone syusyoo "Prime Minister Nakasone"

yu'kawa ha'kase "Dr Yukawa"

ka'too kyoozyu "Professor Kato"

f) [Geographical term + Specifier]

kyu'usyuu na'nbu "Kyushu (area name)" "south"
   = "southern Kyusyu"

suko'ttorando ho'kubu "Scotland" "northern part"
   = "northern Scotland"

ro'ndon syuuhen "London" "surrounding area"
   = "London suburbs"
g) [Temporal order + Position]

zi'ki daito'oryoo "next time" "president"
= "next President"

syo'dai kaityoo "first" "chairman"
= "first chairman"

Examples in (15a) represent personal names (i.e. family name plus given name), those in (15b) and (15c) involve two elements forming a coordinate structure and a case relation respectively; those in (15d) represent the combination of an organization plus a status or position therein; those in (15e) denote the sequence of a personal name plus the person's occupational/social status or title; those in (15f) involve the sequence of two nouns the first of which denotes a geographical term with the second specifying it further; those in (15g) involve a noun denoting a person's position in the society or organization which is modified by a preceding noun representing a chronological order. All of these constructions involve the concatenation of two noun forms, accompanied by no marker characteristic of phrasal constructions, but they are not subject to the compound accent rules to which ordinary compound constructions are subject.

The discrepancy between morphology and phonology — that is, the discrepancy between the phonology-based definition of compounds and the morphology-based one — has not attracted serious attention in the past. The only exception to this may be Hayata (1969), who apparently adopts the phonology-based definition without developing any argument to substantiate the position. The advantage of adopting the phonology-based
definition appears to be that the CARs can be treated as a set of exception-free rules. Despite this apparent advantage, there are quite a few reasons to reject the definition in favour of the morphology-based definition.

Note first that adopting the phonology-based definition leads to a circular argument whereby the CARs are supposed to apply to "compounds," or the category which itself is defined as a 'category which is subject to the CARs'. In addition to this circularity relating to the two notions, 'compounds' and 'CARs,' the phonology-based analysis leaves it unexplained why only the [noun + noun] constructions constituting certain types of semantic relations become immune from the prosodic compounding process while other constructions of the same morphological composition readily undergo the rules. If one adopts the morphology-based definition, however, one can avoid both the circularity and the problem arising from it. Under this analysis, compounds are defined primarily on the basis of their morphological structure, and the CARs are to apply to all the compound constructions thus defined, with the exception of some semantically marked ones.

Another reason to prefer the morphology-based definition of compounds to the phonology-based one is that no absolute borderline can be drawn between compound-type nominal combinations and phrase-type nominal combinations. Consider (16), for instance, which lists typical examples which are subject to the CARs although they apparently have identical
semantic, syntactic and morphological structures to the expressions in (15).

(16)  
(a) moota'kutoo  \< mo'o + ta'kutoo  "Mao Ze-dong"  
syuuoo'nrai  \< syu'u + o'nrai  "Zhou En-lai"  

(b) tyuutoha'npa  \< tyuuto + hanpa  
 "Incompleteness" = "half-way" "fragment"  
syakusizyo'ogi  \< sya'kusi + zyo'ogi  
 "officialism" = "dipper" "ruler"  

(c) yukuehu'mei  \< yukue + humei  
 "(state of) being missing"  
 = "whereabout" "being unknown"  

kiokuso'ositu  \< kioku + soositu  
 "amnesia" = "memory" "loss"  

zikobo'oiei  \< zi'ko + booei  
 "self-defense" = "self" "defense"  

sedaiko'otai  \< se'dai + kootai  
 "generation change" = "generation" "change"  

tikakuhe'ndoo  \< tikaku + hendoo  
 "diastrophism" = "earth's crust" "change"  

kenpooi'han  \< ke'nppo + ihan  
 "breach of the Constitution"  
 = "constitution" "violation"  

95
(d) syuugiingi'tyoo \(<\) syuugi'in + gi'tyoo

"Speaker of the House of Commons"
= "House of Commons" "Speaker"

kengikaigi'in \(<\) kengi'kai + gi'in

"Prefectural Assembly member"
= "Prefectural Assembly" "member"

(e) meizite'nnoo \(<\) me'iizi tenno'o

"Emperor Meiji" = "Meiji (Era)" "emperor"

erizabesuzyo'ooo \(<\) eriza'besu + zyoo'o

"Queen Elizabeth" = "Elizabeth" "queen"

Given these examples, one will wonder, quite naturally, what principle underlies the accentual difference between these and the constructions in (15). With some expressions, the distribution appears to be quite arbitrary and to be attributed to the idiosyncrasy of each compound expression: e.g. there is no reason why yukuchu'mei, kikuso'osityu and syuugiingi'tyoo should undergo the CARs while i'siki humei, si'nsin soositu and booe'ityoo tyookan should not. Nevertheless, one can find one broad tendency behind the distribution of the two types of accent patterns, according to which nominal combinations become more subject to the CARs as their use becomes more established in the language. Such expressions as zikobo'oei, kenpo'o'han and tikakuhe'ndoo in (16c) may be good examples to show this tendency as opposed to ta'itoru booei, ke'npoo kaisei and seikyoku hendoo in (15c). If one adopts the phonology-based definition of 'compound,' one will be obliged to assume that the syntactic
label of a give expression is determined by such factors as its prosodic idiosyncrasy and the degree of its establishedness in language use. An analysis on the morphology-based definition of 'compound,' on the other hand, can provide a reasonable account for all these cases: the prosodic (accentual) difference or variation mentioned above simply reflect the difference with respect to whether the semantic constraint regulates the application of the CARs or it fails to do so under certain circumstances.

This situation is even more complicated by the existence of quite a few expressions as illustrated in (17)–(19) below, whose pronunciation fluctuates between the two accentual patterns, (a) compound accent pattern, and (b) phrasal accent pattern. The choice between the two patterns seems to vary from one speaker to another, from one expression to another, and even from one utterance to another within the same speaker. According to my observation, however, the compound accent pattern, *ceteris paribus*, tends to be preferred to the phrasal one as the particular expression becomes totally familiar to the speaker and also as the expression is used in a fast speech rather than in a slow, careful speech.
(17) Personal Names

1. to'o syo'ohei → (a) toosyo'ohei  
   (b) to'o syo'ohei
   "Deng Xiao-ping"

2. ze'n to'kan → (a) zento'kan  
   (b) ze'n to'kan
   "Chun Doo Hwan"

3. hura'nku na'gai → (a) hurankuna'gai  
   (b) hura'nku na'gai
   "Frank Nagai"

3. anto'nio i'noki → (a) antonioi'noki  
   (b) anto'nio i'noki
   "Antonio Inoki"

4. bi'ito ta'kesi → (a) biitota'kesi  
   (b) bi'ito ta'kesi
   "Beat Takeshi"

(18) Coordinate Structures

1. to'ozai + na'nboku → (a) toozaina'nboku  
   (b) to'ozai na'nboku
   "east-west" "south-north" = "all directions"

2. zikyuu + zisoku → (a) zikyuuzi'soku  
   (b) zikyuu zosoku
   "self-supply" "self-sufficiency"  
   = "self-sufficiency"

3. meisyo + kyuuseki → (a) meisyokyu'useki  
   (b) meiyyo kyuuseki
   "scenic spot" "historic spot"  
   = "scenic and historic spots"

(19) Case Relations

1. se'isin + hakuzyaku → (a) seisinha'huzyaku  
   (b) se'isin hakuzyaku
   "mind" "weakness" = "weakmindedness"

2. hi'gai + moosoo → (a) higaimo'osoo  
   (b) hi'gai moosoo
   "damage" "illusion" = "delusion of persecution"
3. antyuu + mosaku \[\rightarrow\] (a) antyuumo'saku
(b) antyuu mosaku
"darkness" "groping" = "groping in the dark"

4. sinsyuku + zizai \[\rightarrow\] (a) sinsyukuzi'zai
(b) sinsyuku zizai
"expansion/contraction" "freedom" = "elasticity"

If one should define 'compound' on phonological criteria, one would inevitably be led to the argument that the syntactic category of a given expression varies depending upon such factors as the speaker's familiarity to it as well as the speech style with which the expression is uttered.

While the phonology-based definition of 'compound' thus falls into difficulties, analyses on the morphology-based definition can provide a reasonable account for the cases mentioned above. According to this definition, the constructions in (15) are regarded as exceptional types of compounds, compounds which fail to undergo the CARs because of the marked semantic relationships holding between their two component words (cf. section 3.2 below, and Kubozono, 1987a). The compound accent patterns as observed in the constructions in (16) and the accentual fluctuation as given in (17)-(19) are to be viewed as exceptions to this "semantic constraint" (i.e. exceptions to the exceptions) in which the constraint becomes void under certain paralinguistic and pragmatic contexts.

A third argument for favoring the morphology-based analysis comes from a consideration of the accentual patterns shown by complex constructions made up of three or more component words.
As will be discussed in section 3.2, if a third member is added to the noun sequence which is immune to the CARs, its second member is accentually unified with the third member to the exclusion of the first. That is, the CARs apply to the sequence of $N_2$ and $N_3$ even if they fail to apply to that of $N_1$ and $N_2$ ('/' denotes an accent phrase boundary, or the fact that the compounding process does not apply over the two elements concerned while its absence means that the process applies):

(20) Accentual Pattern in Complex Compounds (cf. (15))

$$[[N_1 N_2] N_3] \rightarrow N_1/N_2 N_3,$$

where $[N_1 N_2] \rightarrow N_1/N_2$

a) $[[i'ppu tasai] se'ido] \rightarrow i'ppu tasaise'ido$

"one husband" "many wives" "system" = "polygamy"

b) $[[i'siki humei] zyootai] \rightarrow i'siki humeizyo'otai$

"consciousness" "missing" "state" = "state of unconsciousness"

c) $[[ke'npoo kaisei] mondai] \rightarrow ke'npoo kaiseimo'ndai$

"Constitution" "reform" "issue" = "issue of constitutional reform"

d) $[[ziyu'u mi'nsyu] to'o] \rightarrow ziyu'u minsyutoo {+DeAcc}$

"liberty" "democracy" "party" = "Liberal Democratic Party"

e) $[[i'ndo yooro'ppa] go'zoku] \rightarrow i'ndo yooroppago'zoku$

"India" "Europe" "language group" = "Indo-European Family of Languages"

If one should hold the view that the first and second nouns

100
constitute a noun phrase rather than a compound noun in examples as given in (20), then it would amount to saying that the CARs apply over the category boundary of NP, entirely exclusive of the first noun (cf. (21a)). On the other hand, the morphology-based analysis will be free from such a problem. Although one still has to account for the accentual exclusion of the first noun (cf. (21b)), one can do so in an appropriate manner by means of an general and independently motivated principle regarding the application of the CARs (or, to be more exact, the prosodic process of 'accent phrase formation') (cf. section 3.6):

(21)

a) \([[N \, N]_{np} \, N]_{n}\)

\[\]

b) \([[N \, N]_{n} \, N]_{n}\)

\[\]

Our last argument for the treatment of the constructions in (15) as compounds, not as phrases, comes from another aspect of complex constructions. As mentioned in (20) above, a special class of left-branching compound-like constructions yield more than one accentual phrase. Similarly, right-branching compound-like constructions exhibit the same accentual behavior as this, as illustrated below (cf. section 3.3):
Right-Branching Compound-like Constructions

\[ N_1 [N_2 N_3] \rightarrow N_1/N_2N_3 \]

a) \[ \text{[ni'tibei [a'npo zyooyaku]]} \]
\[ \rightarrow \text{ni'tibei anpozyo'oyaku} \]

"Japan-US" "security" "treaty"
= "Japan-US Security Treaty"

b) \[ \text{[na'goya [ko'ogyoo daigaku]]} \]
\[ \rightarrow \text{na'goya koogyooda'igaku} \]

"Nagoya" "industry" "university"
= "Nagoya Institute of Technology"

What is interesting with these complex constructions as well as those in (20) is that they yield one accentual phrase in abbreviated forms:

(23) a. \(=(20d))\ zimintoo < zi'min + to'o \(+\text{DeAcc})\)
b. \(=(20e))\ inoogo'zoku < inoo + go'zoku\)
c. \(=(22a))\ nitibeia'npo < ni'tibei + a'npo\)
d. \(=(22b))\ nagoyako'odai < na'goya + koodai\)

On the phonology-based definition of 'compound,' one has no choice but to assign dual labels to these constructions, one of noun phrase to the unabbreviated forms in (20) and (22) and one of compound noun to the abbreviated forms in (23). In other words, the syntactic label of a given expression would change depending upon whether they are abbreviated or not. Adopting the morphology-based analysis, one does not fall into such a difficulty — both the abbreviated and full forms represent 'compounds' with the only difference that in the latter, the first two component words fail to undergo the CARs because they
involve a marked semantic and syntactic (branching) structure, respectively.

To summarize, there are several independent reasons to reject the phonology-based definition of 'compound' in favor of the morphology/syntax-based one. This being the case, it follows that it is essential to recognize two types of compound constructions, i.e. those which undergo the CARs to take a compound accent pattern, and those which fail to undergo the rules, thus taking the same accentual patterns as those of phrase constructions.

2.2. Two Components of Prosodic Compound Formation

It was shown in the preceding discussion that compound constructions do not always manifest themselves in a single accent unit but are classified into more than one group depending upon the accentual pattern they take. Thus, compound nouns consisting of two elements fall into two groups, those which result in one accentual phrase by undergoing the CARs and those which yield two phrases by failing to undergo the rules. Likewise, compound constructions consisting of three elements — \[[A B] C\] or \[A [B C]\] — show varying accentual patterns: i.e. monophrasal (ABC), biphasal (A/BC or AB/C) or triphrasal (A/B/C).

In the discussion so far, it has been tentatively assumed that the CARs are constrained directly by such factors as the
semantic and/or syntactic (branching) relationships holding between the two nouns to which they apply, and that multi-phrasal accentual patterns result when the CARs are blocked by these constraints. In other words, it has been hypothesized that the CARs determine the phrasing patterns of compounds as well as their accentuation: cf. (24a). There are, however, several reasons to think the other way round, that is, that phrasing patterns of compounds are input to, not output from, the CARs. Under this new analysis, the prosodic compound formation process (PCFP) is seen to involve two independent, if not unrelated, processes: "accentual phrasing process" (or Accent Phrase Formation: APF), which determines the accentual phrasing patterns of compounds, and the CARs, which, as they stand now, modify the accentuation (accentedness and accent location) within the domain defined by APF. The constraints which have hitherto been thought to constrain the CARs are now seen as the constraints on APF: cf. (24b):
2.2.1. Nature of PCFP

One can find four lines of evidence to choose the analysis in (24b) in preference to that in (24a). The first piece of argument concerns the very nature of the CARs themselves. We have hitherto contented ourselves by characterizing the CARs as a set of accent assignment rules. A careful examination of the rules, however, reveals that their main function is not simply to reassign word accents but to give compound constructions the very basic accentual feature which simplex words commonly have, that is, the feature of 'at most one accent being permitted per word.' In other words, the essential function of the compounding process is one of accentual unification or phrasing to yield a single accentual unit out of two (or more) syntactic words each of which can potentially constitute an independent accentual phrase.
This point becomes abundantly clear if one compares the compound formation process of Japanese with that of English. In English, the compounding process simply involves a change in the overall stress (prominence) pattern without affecting the prosodic identity (i.e. stress pattern) of each component word. By contrast, the compounding process of Japanese causes the component words to lose their prosodic identity (i.e. accent patterns) by deaccenting the first element and accenting, where applicable, the second element. Given that these two accentual changes go together all the time, as illustrated in (25) below, the overall effect is all too plain — it yields one accentual unit out of two potential units. Seen in this light, it is clear that they do not represent two separate processes but two inseparable components of one organic whole.

(25) (cf. (4c))

\[
\begin{align*}
\text{sy\'a'kai seisaku} & \rightarrow * \text{syakaiseisaku} \\
& \quad * \text{sy\'a'kai se'isaku} \\
\text{de\'nki airon} & \rightarrow * \text{denkiairon} \\
& \quad * \text{de\'nki a'iron}
\end{align*}
\]

With this characteristic of Japanese prosodic compound formation process in mind, let us refer back to the conventional formulation of the CARs:
In a compound noun \([N_1, N_2]\) where \(N_2\) is three or more morae long,

a) the accent of \(N_2\) predominates as compound accent.

b) If \(N_2\) is either accented on its final syllable or unaccented, put the compound accent on the first syllable of \(N_2\).

As we confirmed in section 2.1.2, the compound accent rule in (26) provides an adequate description of the accentual changes involved in compound formation. It must be pointed out, however, that the rule does not capture the functional relatedness holding between the two inseparable aspects which the compounding process involves: the overall 'goal' of the process can be inferred only from the combined effects of the two subcomponents of the rule, but it is not explicitly expressed by any formal device. What must be noted furthermore is that this inadequacy of the conventional compound accent rule does not stem from the analysis of the rule as an accent assignment rule or from any possible inadequacy of the way in which the rule is formulated. But the inadequacy derives from the assumption that the prosodic compound formation process in Japanese can be fully described in the form of a set of accent assignment rules, or the assumption that the process is no more than an accent assignment process. Given that PCFP is an accentual unification process as well as an accent assignment one, it should be clear why we need to introduce the new concept of "accentual phrasing" to describe the first aspect of the process. That is, viewing PCFP as involving two aspects and hence two types of rules is the key to a better
understanding of the process.

2.2.2. PCFP and Conditions

A second line of argument for the treatment of accentual phrasing as an independent part of PCFP comes from the fact that the process is constrained by several types of utterance (sentence)-level structures. As will be discussed in section 3.3 below, for example, compound constructions consisting of three elements show different accentual patterns depending on their syntactic (branching) structures: Left-branching compounds, in which the first component word has a narrow scope, generally fuse the three component words into one accentual phrase (unless, of course, they are constrained by the semantic constraint) whereas right-branching compounds generally result in two accentual phrases, introducing an accent phrase boundary between the first two components (cf. (22)). Moreover, as will be discussed in section 3.4 below, PCFP is constrained by a rhythmic factor which can only be defined in reference to the overall branching structure of the compound constructions concerned. If one adopts the conventional interpretation of PCFP, thereby identifying PCFP with the CARs, then it follows that the CARs themselves are constrained by such high-level information about the hierarchical organization of sentences (cf. (24a)). This is apparently an unfavorable result since it misses the generalization we saw in Chapter One (section 5), that word accents and phonological rules manipulating them are generally free from such sentence-level information.
While the conventional interpretation of FCFP misses an important generalization, we can avoid this problem with no difficulty under the new analysis I am proposing here. Under this analysis, which is illustrated in (24b), the branching constraint and other kinds of constraints on the compounding process are seen to constrain the process of accentual phrasing, and not the process of accent assignment. The role assigned to the CARs therein is simply to reassign word accents in a certain well-defined manner within the domain of each accentual phrase, which is already defined by the process of accentual phrasing.

2.2.3. FCFP and MPF

Our third and probably the most important argument for analyzing FCFP into two subparts comes from the significant parallelism observed between the compounding process and what I call "minor phrase formation (MPF)," an intonational phrasing process to be defined in the phrasal level of phonology. In brief, MPF plays the role of yielding a single intonational unit out of the sequence of syntactic phrases which can potentially result in more than one intonational unit (i.e. 'minor phrase,' to be exact): 'z' represents a minor phrase boundary.
PCFP and MPF crucially resemble each other, first of all, in the function they play in the phonological system of Japanese: they both have the effect of yielding one prosodic unit out of a sequence which can potentially form more than one unit, and, in so doing, define the domains within which other rules apply. PCFP defines the domain of an accentual phrase within which the CARs operate to yield compound accent patterns. MPF, on the other hand, defines the domain of a minor phrase, the domain within which such rules as tone assignment rules and the phonetic realization rules apply (cf. Chapter Four).

Second, PCFP and MPF also show a crucial resemblance with respect to the kinds of constraints imposed on them. For example, MPF is constrained by exactly the same branching constraint that constrains PCFP (cf. (24)). That is, its application is blocked by a right-branching node, with the result that constructions involving a right-branching structure are decomposed into more than one (minor) intonational phrase, as
schematically shown in (28) below — for a detailed discussion, see section 3.3 of this chapter and section 6 of Chapter Four. (Here, again, '/' denotes that the phrasing processes are blocked in the domain concerned):

(28) Branching Constraint on PCFP and MPF

\[[A [B C]] \rightarrow A/BC\]

Likewise, both PCFP and MPF are constrained by a rhythmic factor, whereby uniformly left-branching constructions made up of four (or more) elements tend to be phrased into two prosodic phrases (i.e. accented phrases and minor intonational phrases, respectively). (29) schematizes this (cf. section 3.4 of this chapter and section 6 of Chapter Four):

(29) Rhythmic Constraint on PCFP and MPF

\[[[[A B] C] D] \rightarrow AB/CD\]

And last, but not least, the two prosodic processes in question crucially resemble in the phrasing patterns they yield when subject to various constraints. It was suggested in section 2.1.2 that PCFP applies between the second and third elements in left-branching compounds even if it fails to apply, because of the semantic constraint, between the first and second elements (cf. (20) above). MPF shows exactly the same phrasing behavior as this although the process is blocked by a different kind of constraint (i.e. by 'accentual constraint': cf. section 6,
Moreover, in constructions shown in (30) below, which are subject to the branching constraint illustrated in (22) above, both PCFP and MPF yield one and the same phrasing pattern whereby the last three elements constitute one unified phrase to the exclusion of the first:

\[(30) \quad [[A [B C]] D] \rightarrow A/BCD\]

To capture all the crucial parallelisms between PCFP and MPF mentioned so far, it seems not only plausible but also essential to analyze PCFP as involving the aspect of accentual phrasing along with that of accentuation and, accordingly, to represent the former aspect independently from the latter in the phonological system of Japanese.

2.2.4. PCFP and Dialect Variation

The last piece of evidence for the view of PCFP as comprising two subparts — one of 'accent phrase formation' and one of 'accentuation' — comes from a consideration of different dialects of Japanese which show different behavior with respect to the accentual patterning of prosodically non-unified compounds and complex compounds.

As is well known, different dialects of Japanese show different accentual and tonal patterns (cf. Haraguchi, 1977), and the accentual patterning of prosodically non-unified compounds and complex compounds is no exception in this regard. My preliminary observation of the three distinct dialects which I am familiar with — Tokyo Dialect, Osaka Dialect and my native
Kagoshima Dialect — suggests, however, that the accentual differences shown by these dialects are essentially attributable to the differences in accentuation, not in accentual phrasing. In other words, the three dialects exhibit virtually no difference in accentual phrasing of prosodically non-unified and complex compound expressions such as those in (15), (20) and (22). If this observation is justifiable and also is shown to be applicable to other dialects of the language, it will justify the position to make a clear distinction between 'dialect-universal' phenomena and 'dialect-particular' phenomena, and hence, to divide PCFP into the two subparts, one of the 'dialect-universal' accentual phrasing and one of the 'dialect-particular' accentuation.

To summarize, I have discussed the following four lines of evidence to justify the line of analysis I propose here: (i) the characterization of PCFP as a phrase unification process, (ii) the various types of constraints imposed on PCFP, (iii) the significant parallelisms observed between PCFP and MPF, and (iv) the similarities and differences which different dialects of Japanese show in accentual patterning of prosodically non-unified and complex compounds. All these pieces of evidence show that the concept of 'accentual phrasing' is a well-motivated one in the phonological system of Japanese, and that the process it denotes constitutes an essential component of the compound formation process which is independent of, if not unrelated to, the accent assignment (i.e. accentuation) aspect of the same process.
2.3. Two Types of Phrasing Processes

By now it will be abundantly clear why we need to introduce the two new concepts, 'accentual phrasing' and 'accentual phrase' into Japanese phonology. Before considering in depth the various kinds of factors that constrain the process of accentual phrasing, or 'accent phrase formation' (APF) in depth, it may be worth spending a few paragraphs to sketch the fate of prosodically non-unified compounds at later stages of phonological derivation, and thereby outline how APF interacts with and differs from MPF, the intonational phrasing process briefly sketched above.

By definition, compound constructions which fail to undergo APF also fail to undergo the CARs and, consequently, keep the accentual pattern of their component words intact (cf. (15)). Since their resultant accentual patterns are indistinguishable from those of comparable phrase constructions such as noun phrases, verb phrases, etc. (cf. (14)), prosodically non-unified compounds show the same prosodic behavior as phrasal constructions at the phrasal level of phonology. Specifically, those whose first element is unaccented eventually undergo the process of MPF to form one intonational phrase. (31) illustrates this with (a) typical prosodically non-unified compounds (noun sequences constituting personal names, in this case) and (b) noun phrases (cf. (27)).
(31) Minor Phrase Formation

(a) \([-\text{Accent}][+/\text{-Accent}] \rightarrow % [-\text{Accent}][+/\text{-Accent}] %\]

Input nakasone yasu’hiro nakasone haruo

MPF % nakasone yasu’hiro % % nakasone haruo %

Phonetic na[kasone yasu]hiro na[kasone haruo]

Output "Nakasone Yasuhiro" "Nakasone Haruo"

(b) \([-\text{Accent}][+/\text{-Accent}] \rightarrow % [-\text{Accent}][+/\text{-Accent}] %\]

Input akai tora’kku akai kuruma

MPF % akai tora’kku % % akai kuruma %

Phonetic a[kai tora]’kku a[kai kuruma]

Output "red truck" "red car"

As noted above, MPF is similar to APF in that it fuses two potential prosodic phrases into one. In fact, when this process applies to sequences of an unaccented word plus an accented one, e.g. (31a), the intonational configuration that surfaces at the phonetic output is very similar to and often indistinguishable from that of the compounding process. Compare (31a) with ordinary compounds as in (32) below:

(32) (=3d) Prosodic Compound Formation Process (PCFP)

Input kyooiku + se’ido

PCFP kyooikuse’ido

Phonetic output kyooikuse’ido
This apparent neutralization in intonational patterning result from two combined factors: (i) lack of accent in the first element and (ii) presence of accent in the second element. Since the first elements are unaccented, the effect of deaccenting is masked in compound formation. This renders the accent of the second element ambiguous in that it can be interpreted either as a compound accent or the word accent which the element originally had.

Although the output of the compound formation process and that of MPF can thus yield an indistinguishable intonational pattern in certain phonological environments, this does not of course deny the distinction between the two types of phrasing processes in Japanese phonology. If we should analyze the intonational configuration in (31a) as being due to the compounding process rather than MPF, we would have to say that sequences of an unaccented word and an accented one unconditionally undergo the compound formation process without being constrained by the semantic constraint. This clearly misses the generalization that the compound formation process takes place independently of the accentedness of component words to which they apply.

Besides this point, which is particularly relevant to the two cases in (31) and (32), APF and MPF crucially differ from each other in the following four points. Note, first, that the two types of phrasing process involve different morphological forms as their inputs. In the case of compound noun formation, for example, the input to APF has to be a sequence of two (or
more) nominal(ized) forms of words (cf. section 2.1.1). MPF, by contrast, can apply to any sequence of words which has failed to undergo APF, from prosodically non-unified compounds to various types of phrasal constructions, with virtually no condition on the morphological forms of the inputs.

APF and MPF differ in the phonological conditions as well as the morphological condition. As will be discussed in depth in Chapter Four, MPF is sensitive to the accentedness of the left-hand element of the sequence to which it applies, while generally failing to apply to the sequence whose left-hand element is accented. APF, by contrast, applies irrespective of the accentedness of the component words, as we have repeatedly seen.

Thirdly, the two types of phrasing processes differ in the effects they yield. APF defines the domain of the CARs, which in turn modifies word accent patterns, whereas MPF is a process which involves no modification of word accents whatsoever.

And last, APF is an obligatory rule in the strict sense of the term while MPF is not: the latter fails to apply in certain contexts, notably when either the whole phrase or its right-hand element attracts pragmatic focus in some way or other. APF, like other rules applying at the lexical level, does not generally permit such pragmatic variation. (Here, again, capitalized words mean that they bear pragmatic emphasis.)
(33) a) APF

SYA'KAI + SE'IDO → SYA'KAI SE'IDO
SYA'KAI + se'ido → SYA'KAI se'ido

b) MPF

<table>
<thead>
<tr>
<th>Input to IP</th>
<th>NAKASONE</th>
<th>YASU'HIRO</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPF (blocked)</td>
<td>% NAKASONE % YASU'HIRO %</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phonetic Output</th>
<th>na\kasone ya\su\hiro</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Input to IP</th>
<th>nakasone</th>
<th>YASU'HIRO</th>
</tr>
</thead>
<tbody>
<tr>
<td>MPF (blocked)</td>
<td>% nakasone % YASU'HIRO %</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phonetic Output</th>
<th>na\kasone ya\su\hiro</th>
</tr>
</thead>
</table>

From the differences pointed out so far, it will be understood that APF and MPF represent two different phrasing processes in Japanese phonology although their effects can sometimes be neutralized at the intonational output. In sum, MPF is an intonational phrasing process to be defined at the phrasal level while APF is an accentual phrasing process to be defined at the lexical level. The distinction between these two types of phrasing processes will turn out to be very important in discussing the accentual patterning of complex compounds as will be shown in the next section.
3. ACCENT PHRASE FORMATION

It was shown in the preceding discussion that Japanese compounds fall into two types, those which undergo the phonological process of compound formation and those which fail to do so. It was also claimed that the process of prosodic compound formation is to be defined not simply as an accent assignment process but, more significantly, as an accent phrase formation process which unifies two potential accentual units into one. Having characterized compounds and the compound formation process in this way, let us now consider various constraints on the prosodic process of compound formation, with a special emphasis on the prosodic structure of complex compounds. Three types of constraints will be proposed — "semantic," "branching" and "rhythmic" — and it will be argued that these constraints enable us to account for virtually all the accentual patterns shown by complex compounds as well as many accentual phenomena which have hitherto been left unaccounted for. In addition to this, I would also like to explore the principle(s) underlying the patterning in accentual phrasing, that is, the relation between syntactic and phonological structures of compound constructions. A few claims will be made on the basis of this discussion, notably that the notion of 'cyclicity' does not work in accounting for the accentual patterning of complex compounds in Japanese.
3.1. Basic Facts and Rule

3.1.1. Basic Facts

Let us begin with the general observations of complex compound constructions in Japanese. The present phonological analysis of complex compounds has revealed several basic points of interest (see Introduction for the outline of the methodology). First, there is a striking tendency in regard to the syntactic (constituent) structure which this type of compound constructions take. In compounds made up of three elements, for instance, those with a left-branching structure (cf. (34a)) outnumber those with a right-branching one (cf. (34b)). This tendency shows up more distinctly in more complex compound constructions. Thus, the uniformly left-branching structure, i.e. (35), accounts for a majority of four-element compounds, followed by constructions involving the combination of the two types of structures, i.e. (36a)-(36c), while the uniformly right-branching structure, as given in (37), accounts for the least part.

(34) a) Left-Branching Compounds: [[A B] C]

```
  sya'kai syu'gi ko'kka
"society" "principle" "nation" = "socialist state"
```
b) (=(22a)) Right-Branching Compounds: \([A [B C]]\)

\[
ni'tibe i a'npo zyooyaku
\]

"Japan-US" "security" "treaty"
= "Japan-U.S. Security Treaty"


\[
ziyu'u mi'nsyu to'o taikai
\]

"freedom" "democracy" "party" "conference"
"Liberal-Democratic Party Conference"

(36) Left-Branching + Right-Branching

a) \(\[[[A B] C D]\]"

\[
ke'izai taisaku kakuryoo ka'igi
\]

"economy" "measures" "Cabinet member" "meeting"
= "Cabinet meeting on economic measures"

b) \(\[[A [B C]] D\]"

\[
ze'nkoku yo'ron tyo'osa kekka
\]

"whole nation" "opinion poll" "survey" "result"
= "result of a nation-wide opinion poll"
While it seems clear that Japanese complex compounds show a syntactic asymmetry in the sense that the left-branching structure is much preferred to the right-branching structure, the reason for this asymmetry is not clear. A consideration of Japanese sentence structure might hint that it has something to do with the language being a 'left-branching language' or a language which favors the left-branching structure in general (cf. Kuno, 1973: 6). Although Japanese is admittedly a 'left-branching language,' this speculation seems untenable since English, a typical 'right-branching language, also favors left-branching compounds as against right-branching ones (cf. Chomsky & Halle, 1968:92). Another and more plausible account is to link the asymmetry in question to the unmarked word order, that is, to the fact that the Japanese as well as English favors the word
order [modifier + head] rather than [head + modifier]. This account may be supported by the Ladd's (personal communication) observation that the right-branching structure appears to be preferred in French, a typical [head + modifier] language. This line of research may shed some new light on the relationship between word formation and sentence structure, but I do not propose to explore this topic in this thesis.

A second noteworthy observation from the present analysis of complex compound nouns is one of the asymmetry regarding the lexical status of component words. Generally speaking, complex compound nouns predominantly involve Sino-Japanese words, with many consisting purely of words of this origin (e.g. (34)-(37)). By contrast, both native Japanese and foreign (other than Sino-Japanese) words tend to become rarer as the compounds become more complex. Thus, complex compounds consisting solely of native Japanese words are mostly three-element compounds, typically involving a deverbal (or de-adjectival) noun as a second member (e.g. (38a)). Moreover, compounds made up of four or more components involve native Japanese words only in combination with Sino-Japanese words (e.g. (38b)). Similarly, foreign words do not generally constitute a complex compound on their own but are blended with Sino-Japanese words (e.g. (38c)). Exceptions to this may be those compounds borrowed from foreign languages as such (e.g. (38d)), where it seems the notion of compound is not often clearly felt by native speakers of Japanese.
3.1.2. Basic Rule

As mentioned above, the left-branching structure is the unmarked constituent type in Japanese compounds. Compounds of this type show a rather uniform accentual pattern with the exception of those which are subject to the semantic constraint — e.g. (20) — or the rhythmic constraint to be discussed in section 3.4 below. Putting aside these exceptional cases for a moment, left-branching three-noun compounds yield one unified accentual phrase in which the rightmost element (i.e. head noun) determines the accentuation of the whole compound according to the compound rules (CARs) outlined in section 1.2 above:

(39) [[A B] C] → ABC

a) (=(34a))

[[syā'kai syu'gi] ko'kka] → syakaisyugiko'kka

b) (=(38a))

[[asi' naga] ozisan] → asinagao'zisan
3.2. Semantic Constraint

3.2.1. Semantic Constraint Summarized

In illustrating prosodically non-unified compounds in section 2.1.2 above, I briefly outlined the semantic constraint on the prosodic compound formation process. Before discussing the effect of this constraint in complex compound nouns, let us consider two interesting questions about the constraint itself.

The first question is what general principle, if any, lies behind the marked semantic structures constituting the constraint. That is, given the seven types of marked semantic structures in (15), one may rightly ask why compounds involving these semantic structures reject the application of the prosodic process, thereby failing to unify themselves into a single accentual phrase. A couple of answers can be conceived to this question, but none seems to provide a satisfactory account.

From the cases in (15e) and (15f), for example, it may be hypothesized that noun sequences involving a proper name constitute exceptions to the process. This idea can be easily refuted by the fact that Japanese has a number of compounds which

\[ c) \text{ (38c)} \]
[[mo'otaa bo'oto] kyoosoo] \[\rightarrow\] mootaabootokyo'osoo

\[ d) \text{ (38d)} \]
[[ku'rosu wa'ado] pa'zuru] \[\rightarrow\] kurosuwaadopa'zuru
involve a proper name (personal or impersonal) but which readily take the compound accent pattern: E.g.

(40) a) Organization

  tookyoo daigaku → tookyooda'igaku
  "Tokyo" "university" = "Tokyo University"

  niho'n ginkoo → nihongi'nkoo
  "Japan" "bank" = "Bank of Japan"

  sat'tyaa na'ikaku → sattyana'ikaku
  "Thatcher" "government" = "Thatcher Government"

  re'egan seiken → reeganse'iken
  "Reagan" "administration" = "Reagan Administration"

b) Place

  tookyoo eki → tookyo'oeki
  "Tokyo" "station" = "Tokyo Station"

  nyuuyoo'oku syu'u → nyuuyooku'syuu
  "New York" "state" = "New York State"

  hibiya kooen → hibiyako'oen
  "Hibiya" "park" = "Hibiya Park"

c) Time

  e'do zidai → edozi'dai
  "Edo" "period" = "Edo Period"

  me'izi i'sin → meizii'sin
  "Meiji" "restoration" = "Meiji Restoration"

d) Others

  a'sahi sinbun → asahisi'nbun
  "Asahi" "newspaper" = "Asahi Newspaper"
Alternatively, it may be hypothesized that the semantic constraint is characterizable on the notion of "subcategorization" in such a way that the prosodic process is blocked if the attribute (i.e. N1) does not subcategorize the head noun (i.e. N2). This generalization is partly justifiable since few, if any, of the prosodically non-unified compounds in (15) or other similar examples in my corpus involve the subcategorization of the head noun by the noun in the attributive position: *yu'kawa ha'kase* "Dr Yukawa" does not refer to a particular category of doctor, *ka'too kvoozvu* "Professor Kato" does not denote a special type of professor, etc., while *igakuha'kase* "doctor of medicine" and *meiyokvo'ozvu* "Professor Emeritus" denote a particular type of doctor and professor, respectively. It must be noted, however, that Japanese has many compounds which do not involve the semantic relation in question and yet undergo the compounding process. The proper names cited just above in (40) are good examples of this: *tookyooda'igaku* "Tokyo University" does not name a special type of university, *nyuuvooku'syuu* "New York State" does not denote a special
category of state, etc. In fact, one can find many examples like these, so many that it seems impossible to generalize the semantic constraint under the notion of "subcategorization". What one can do at best will be to propose an implicational law as in (41) or a picture as in (42) to describe the relation between the two events.

(41) Implicational Law

If PCFP does not apply to [XY]n when both X and Y represent terminal elements, then X does not subcategorize Y.

(42)

<table>
<thead>
<tr>
<th>PCFP applies</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>X subcategorizes Y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>YES</td>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>NO</td>
<td>OK</td>
<td></td>
</tr>
<tr>
<td>e.g. (40)</td>
<td></td>
<td>OK</td>
</tr>
<tr>
<td>e.g. (15)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All in all, there seems to be no single principle which uniquely characterize all the marked semantic structures in (15) as opposed to others. I will therefore content myself here with the classification developed in (15), leaving the issue as an open question for future work.

The other question I would like to raise here is one of the similarities to be observed between Japanese and English as regards the semantic constraint. As is well known, English exhibit two types of simplex compounds as does Japanese, (a)
those which readily undergo the compound stress rule (CSR) to yield a compound stress pattern with the main stress on the initial element —(43a) — and (b) those which fail to undergo CSR to yield a phrasal stress pattern with the main stress on the second element —(43b):

(43) Two Types of English Compounds

a) Initially-Stressed Compounds

BLACKboard, WHITE house, GREENhouse,

b) Finally-Stressed Compounds

lawn TENNIS, morning PAPER, orange SQUASH

As in the case of Japanese compounds, no precise borderline can be drawn between these two types of compounds, e.g. (44). Nor is there apparently any general principle which can uniquely characterize the distinction (cf. Fudge, 1984; Ladd, 1984). It is often claimed, however, that finally-stressed compounds can be broadly distinguished from initially-stressed counterparts on the basis of the semantic structure which the component words form (cf. Sweet, 1891; Kingdon, 1958; Fudge, 1984). In other words, finally-stressed compounds can be seen as exceptional cases of compounds, cases where CSR is blocked because of the marked semantic structures involved.
What is more interesting about the semantic constraint thus defined is that some of the marked semantic structures constituting the constraint in English are crucially similar to those cited about Japanese, i.e. those in (15). For example, compound nouns whose component words constitute a coordinate relation generally fail to undergo CSR as illustrated in (45a): cf. Adams (1973). Likewise, the compound rule generally fail to apply to compound nouns which constitute a personal name, e.g. (45b), as well as to those made up of a personal name plus the person's social/occupational position or status, i.e. (45c). The compound rule does not apply to many of those compounds which involve the name of an organization followed by a noun representing a position in it, i.e. (45d). These examples are comparable to the Japanese cases we saw in (15) (i.e. (15b), (15a), (15e) and (15d) respectively.)
(45) Semantic Constraint in English

a) Coordinate Relation<22>

producer-DIRECTOR, king-EMPEROR, historian-POLITICIAN

b) Personal Name: [given name + family name]

William JONES, Mary SMITH, Margaret THATCHER

c) [Status/Position + Personal Name]<23>

Professor HIGGINS, Colonel PICKERING, President REAGAN, Doctor JONES

d) [Organization + Position]<24>

department CHAIRMAN, company EXECUTIVE, team MANAGER, university PROFESSOR

It is not clear why these particular semantic structures constitute a semantic constraint on the prosodic compounding process both in Japanese and English. It is worth emphasizing, however, that the very similarities shown by the two languages in this respect suggest that the content of the semantic constraint is not determined purely by language-particular factors but is attributable, at least in part, to some universal principle. Although I do not propose to go into this question any further in this thesis, a cross-linguistic study of the problem may give some interesting insights into the relations between the semantic and prosodic structures of compounds, leading to the generalization of the relations as a language-universal rule.
3.2.2. Semantic Constraint in Three-Element Compounds

While many complex compound nouns yield one unified accentual phrase, as illustrated in (39), there are also many compound nouns which are phrased into more than one accentual unit. One of the major sources of these multi-phasal compounds is those which are subject, in some way or other, to the semantic constraint sketched in (15) above. In fact, as compounds become longer and involve a more complicated structure, they are more likely to involve two nouns subject to the constraint, particularly those constituting a coordinate structure or a case relation. (46)-(48) illustrate the effect of the semantic constraint in three-element compound nouns. The first two component words of these compounds involve, respectively, a coordinate relation (cf. (15b)), a case relation (cf. (15c)), and the sequence of an organization plus a position in it (cf. (15d)).

(46) $[[A \, B] \, C] \rightarrow A/DC$, where $[A \, B]$ = coordinate structure

a) $[[zi'yu'u \, minken] \, undoo] \rightarrow zi'yu'u \, minkenu'ndoo$

"freedom" "civil rights" "movement"

= "movement for freedom and civil rights"

b) $[[zi'yu'u \, mi'nsyu] \, to'o] \rightarrow zi'yu'u \, minsyutoo$ (+DeAcc)

"freedom" "democracy" "(political) party"

= "Liberal-Democratic Party"

c) $[[zi'syu \, dokuritu] \, undoo] \rightarrow zi'syu \, dokurituu'ndoo$

"autonomy" "independence" "movement"

= "independence movement"
d) \([\text{[i'ndo yooroppa] go'zoku}] \rightarrow \text{i'ndo yooroppago'zoku}\)

"India" "Europe" "language family"  
= "Indo-European Family of Languages"

e) \([\text{i'ppu tasai] seido}] \rightarrow \text{i'ppu tasaise'ido}\)

"one husband" "many wives" "system" = "polygamy"

f) \([\text{ma'rukusu re'enin] syu'gi}] \rightarrow \text{ma'rukusu reeninsyu'gi}\)

"Marx" "Lenin" "principle" = "Marxism-Leninism"

g) \([\text{sa'ttyaa re'egan] kaidan}] \rightarrow \text{sa'ttyaa reeganka'idan}\)

"Thatcher" "Reagan" "meeting"  
= "Thatcher-Reagan meeting"

h) \([\text{zikiyu zisoku] ke'izai}] \rightarrow \text{zikiyu zisokuke'izai}\)

"self-supply" "self-sufficiency"  
= "self-supporting economy"

i) \([\text{hatuon a'kusento] zi'ten}] \rightarrow \text{hatuon akusentozi'ten}\)

"pronunciation" "accent" "dictionary"  
= "dictionary of pronunciation and accent"

(47) \([\text{[A B] C}] \rightarrow \text{A/BC, where [A B] = case relation}\)

a) \([\text{[ko'omu sikkoo] boogai}] \rightarrow \text{ko'omu sikkoobo'ogai}\)

"official duties" "execution" "interference"  
= "interference with a government official in the execution of his duties"

b) \([\text{da'nyyo byoodoo] hooan}] \rightarrow \text{da'nyyo byoodooho'oan}\)

"men and women" "equality" "bill"  
= "Sex Equality Bill"

c) \([\text{ke'npo kaisei] mondai}] \rightarrow \text{ke'npo kaiseimo'ndai}\)

"Constitution" "reform" "problem"  
= "constitutional reform issue"
d) \[\text{[mo'ndko kaihoo syu'gi]} \rightarrow \text{mo'ndko kaihoosyu'gi}\]
   "door" "open" "principle" = "open-door principle"

e) \[\text{[ta'itoru booei sen]} \rightarrow \text{ta'itoru booeisen}\]
   (+DeAcc)
   "title" "defense" "match" = "title defense match"

f) \[\text{[o'nsei tazyuu hoosoo]} \rightarrow \text{o'nsei tazyuuho'osoo}\]
   "sound" "multiplex" "broadcast" = "bilingual broadcast"

g) \[\text{[da'nzyo kyoogaku se'idio]} \rightarrow \text{da'nzyo kyoogakuse'idio}\]
   "men and women" "co-education" "system" = "co-education system"

h) \[\text{[ta'iki bansei] kata']} \rightarrow \text{ta'iki banseigata}\]
   (+DeAcc)
   "great talent" "to bloom late" "type" = "late-bloomers"

i) \[\text{[zyosei kaihoo undoo]} \rightarrow \text{zyosei kaihoou'ndoo}\]
   "women" "release" "movement" = "Women's Liberation Movement"

(48) \[[\text{A B} C] \rightarrow \text{A/BC},\]
    where \[\text{[A B]} = \text{[organization + status]}\]

a) \[\text{[ka'kutoo daihyoo] situmon]} \rightarrow \text{ka'kutoo daihyoosi'tumon}\]
   "each party" "representative" "questions"
   "queries by the representative of each party"

b) \[\text{[seito'kai kaiyoo] se'nkyo]} \rightarrow \text{seito'kai kaiyoose'nkyo}\]
   "student union" "president" "election"
   = "student union president election"

As suggested in section 2.1.2 above (cf. (21)), the compound
formation process takes place over the last two elements in (46)–
(48) even though it is blocked over the initial two elements.
That is, these compounds are phrased into two accentual units: the initial element forms a phrase on its own with the word accent (if any) intact, while the second and third elements undergo the compounding process to yield a compound accent on a proper syllable (except, of course, when the third element happens to be a deaccenting morpheme as in (46b) and (47b)). Although there are exceptions to the 'law' embodied in (46)-(48), the semantic constraint accounts for a good part of the three-element compound nouns taking a bipartite accentual pattern.

What must be noted in regard to the accentual patterning in (46)-(48) is that the second and third elements, \( B \) and \( C \), form one accentual phrase to the exclusion of the first one, \( A \), although \( B \) forms a (syntactic) constituent with \( A \) rather than with \( C \). This syntax-phonology mapping relation, which represents a discrepancy between the syntactic (constituent) structure and the phonological structure, is a phenomenon rather commonly observed in the compounding process in Japanese and, for that matter, in Japanese phonology in general.

As we shall see shortly (see also (30) given above), for example, compound constructions involving more complex structures exhibit accentual patterns as illustrated in (49) below, where '/' indicates an accentual phrase boundary:

\[
\begin{align*}
(49) \quad & a) \quad [[[A \ B] \ C] \ D] \rightarrow (APF) \rightarrow A/BCD, AB/CD, A/B/CD \\
& b) \quad [[A \ [B \ C]] \ D] \rightarrow (APF) \rightarrow A/BCD
\end{align*}
\]
The same accentual patterning as exemplified in (46)-(48) is also found in left-branching compound constructions which involve a special kind of prefix-type morphemes in the initial position.

(50) \[[[A B] C] \rightarrow A/BC, \text{where } A = \text{special prefix}\]

a) \[[[zi'ki \ daito'oryoo] \ ko'oho}^{28}\]
   \[\rightarrow zi'ki \ daitooryooko'oho\]
   "next" "president" "candidate"
   = "candidate for the next President"

b) \[[[tyo'o \ yuumei] \ daigaku] \rightarrow tyo'o \ yuumeida'igaku\]
   "ultra" "famous" "university"
   = "ultra-famous university"

c) \[[[ta'i \ betonamu] \ seisaku]\]
   \[\rightarrow ta'i \ betonamuse'isaku\]
   "against" "Vietnam" "policy"
   = "policy towards Vietnam"

The kind of syntax-phonology discrepancy as in (46)-(48) is found not only in the accentual phrasing process in compound formation but also in the intonational phrasing process (MPF), which was briefly sketched in sections 2.2 and 2.3 above. Thus, the second and third elements in (51a) form a single intonational phrase even if the sequence of the first and second elements do not constitute a unified intonational phrase because of a certain constraint on the phrasing process. Likewise, the phrasing process yields a single intonational phrase out of the sequence of the last three elements in (51b) to the exclusion of the first element which forms a syntactic constituent with the second element.
(51)  a) \([\text{[A B] C}] \rightarrow \text{A/BC}\)

b) \([\text{[A [B C]] D}] \rightarrow \text{A/BCD}\)

All these additional facts suggest that the accentual patterning in (46)-(48) is not an exceptional phenomenon but represents a subcase of a rather general rule in the prosodic system of Japanese. I will come back to this issue and discuss its theoretical implications in depth later (section 3.6 as well as Chapter Four, section 6).

3.2.3. Semantic Constraint in More Complex Compounds

The effect of the semantic constraint can be further found in compound constructions more complex than those discussed in the preceding section. Uniformly left-branching compound nouns whose initial two members are subject to the semantic constraint, for example, show the accentual pattern as shown in (52), whereby the first element constitutes an accentual (and intonational) unit independently of the rest of the compound:
(52) $[[[A \ B] \ C] \ D] \rightarrow A/BCD$

(i) $[A \ B] = \text{coordinate structure}$

a) $[[[ziyu'u \ mi'nsyu] to'o] \ taikai]$  
   $\rightarrow \ ziyu'u \ mi'nsyutoota'ikai$

"freedom" "democracy" "party" "conference"  
= "Liberal-Democratic Party conference"

b) $[[[ma'rukusu \ re'enin] \ syu'gi] \ sisoo]$  
   $\rightarrow \ ma'rukusu \ reeninsyugisi'soo$

"Marx" "Lenin" "principle" "idea"  
= "Marxism and Leninism Theory"

c) $[[[ziyu'u \ minken] \ undoo] \ si]$  
   (+PreAcc)  
   $\rightarrow \ ziyu'u \ minkenundo'osi$

"freedom" "civil rights" "movement" "history"  
= "history of the movement for freedom and civil rights."

ii) $[A \ B] = \text{Case Relation}$

a) $[[[ko'omu \ sikkoo] \ boogai] \ zai]$  
   (+PreAcc)  
   $\rightarrow \ ko'omu \ sikkooobo'igai$

"official duties" "execution" "interference" "crime"  
= "crime of interference with a government official in the execution of his duties"

b) $[[[da'nzyo \ kyoogaku] \ se'ido] \ mondai]$  
   $\rightarrow \ da'nzyo \ kyoogakuseidomo'ndai$

"men and women" "co-education" "system" "problem"  
= "issue of co-education system"

c) $[[[i'si \ yuuguu] \ zeisei] \ hooan]$  
   $\rightarrow \ i'si \ yuuguuzeiseiho'oan$

"doctor" "to treat favorably" "tax system" "bill"  
= "pro-doctor tax bill"

d) $[[[ta'iki \ bansei] \ kata'] \ ningen]$  
   $\rightarrow \ ta'iki \ banseigatani'ngen$

"great talent" "to bloom late" "type" "man"  
= "late-bloomers"
Similarly, uniformly left-branching compound nouns yield two accentual units when the sequence of their initial two members constitutes a case relation with the third member, with a phrase boundary introduced between the second and third elements. (Note that the sequence of the two component words in question cannot form a coordinate structure to the exclusion of the initial component in the compound constructions under consideration.)

(53) $[[[A B] C] D] \rightarrow AB/CD,$
where $[[AB] C] = $ case relation

a) $[[[niho'n bu'nka] kenkyuu] se'ntaa]$  
$\rightarrow$ nihonbu'nka kenkyuuse'ntaa

"Japan" "culture" "research" "center"  
= "Center for Japanese culture research"

b) $[[[niho'n rettoo] kaizoo] ro'n]$
   (+PreAcc)  
$\rightarrow$ nihonre'ttoo kaizo'oron

"Japan" "archipelago" "reconstruction" "theory"  
= "Japanese Archipelago Reconstruction Plan"

c) $[[[hoppoo ryo'odo] henkan] mondai]$  
$\rightarrow$ hoppooryo'odo henkanmo'ndai

"north" "territory" "retrocession" "problem"  
= "northern territory retrocession issue"

d) $[[[koku'nai sizyoo] kaihoo] mondai]$  
$\rightarrow$ kokunaisi'zyoo kaihoomo'ndai

"home" "market" "open" "problem"  
= "issue of the opening of the domestic market"

e) $[[[kanbozis nanmin] lcyuuen] undoo]$  
$\rightarrow$ kanboziana'nmin kyuuenu'ndoo

"Cambodia" "refugee" "rescue" "movement"  
= "Cambodian refugee rescue campaign"

f) $[[[yozyoo zinin] kaisyoo] mondai]$  
$\rightarrow$ yozyoozi'nin kaisyoomo'ndai

"redundancy" "workers" "solution" "problem"  
= "redundant workers reemployment issue"
The semantic constraint can apply more than once within a given compound expression, decomposing it into more than two accentual units. Although instances of this accentual pattern are rare, this is simply because few compound nouns involve the marked semantic structures in question more than once, not because the semantic constraint fails to apply to such compounds. Thus, the accentual pattern in (54) results if (i) the first three nouns constitute a coordinate structure, (ii) the first two nouns constitute a case relation with each other and with a third member at the same time, and (iii) the first two nouns combined form a case relation with the third noun while constituting a coordinate structure with each other:

(54)

(i) \([A B C] D \rightarrow A/B/CD\)

a) \([kyooiku ka'gaku bu'nka] ki'kan\)
   \(\rightarrow\) kyooiku ka'gaku bunkaki'kai

   "education" "science" "culture" "organization"
   = "(UN)ESOO"

b) \([ooa'me kyoohuu haroo] tyuuui'hoo\)
   \(\rightarrow\) ooa'me kyoohuu harootyuui'hoo

   "heavy rain" "stormy wind" "surge" "warning"
   = "storm warning"
(ii) \([[[[A \ B] \ C] \ D] \rightarrow A/B/CD\)

   a) \([[[[t'i'ngin neage] yookyuu] undoo] \rightarrow t'i'ngin neage yookyuu'ndoo\]

   "wage" "increase" "demand" "movement"
   = "wage increase demand campaign"

   b) \([[[[orinpi'kku yu'uti] hantai] undoo] \rightarrow orinpi'kku yu'uti hantaiu'ndoo\]

   "Olympics" "staging" "protest" "movement"
   = "campaign against the staging of the Olympics"

   c) \([[[[ko'ozan heisa] hantai] undoo] \rightarrow ko'ozan heisa hantaiu'ndoo\]

   "coal mine" "closure" "protest" "movement"
   = "campaign against the mine closure"

(iii) \([[[[A \ B] \ C] \ D] \rightarrow A/B/CD\)

   a) \([[[[ze'nkoku ze'ndo] kooenka] koosoo] \rightarrow ze'nkoku ze'ndo kooenkako'osoo\]

   "whole nation" "whole land" "beautification"
   "plan" = "nation-wide cleaning plan"

In sum, the semantic constraint enables us to account for
the most, if not all, instances of the accentual split which many
complex compound constructions show.

3.3. Branching Constraint

Up to this point, we have considered only those compounds
which involve the left-branching structure. As exemplified in
section 3.1.1 above, however, Japanese permit compounds involving
the right-branching structure and, for that matter, compounds
uniformly organized by the right-branching structure (i.e.
uniformly right-branching compounds) as well. Although the
number of these compounds is relatively small, as has been
mentioned, it is not too small to be completely ignorable. On the contrary, recognition of this marked type of compound structure and its characteristic accentual behavior is essential for a full and adequate understanding of the accentual patterns which Japanese compounds exhibit. Moreover, Japanese compounds show essentially the same behavior as those of English in that the right-branching constituent node blocks the application of the prosodic compound formation process. By way of introduction to the right-branching compound nouns in Japanese, let us briefly consider those in English first.

3.3.1. Branching Constraint in English Compounds

Compounds involving the right-branching structure (henceforth, "right-branching compounds" for short) have drawn relatively little attention in the phonology of English, presumably because "such constructions are rare" (Chomsky & Halle, 1968: 92). However few they may be, compounds of this type are in fact found in English, as illustrated in (55) below (cf. Chomsky & Halle, ibid.: 93; Halle & Keyser, 1971: 20–2; Liberman & Prince, 1977: 267–9; Selkirk, 1984: 249–50):

(55) Right-Branching Compounds in English

  a) [evening [computer class]]
     "computer class held in the evening"

  b) [theater [ticket office]]
     "ticket office in the theater"

  c) [kitchen [towel rack]]
     "towel rack in the kitchen"

  d) [chemistry [research-laboratory]]
     "research laboratory for chemistry"
When the right-hand element of a compound is itself branching as in (55), the nuclear stress is placed on the second element (i.e. on the element in the attributive position of the right-hand element) in unmarked, non-contrastive context (capitalized words, again, indicate that they take the nuclear stress):

(56) Prominence Pattern

a) evening COMPUTER class
b) theater TICKET office
c) kitchen TOWEL rack
d) chemistry RESEARCH-laboratory

In other words, the compounds in (55) have the same overall stress (prominence) pattern as phrase constructions consisting of a modifier plus a compound as given in (57):

(57) \[A \ [B \ C]_n \] _np

a) popular COMPUTER class
b) small TICKET office
c) old TOWEL rack
d) famous RESEARCH-laboratory

The stress pattern in (56) contrasts with that of many left-branching compounds, in which the compound stress rule generally yields greatest prominence on the compound-initial element:
(58) Left-Branching Compounds in English

a) [[LABOR union] president]
   cf. [LABOR union], [UNION president]

b) [[RADIO station] manager]
   cf. [RADIO station], [STATION manager]

c) [[COMMUNITY center] building]
   cf. [COMMUNITY center], [CENTER building]

The notion that the phrasal stress pattern in the compounds in (56) should be attributed to their structural configuration, and not to any semantic factors, can be readily verified by the fact that the first and last elements in (56) form initially-accented compounds when they form a compound to the exclusion of the second element (cf. Chomsky & Halle, ibid.:93): EVENING class, THEATER office, KITCHEN rack and CHEMISTRY laboratory. This confirms that the right-branching node blocks the application of the compound stress rule and, as a consequence, yields the default phrasal stress pattern between the first element and the rest.

This rule is capable of handling not only the simple right-branching compounds as in (55)-(56) but the stress pattern of more complex compounds as well. Thus, compounds consisting of four elements take the nuclear stress on the left-most element dominated by the right-branching node in the two types of compound constructions below (cf. Liberman & Prince: pp. 258-9):<30>
(59)

(i) a) [[law degree] [LANGUAGE requirement]]
   b) [[labor union] [FINANCE committee]]

(ii) a) [[evening [COMPUTER class]] instructor]
   b) [[kitchen [TOWEL rack]] refill]
   c) [[theater [TICKET office]] manager]

3.3.2. Branching Constraint in Japanese Compounds

Just as the right-branching structure induces a phrasal stress pattern in preference to the compound accent pattern in English, so the right-branching structure in Japanese compounds has the effect of blocking the otherwise uniform application of the compound formation process, thereby yielding a phrasal accent pattern (cf. (22)). In fact, the only major difference between English and Japanese in this regard is one of realization. The compound and phrasal patterns in English are realized as a difference in relative prominence pattern, whereas in Japanese the two patterns differ in the patterns they take as regards accentual phrasing. To be more specific, compound accent pattern in Japanese involves modification of word accents in order to unify two potential accentual units into one, while its phrasal counterpart is defined as a default case of this accentual process: cf. (14) in section 2.1.1 above.

With this realizational difference in mind, let us consider how the right-branching structure behaves in Japanese compounds. (60) illustrates compound nouns consisting of three elements with the last two nouns forming a constituent:
(60) \[ A[B,C]_n \rightarrow A/BC^{<31><32>} \]

a) \((= (22a)) [ni\'tibei [a\'npo zyooyaku]] \rightarrow ni\'tibei anpozyo\'oyaku

b) \((= (22b)) [na\'goya [ko\'ogyoo daigaku]] \rightarrow na\'goya koogyooda\'igaku

c) [tiho\'o [kookyoo dantai]] \rightarrow tiho\'o kookyooda\'ntai

"area" "public" "body" = "local public body"

d) [ni\'ttyuu [yuukoo kyookai]] \rightarrow ni\'ttyuu yuukkyoyo\'okai

"Japan-China" "friendly relation" "association" = "Sino-Japanese Friendship Society"

e) [ze\'nkoku [yo\'ron tyo\'osa]] \rightarrow ze\'nkoku yorontyo\'osa

"whole land" "public opinion" "survey" = "nation-wide opinion poll"

f) [se\'kai [saikoo kiroku]] \rightarrow se\'kai saikooki\'roku

"world" "best" "record" = "world (best) record"

g) [se\'kai [zinken sengen]] \rightarrow se\'kai zinkense\'ngen

"world" "human rights" "declaration" = "World Human-Rights Declaration"

h) [ta\'nki [ka\'igai ryuugaku]] \rightarrow ta\'nki kaigairyu\'ugaku

"short period" "overseas" "study abroad" = "short-time study abroad"

i) [ko\'ohaku [uta\' kassen]] \rightarrow ko\'ohaku utaga\'ssen

"red and white" "song" "battle" = "singing contest between two groups"

j) [kokuritu [geizyutu kyookai]] \rightarrow kokuritu geizyutukyo\'okai

"national" "art" "association" = "National Art Association"
k) [kokusai [roodoo ki'kan]]
    \[\rightarrow\] kokusai roodooki'kan

"inter-nation" "labor" "organization"
    = "International Labor Organization"

In (60), the last two elements constitute a single accentual phrase by undergoing the compounding process while the first element forms an accentual unit on its own with its word accent (if any) intact. This accentual pattern is exactly the same as what we observed with left-branching compounds subject to the semantic constraint, i.e. (20) and (46)–(48) (and, accordingly with the accentual pattern of noun phrases consisting of an adjective plus a compound noun — see NOTE <31>).

Given the examples in (60), it might be hypothesized that the resultant accentual pattern may have to do with the semantic content of the left-hand (i.e. left-most) element. This speculation may be justifiable, at least partially, since many of the right-branching compounds in my corpus take as their left-hand element a noun representing such things as a 'place' (e.g. (60b), or 'time' (e.g. (60h)).<33> While this speculation is worth exploring in more depth, it must be emphasized that it does not invalidate the notion of 'branching constraint' and the generalization on syntax. That the accentual split in (60) is essentially attributable to the structural configuration of the compounds is clearly shown by the compounds in (61) below, where it is shown that the left-hand elements in (60) readily undergo the compounding process if the second element is left out.
In sum, it can be said that the prosodic compound formation process (PCFP) is blocked by a right-branching node. Compared with the accentual pattern which unmarked left-branching compounds show (cf. (39)), this means that the right-branching
structure shows a marked prosodic behavior by rejecting the process of accent phrase formation (APF), that is, by taking the phrasal accentual pattern instead of the compound accent pattern. This point can be summarized as follows:

(62) Syntax-Related Asymmetry in APF

a) \([A B] \rightarrow AB\)
b) \([A B C] \rightarrow ABC\)
c) \([A [B C]] \rightarrow A/BC\)

It is interesting to note in this connection that the prosodic asymmetry as we find between right-branching compounds and their left-branching counterparts is not restricted to the compound formation process but is a phenomenon rather generally observed in Japanese phonology. As we shall see in Chapter Four, the two types of constituent structures show an asymmetry comparable to the one in (62) in regard to the intonational phrasing process, i.e. 'minor phrase formation (MPF),' with the right-branching structure blocking the phrasing process.

Moreover, a constraint of essentially the same nature is found to apply on the process of *rendaku*, which, as mentioned in section 2.1.1 above, voices an initial voiceless consonant of the second member in a certain class of compounds. As Otsu (1980) notes, this voicing process does not apply over the right-branching node (e.g. (63b)) while its application is in no way blocked by the left-branching node (e.g. (63a)):°
(63)

(i)  
\text{nise} "pseudo" + \text{tanuki} "raccoon dog" + \text{siru} "soup"

\begin{itemize}
  \item[a)] \text{[[nise tanuki] siru]}
  \begin{align*}
  & \downarrow \\
  & d \\
  & z \\
\end{align*}
  "soup made from a pseudo raccoon dog"

  \item[b)] \text{[nise [tanuki siru]]}
  \begin{align*}
  & \downarrow \\
  & d \\
  & z \\
\end{align*}
  "raccoon dog soup which is not authentic"
\end{itemize}

(ii)  
\text{nuri} "lacquered" + \text{hasi} "chopstick" + \text{ire} "case"

\begin{itemize}
  \item[a)] \text{[[nuri hasi] ire]}
  \begin{align*}
  & \downarrow \\
  & b \\
\end{align*}
  "case for lacquered chopstick"

  \item[b)] \text{[nuri [hasi ire]]}
  \begin{align*}
  & \downarrow \\
  & b \\
\end{align*}
  "chopstick case which is lacquered"
\end{itemize}

Having understood that the prosodic asymmetry as shown in (62) is a general phenomenon in Japanese phonology, let us tentatively formulate the branching constraint in (62c) as in (64a) or (64b), which conditions the prosodic compound formation process (PCFP), or to be more exact, on 'accent phrase formation' (APF) (cf. Kubozono, 1985:69 — See Appendix II).

(64) Branching Constraint on PCFP (APF) — (tentative)

\text{In[X Y], XY forms one accentual phrase}

\begin{itemize}
  \item[a)] unless Y branches.
  \item[b)] if Y is a terminal element.
\end{itemize}

The branching constraint, whichever version one may adopt, correctly predicts that the right-branching compounds in (60) result in two accentual phrases, yielding a prosodic asymmetry
with left-branching counterparts as shown in (62).

3.3.3. Generalizations on Branching Constraint

3.3.3.1. Three-Element Compounds

The branching constraint outlined and tentatively formulated above enables us to account for a number of accentual phenomena which would otherwise remain unaccounted for. It explains, for instance, why there is a difference in accentual pattern between (i) a full form of compound expressions and (ii) their shortened (abbreviated) form:

(65) (= (22), (23))

a) "Japan-US Security Treaty"

(i) [ni'tibei a'npo zyooyaku] → ni'tibei anpozyo'oyaku
(ii) [ni'tibei a'npo] → nitibeia'npo

b) "Nagoya Institute of Technology"

(i) [na'goya ko'ogyoo daigaku] → na'goya koogyooda'igaku
(ii) [na'goya koodai] → nagoyako'odai

Similarly, the branching constraint can easily handle the distinctive function of the accentual phrasing process, that is, the fact that some compound expressions disambiguate their structural ambiguity by the accentual phrasing patterns they choose. This is illustrated in (66), in which (i) and (ii) represent the right-branching and left-branching interpretations respectively:
(66) Structurally Ambiguous Compounds

a) \textit{niho'n-buyoo-kyookai} "Japan-dance-association"

(i) \([\text{niho'n} \ [\text{buyoo} \ kyookai]] \rightarrow \text{niho'n buyookyo'okai}\)

"Japan Dancing Association"

(ii) \([\text{niho'n} \ \text{buyoo} \ kyookai] \rightarrow \text{nihonbuyookyo'okai}\)

"Association for Japanese Dance"

b) \textit{do'itu-bu'ngaku-kyookai}

"Germany-literature-association"

(i) \([\text{do'itu} \ [\text{bu'ngaku} \ kyookai]] \rightarrow \text{do'itu bungakukyo'okai}\)

"Literary Society of Germany"

(ii) \([\text{do'itu} \ \text{bu'ngaku} \ kyookai] \rightarrow \text{doitubungakukyo'okai}\)

"Society for German literature"

Moreover, the branching constraint can account for the differences in accentual patterning between pairs of similar expressions, including the pair in (67a) below, whose accentual difference Hayata (1969) observes but leaves unexplained. (Again, (i) and (ii) denote the right-branching and left-branching structures respectively, while (iii) represents a simplex two-element compound structure):<36>

(67) Pairs of Similar Compound Expressions

a) (i) \([\text{bo'suton} \ [\text{re'ddo} \ so'kkusu]} \ "\text{Boston Red Sox}\"

\(\rightarrow \text{bo'suton reddoso'kkusu}\)

(ii) \([\text{nyu'u yo'oku} \ ya'inkiisu}] \ "\text{New York Yankees}\"

or \([\text{nyuuyo'oku} \ ya'inkiisu}] \rightarrow \text{nyuuyookuya'inkiisu}\)
b) (i) [to'oa [koku'nai kookuu]]
   \[\rightarrow to'oa koku\text{a}ko'okuu\]
   "Toa" "inland" "airline" = "Toa Domestic Airlines"

(ii) [[ze'n niho'n] kookuu]
   \[\rightarrow \text{ze}n\text{h}i\text{n}ko'okuu\]
   "all" "Japan" "airline" = "All Nippon Airways"

(iii) [niho'n kookuu] \[\rightarrow \text{n}i\text{ho}'okuu\]
   "Japan" "airline" = "Japan Airlines"

c) (i) [kokuritu [geizyutu kyookai]]
   \[\rightarrow \text{kokuritu} geizyutukyo'okai\]
   "state(-run)" "art" "association"
   = "National Art Association"

(ii) [[kokuritu daigaku] kyookai]
   \[\rightarrow \text{kokuritu} daigakukyo'okai\]
   "state(-run)" "university" "association"
   = "Association of National Universities"

d) (i) [kokusai [roodoo kikoo]]
   \[\rightarrow \text{kokusai} roodo'ki'koo\]
   "international" "labour" "organization"
   = "International Labour Organization (ILO)"

(ii) [[kokusai rengoo] kensyoo]
   \[\rightarrow \text{kokusai} rengooke'nsyoo\]
   "international" "union" "charter"
   = "United Nations Charter"

3.3.3.2. Four-Element Compounds

The branching constraint holds not only in compounds comprising three elements but in more complex compounds as well. (68)-(70) illustrate four-element compound nouns where the constraint blocks APF once in a given expression, that is, between the second and third elements in (68) and between the
initial two elements in (69) and (70):<37>

(68) [[A B][C D]] \rightarrow AB/CD

a) (= (36a)) [[ke'izai taisaku [kakuryoo ka'igi]]
\quad \rightarrow keizaitaisaku kakuryooka'igi

"economy" "measures" "cabinet member" "meeting"  
= "cabinet meeting on economic measures"

b) [[zi'syu ka'nri] [roodoo kumiaij]]
\quad \rightarrow zisyuka'nri roodookumiai

"autonomy" "control" "labor" "union"  
= "Solidarity Union (of Poland)"

c) [[terua'bibu kuukoo] [ransya zi'ken]]
\quad \rightarrow teruabibukukuukoo ransyazi'ken

"Tel Aviv" "airport" "attack" "incident"  
= "Tel Aviv Airport Terrorist Attack"

d) [[kakusei zai] [mansei tyu'udoku]]
\quad (+PreAcc)
\quad \rightarrow kakuse'izai manseityu'udoku

"awakening" "medicine" "chronicity" "addiction"  
= "chronic addiction to anti-hypnotic drug"

(69) [[A [B C]] D] \rightarrow A/BCD

a) (= (36b)) [[ze'nkoku [yo'ron tyo'osa]] kekka]
\quad \rightarrow ze'nkoku yo'rontyoosake'kka

"whole nation" "public opinion" "survey" "result"  
= "result of a nation-wide opinion poll"

b) [[tyu'ugoku [zanryuu ko'zi]] mondai]
\quad \rightarrow tyu'ugoku zanryukozimo'ndai

"China" "to remain" "orphan" "problem"  
= "problem of (war) orphans abandoned in China"

c) [[ka'nsai [si'n kuuroo]] mondai]
\quad \rightarrow ka'nsai sinkuukoomo'ndai

"Kansai (area name)" "new" "airport" "problem"  
= "problem of the New Kansai Airport"

d) [[ni'tibei [ke'izai masatu]] mondai]
\quad \rightarrow ni'tibei keizaimasumbo'ndai

"Japan-US" "economy" "friction" "problem"  
= "problem of Japan-US economic friction"
What deserves special emphasis here is the accentual pattern in (69), where the compounding process has applied between the last three elements despite that it is blocked between the first two elements. That is, APF (and, hence, the CARs) applies between $\mathcal{D}$ and $\mathcal{D}$ to the exclusion of $\mathcal{A}$ although $\mathcal{D}$ forms a constituent with $\mathcal{A}$ rather than with $\mathcal{D}$. This leads the compounds in (69) to have the same accentual pattern as those in (70), neutralizing the difference in constituent structure. This accentual patterning is attributable to two principles: the accentual split between the initial two elements is due to the prosodic asymmetry formulated as the branching constraint (64) while the accentual unification of the last three elements and the resultant neutralization with the compounds in (70) in
accentual patterning represent the discrepancy between the phonological structure and the syntactic (branching)/semantic structures of compound constructions which is parallel to the one pointed out in section 3.2 above. I will discuss the theoretical implications of this accentual patterning in section 3.6 below.

Just as the semantic constraint can apply more than once within a single compound expression, so the branching constraint can exert its effect more than once too. Thus, uniformly right-branching compounds (cf. (37)) are decomposed into three (or more) accentual units, as illustrated in (71) below:

(71) [A [B [C D]]] → A/B/CD

a) (= (37)) [ki'ndai [niho'n [zyozyoo bu'ngaku]]] → ki'ndai niho'n zyozyoobu'ngaku

"modern times" "Japan" "lyricism" "literature"
= "modern Japanese lyric literature"

b) [ni'kkan [te'iki [kakuryoo ka'igi]]] → ni'kkan te'iki kakuryooka'igi

"Japan-Korea" "regular time" "cabinet member" "meeting"
= "Japan-Korea regular inter-cabinet meeting"

c) [kokuren [se'kai [hoken ki'kan]]] → kokuren se'kai hokenki'kan

"United Nations" "world" "health" "organization"
= "U.N. World Health Organizations (WHO)"

Finally, let us consider the cases where a single compound expression is subject to both the semantic and branching constraints. The compound nouns in (72) below involve a coordinate structure between the second and the third component words while those in (73) are subject to the semantic constraint between the initial two elements. In all these cases, the whole
compounds are phrased into three accentual units, yielding the same triphrasal accentual pattern as in (54) and (71).

(72) \([A \, [[B \, C] \, D]]\) where \([BC] = \) coordinate structure
\[\rightarrow A/B/CD\]

a) \([ni'tibei \, [[tuusyoo \, gyo'gyoo \, zyooyaku]]\]
\[\rightarrow ni'tibei \, tuusyoo \, gyo'gyoozyo'oyaku\]
"Japan-US" "trade" "fishery" "treaty"
= "Japan-US Trade and Fishery Treaty"

b) \([niho'n \, [[densin \, denwa] \, ko'osya]]\]
\[\rightarrow niho'n \, densin \, denwako'osya\]
"Japan" "telegraph" "telephone" "corporation"
= "Japan Telephone and Telephone Public Corporation"

(73) \([[A \, B][C \, D]]\) where \([AB] = \) coordinate structure
\[\rightarrow A/B/CD\]

a) \([[yo'sino \, ku'mano] \, [kokuritu \, kooen]]\)
\[\rightarrow yo'sino \, ku'mano \, kokurituko'o'en\]
"Yoshino (area name)" "Kumano (area name)"
"state(-run)" "park" = "Yoshino-Kumano national park"

b) \([[densin \, denwa] \, [kabusiki \, kaisya]]\)
\[\rightarrow densin \, denwa \, kabusikiga'isya\]
"telegraph" "telephone" "stocks" "company"
= "Telegraph and Telephone Company, Inc."

All in all, the branching constraint accounts for a number of accentual phenomena concerning compounds which would otherwise remain unaccounted for, and thereby enables us to make a significant generalization in the phonology of Japanese compounds. I will discuss the theoretical significance of this constraint and of the phenomena resulting from it in section 3.6 below.
3.3.4. Exceptions to the Branching Constraint

Before discussing another type of constraint on the prosodic compound formation process, it may be desirable to spend a few paragraphs to explain the exceptions to the branching constraint. There are, as far as I know, at least three types of cases where the constraint in question fails to work: (i) compounds whose right-hand element consists of two native Japanese words, (ii) those whose head (i.e. the last element) is a short and mostly bound element, and (iii) those which involve a foreign word anywhere in the structure:

(74) [A [B C]] → ABC

(i) a) [iso'ppu [mono' katari]] → isoppumonoga'tari
   "Aesop" "thing" "narration" = "Fables of Aesop"

b) [neri' [ha' migaki]] → nerihami'gaki
   "kneading" "tooth" "polish" = "toothpaste"

c) [ki'nu [ori' mono']] → kinuori'mono
   "silk" "weave" "thing" = "silk fabrics"

(ii) a) [si'ritu [yooti e'n]] → sirituyooti'en
      (+PreAcc)
   "private" "infancy" "garden"
   = "private kindergarten"

b) [si'nri [ge'ngo ga'ku]] → sinrigengo'gaku
      (+PreAcc)
   "psychology" "language" "-ology"
   = "psycholinguistics"

c) [de'nsi [kenbi kyoo]] → densikenbikyoo
      (+DeAcc)
   "electron" "micro" "mirror"
   = "electron microscope"
(iii) a) [ti'kin [karee ra'isu]] → tikinkareera'isu
   "chicken" "curry" "rice"
   = "curry and rice with chicken"

b) [eli'ito [baiorin so'osya]]
   → eriitobaiorinso'osya
   "elite" "violin" "player" = "star violinist"

c) [eri'ito [zyo'si sya'in]] → eriitozyosisya'in
   "elite" "woman" "employee"
   = "distinguished woman employee"

It is not entirely clear why these types of compound expressions are, as it were, immune from the effect of the branching constraint. As for those in (74i) and (74ii), however, it can be pointed out that the last two elements, [BC]ₙ, is a virtually 'lexicalized' or 'etymological' compound in the sense that the compoundedness of the two elements is hardly recognized by native speakers of Japanese. The deverbal nouns in (74i) — katori, migaki, ori — are bound (or 'near-bound') forms, or words which are rarely used independently. And so are the compound-heads, i.e. ζ, in the compound type (74ii). Seen in this light, it could be argued that the last two elements in the compounds in (74i) and (74ii) are so tightly bound that their internal branching structure is somehow masked in the lexicon of the speakers.

This line of reasoning may be partially supported by the comparable situation in English. In English, some right-branching compounds, in all of which the last two component elements are so deeply fused as to be spelled as a single word, exhibit exceptional prosodic behavior with respect to the
branching constraint (cf. (56)).

(75) Exceptions to the Branching Constraint in English

a) [math [hand book]] → MATH handbook
b) [picture [post card]] → PICTURE postcard
c) [steel [ware house]] → STEEL warehouse

It may be possible to account for the compounds in (74c) in a similar manner. As pointed out in Note 9, foreign words (personal names of foreigners other than Chinese and Koreans) are immune to the semantic constraint. Considering this fact together with that in (74c), it seems that foreign words are more subject to the compounding process in general than words of other origins. In other words, compounds involving a foreign word tend to be processed as a linear sequence of one long word without their internal structure being seriously scrutinized by language users.

3.4. Rhythmic Constraint

In the foregoing two sections I outlined two types of constraints on accent phrase formation (APF) and, hence, on the prosodic compound formation process (PCFP) in general. I also showed that these constraints are essential in generalizing the accentual structures of complex compounds. While these two constraints help to account for almost all instances of accentual split observed with complex compound expressions, there are yet a handful of instances which remain unaccounted for. In this section, I will propose a third constraint on the prosodic
compounding process, which I term "rhythmic constraint," and claim that the remaining instances of accentual split can be attributed to this principle.

3.4.1. Optional Accentual Split

By way of introduction, let us consider the examples in (76) which represent the handful of instances which cannot be accounted for by the two types constraints discussed in the preceding sections:

(76) [[[A B] C] D] → (i) ABCD, (ii) AB/CD

a) [[[toonan a'zia] syo'koku] rengoo]
   → (i) toonanaziasyokure'ngoo
   (ii) toonana'zia syokure'ngoo
   "south-east" "Asia" "nations" "union"
   = "The Association of Southeast Asian Nations (ASEAN)"

b) [[[i'ryoo se'ido] kaikaku] hooan]
   → (i) iryooseidokaikakuho'oan
   (ii) iryoose'ido kaikakuho'oan
   "medical treatment" "system" "reform" "bill"
   = "Medical System Reform Bill"

c) [[[sa'n kootai] ki'nmu] se'ido]
   → (i) sankootaikinmuse'ido
   (ii) sanko'otai kimmuse'ido
   "three" "shift" "work" "system"
   = "three-shift work system"

What is characteristic of the compounds in (76) is that they all involve a uniformly left-branching structure consisting of four elements and permit two accentual patterns: (i) a monophra-
sal pattern whereby whole compound expressions are fused into one accentual phrase, and (ii) a bipartite pattern whereby the whole expressions are phrased into two accentual units with a phrasal boundary between the second and third elements. Since the first three component words of these compounds invariably yield one accentual phrase when they stand by themselves, i.e. (77), it can be understood that the uniformly left-branching compounds in (76) undergo an optional accentual split when a fourth element is added. This optional split yields, alongside the monophrasal pattern in (76i), the bipartite pattern in (76ii), an accentual pattern identical to the one in (68).

(77) \[[[A B] C] \rightarrow ABC

a) \[[[toonan a'zia] syo'koku] \rightarrow toonanaziasyo'koku
     *toonana'zia syo'koku
     "Southeast Asian nations"

b) \[[[i'ryo se'ido] kaikaku] \rightarrow iryooseidoka'ikaku
     *iryoose'ido kaikaku
     "medical system reform"

c) \[[[sa'n kootai] ki'nmu] \rightarrow sankootaiki'nmu
     *sanko'otai ki'nmu
     "three-shift work"

3.4.2. Arguments for Rhythmic Constraint

A comparison of the accentual patterns in (76) with those in (77) might suggest that the accentual split in (76-ii) is due to a certain cognitive or articulatory constraint on excessively long accentual phrases. This account appears to be descriptively adequate since no comparable accentual split occurs in other
compound structures made up of the same number of component words, e.g. those in (68)-(71), which are decomposed into more than one accentual phrase due to the branching constraint.

There are, however, three pieces of evidence to suspect that the optional split in the uniformly left-branching compounds is attributable to some more general and well-definable principle. The first piece of evidence concerns the question of why the split occurs between the second and third elements, and not at other logically possible places. That is, under the account based on the cognitive or articulatory constraint, one cannot explain in any plausible way why the uniformly left-branching compounds favor the apparently symmetrical and well-balanced accentual pattern in (78a) in preference to the other patterns as shown in (78b).

\[
(78) \quad [[[A B] C] D] \rightarrow (a) AB/CD \\
* (b) A/BCD, ABC/D
\]

A second line of evidence comes from the fact that the split of the sort in (76ii) — and the resultant neutralization with the structure in (68) — is found not only in accentual phrasing but also in other phonological processes in Japanese. In MPF, the intonational phrasing process outlined in section 2.3 above, for example, phrasal constructions consisting totally of unaccented words show the intonational phrasing as in (79): three-element left-branching phrases in (79a) generally yield a single intonational phrase, as comparable to the accentual phrasing in (77), whereas four-element counterparts in (79b) are
often decomposed into two phrases, yielding the same phrasing pattern as (79c): cf. Chapter Four.

(79) MPF

a) \([A B] C \rightarrow ABC\)

   e.g. naomino aneno yunomi "Naomi's sister's teacup"
   \(\rightarrow na\text{ }omin\text{ }an\text{ }en\text{ }yun\text{ }om\text{ }i\)

b) \([(A B) C] D \rightarrow AB/CD\)

   e.g. naomino aneno yunomino iromo'yoo
   "Naomi's sister's teacup's design"
   \(\rightarrow na\text{ }omin\text{ }an\text{ }en\text{ }yun\text{ }om\text{ }i\text{ }i\text{ }ro\text{ }m\text{ }i\text{ }yoo\)

c) \([(A B)[C D]] \rightarrow AB/CD\)

   e.g. naomino aneno kiiroi yunomi
   "Naomi's sister's yellow teacup"
   \(\rightarrow na\text{ }omin\text{ }an\text{ }en\text{ }k\text{ }i\text{ }roi\text{ }yun\text{ }om\text{ }i\)

The split of the sort in (76-ii) occurs in yet another intonational process called "downstep" or "catathesis". As will be discussed in detail in Chapter Five, sequences of accented phrases as in (80) exhibit pitch configurations as shown in (81a) and (81c).

(80) Downstep

a) \([na'okono a'nino] eri'maki\]
   "Naoko's brother's muffler"

b) \([[[na'okono a'nino] eri'makino] iromo'yoo\]
   "Naoko's brother's muffler's design"

c) \([na'okono a'nino] [ao'i eri'maki]\]
   "Naoko's brother's blue muffler"
Left-branching phrases consisting of three accented phrases generally show the pitch pattern as in (81a), where the second and third (minor) phrases are downstepped (i.e. realized lower in pitch) as relative to their respective preceding phrases. If one more accented minor phrase is added to this three-element sequence, however, the resultant (uniformly) left-branching phrases somehow disfavor the pitch pattern as predicted by rule, i.e. (81b). What they favor instead is the pattern as illustrated in (81c), a pattern in which the sequence of four elements is divided into two subgroups of two, owing to the extra F0 boost given on the third element. Interestingly, this pitch pattern is indistinguishable from the symmetrical pattern shown by the phrase structure in (80c), with the result that the two different branching structures are intonationally neutralized.
Given the fact that uniformly left-branching constructions thus prefer the symmetrical bipartite pattern in these two types of intonational phrases, MPF and downstep, one is further led to suspect that the optional accentual split in (76) may be triggered by a rather general principle that constrains the patterning of phonological elements at an abstract level of Japanese phonology.

In addition to the two kinds of evidence so far given, the analysis of English compounds provides a third piece of evidence to suspect that the optional accentual split in (76) is not simply due to a constraint on excessively long accentual phrases. As Selkirk (1984: 248–9) notes, uniformly left-branching four-element compounds in English permit two stress patterns, one in which the nuclear stress is placed on their initial element, the other in which the third element is as prominent as the initial one. (82) illustrates these two patterns:

(82) Uniformly Left-Branching Compounds in English

a) (i) [[[LABOR union] scandals] committee]
   (ii) [[[LABOR union] SCANDALS] committee]

b) (i) [[[LABOR union] president] election]
   (ii) [[[LABOR union] PRESIDENT] election]

c) (i) [[[LAW degree] requirement] changes]
   (ii) [[[LAW degree] REQUIREMENT] changes]
Of these two stress patterns, (i) represents the basic pattern as predicted by the Compound Stress Rule of English, as shown by Liberman-Prince (1976)'s analysis:

\[(83)\]

\[
\text{\begin{tikzpicture}[baseline=(current bounding box.center)]
  \node (S1) {$S$} child{node (S2) {$S$} child{node (W1) {$W$} child{node (W2) {$W$} child{node (W3) {$W$}}}}};
  \node at (S1-|S2) {$X$};
  \node at (S1-|W1) {$X$};
  \node at (S1-|W2) {$X$};
  \node at (S1-|W3) {$X$};
\end{tikzpicture}}
\]

The variant stress pattern in (82-ii), by contrast, involves additional prominence on the third elements and is, hence, very similar, if not identical, to the stress pattern of the compound constructions in (84):

\[(84) (= (59-i-a)))\]

\[
\text{\begin{tikzpicture}[baseline=(current bounding box.center)]
  \node (S1) {$W$} child{node (S2) {$S$} child{node (W1) {$S$} child{node (W2) {$W$}}}};
  \node at (S1-|S2) {$X$};
  \node at (S1-|W1) {$X$};
  \node at (S1-|W2) {$X$};
\end{tikzpicture}}
[[\text{law degree}\][\text{language requirement}]]

\[
\text{\begin{tikzpicture}[baseline=(current bounding box.center)]
  \node (X1) {$X$};
  \node at (X1-|X1) {$X$};
  \node at (X1-|X1) {$X$};
  \node at (X1-|X1) {$X$};
\end{tikzpicture}}
\]

In view of this, it should be clear that the variation in stress pattern in (82) is governed by the same principle as the accentual variation in (76), the intonational phrasing pattern in (79b) and the pitch pattern in (81c). That is, in all of these four cases, the sequence of four elements are regrouped into two subgroups of two, or to be more specific, monotonous sequences of four elements are reorganized into a well-balanced structure. In
the case of the two types of phrasing processes in Japanese — APF in (76) and MPF in (79b), the reorganization results in the splitting of one long phrase into two, neutralizing two different constituent structures: (76) vs. (68), and (79b) vs. (79c). When the same principle applies to the sequences of four accented phrases, it yields extra boost in pitch on the third element — on the first element of the second subgroup — again neutralizing the two constituent structures, (80b) and (80c). And in the case of the English compound nouns, the same principle yields additional boost in stress prominence on the third element of the uniformly left-branching strings.

Seen in this light, it will be understood that the accentual split in (76) is not an isolated idiosyncratic phenomenon but represents some abstract, (quasi-)universal principle which has the effect of converting otherwise monotonous patterns into alternating and, in that sense, more rhythmic ones.

3.4.3. Principle of Rhythmic Alternation

Given the facts and preliminary generalizations concerning the optional accentual split in question, it is important to refer here to a well-known fact from non-linguistic research. It is often assumed in various areas related to human psychology that the human mind tends to seek in every kind of motor action a rhythmic pattern, or a pattern characterized by "an ordered alternation of contrasting elements" (Crossley-Holland, 1978:744) (cf. Woodrow, 1951; Fraisse, 1963). This tendency is
evident with the perception side of human performance as well as the production side. In discussing musical rhythm, for instance, Crossley-Holland (p. 745) states as follows:

The mind apparently seeks some organizing principle in the perception of music, and if a grouping of sounds is not objectively present, it imposes one of its own. Experiments show that the mind instinctively groups regular and identical sounds into twos and threes, stressing every second or third beat, and thus creates from an otherwise monotonous series a succession of strong and weak beats.

Similarly, Allen (1975:76) states:

With regular sequences of stimuli, such as a sequence of nearly identically spaced nearly identical clicks, the structures usually perceived are simple groupings of two to six successive stimuli per group. Each group has one of its pulses perceptually stronger, usually the first or the last, but in groupings by fours a secondary weak beat is often perceived on the pulses next but one to the 'strong' pulses, giving a fully alternating rhythm.

Given the principle of the subjective grouping and rhythmic organization in perception, it will not be so unrealistic to suppose that the human mind seeks to apply the same rhythmic principle in the production of speech. That is, that sequences of four elements are regrouped into two plus two in order to create rhythmic sequences out of otherwise monotonous patterns. If this is the case, one can now characterize all the four seemingly related phenomena in question — (76), (79), (80) and (82) — as manifestations of a general and abstract principle which, following Selkirk (1984), I will henceforth call the "principle of rhythmic alternation (PRA)".

169
In sum, it can be concluded that the prosodic compound formation process in Japanese is constrained by a rhythmic principle as well as by the semantic and branching constraints outlined in the foregoing sections. Apart from the consideration of the linguistic conditions on the prosodic compound formation process, the fact that Japanese is constrained by the PRA has a far-reaching implication for the rhythmic structure of Japanese.

As is well known, Japanese has generally been characterized as a 'syllable (mora)-timed' language (cf. Abercrombie, 1967; McCawley, 1978; Hoequist, 1983a,b), or a language characterized by the 'rhythm of succession' as opposed to the 'rhythm of alternation' (Allen, 1975). The fact that prosodic processes of Japanese are constrained by the PRA implies that 'rhythm of alternation' and 'rhythm of succession' are not mutually exclusive, as has traditionally been assumed, but can coexist in a single phonological system as independent rhythmic principles.

3.5. Pragmatic Variation

I have deferred until now the question of the variation which complex compounds in Japanese show in accentual patterning. As has been suggested in passing above (cf. Notes 26 and 32), many of the compounds which yield more than one accentual phrase permit a variant pronunciation whereby the whole compound expression is phrased into one accentual unit as if no constraint...
— semantic, branching or rhythmic — has applied. In this short section I will explore various factors influencing this phrasing variation and show that they represent by and large pragmatic ones.

3.5.1. Data

To illustrate the variation in accentual patterning, let us refer back to the three-element compound nouns which are subject to the semantic constraint, i.e. (85), and the branching constraint, i.e. (86).

(85) Accentual Variation: semantic constraint

a) (= (46a)) [[ziyu'u minken] undoo]
   \[\rightarrow (i) ziyu'u minkenu'ndoo
   (ii) ziyuuminkenu'ndoo\]

b) (= (47a)) [[ko'omu sikkoo] boogai]
   \[\rightarrow (i) ko'omu sikkobo'ogai
   (ii) koomusikkoobo'ogai\]

c) (= (46i)) [[hatuon a'kusento] zi'ten]
   \[\rightarrow (i) hatuon akusentozi'ten
   (ii) hatuonakusentozi'ten\]

(86) Accentual Variation: Branching Constraint

a) (= (60a)) [ni'tibei [a'npo zyooyaku]]
   \[\rightarrow (i) ni'tibei anpozoypo'oyaku
   (ii) nitibeiapizoypo'oyaku\]

b) (= (60k)) [kokusai [roodoo kikoo]]
   \[\rightarrow (i) kokusai roodooki'koo
   (ii) kokusairoodooki'koo\]
Although I did not mention it in the foregoing discussion, the same kind of variation is often permissible with more complex compounds. Thus, four-element compound nouns subject to the semantic and branching constraints show the following variation, respectively.

(87) Accentual Variation: Semantic Constraint

a) (= (52-i-a)) [[[ziyu' u mi'nsyu] to'o] taikai]
   → (i) A/BCD: ziyu' u minsyutoota'ikai
   (ii) ABCD: ziyuumsyutoota'ikai

b) (= (52-ii-a)) [[[ko'omu sikkoo] boogai] zai]
   → (i) A/BCD: ko'omu sikkoooba'izai
   (ii) ABCD: koomusikkooba'izai

c) (= (53c)) [[[hoppoo ryo'odo] henkan] mondai]
   → (i) AB/CD hoppooryo'odo henkanmo'ndai
   (ii) ABCD hoppooryoodohenkanmo'ndai

(88) Accentual Variation: Branching Constraint

a) (= (68a)) [[[ke'izai taisaku][kakuryoo ka'igi]]
   → (i) AB/CD: keizaitaisaku kakuryoooka'igi
   (ii) ABCD: keizaitaisukakuryoooka'igi

b) (= (69a)) [[[ze'nkoku [yo'ron tyo'osa]] kekka]
   → (i) A/BCD: ze'nkoku yorontyoosake'kka
   (ii) ABCD: zenkuyorontyoosake'kka

c) (= (70a)) [ni'tibei [[anzen hosyoo] zyooyaku]]
   → (i) A/BCD: ni'tibei anzenhosyoozyo'oyaku
   (ii) ABCD: nitibeianzenhosyoozyo'oyaku

As is clear from the preceding discussion, the accentual variation between the (i) monophrasal pattern and (ii) biphrasal pattern in (85)-(88) represents a variation in accentual phrasing, not simply in accentuation. In other words,
the accentual pattern in (i) represents the case whereby one of the constraints has blocked the application of the APF to yield two accentual phrases, whereas the pattern in (ii) represents the pronunciation whereby such constraints somehow fail to exert their effects on the accentual unification process. Given a phrasing pattern, therefore, the accentuation of the whole compound automatically follows.

3.5.2. Discussion

Having confirmed that the accentual variation in (85)-(88) represents a variation in accentual phrasing, let us consider what principles or factors underlie the variation. As far as my observation goes, the choice between the accentual patterns varies considerably (i) from one speaker to another, (ii) from one compound expression to another within a single speaker, and even (iii) from one utterance to another with the same speaker for the same compound expression. That is, two different speakers can prefer different accentual patterns for the same compound, and the same speaker can choose different accentual patterns for two compounds of the same (semantic/branching) structures, as well as for one particular compound on two different occasions.

Despite these inter- and intra-idioclectal variations, however, it seems that at least three general principles underlie the phrasing variation in question. One of them concerns the style of speech in which compound expressions are used. The general principle is that, ceteris paribus, the same speaker
tends to prefer the bipartite pattern, i.e. (i), to the monophrasal pattern, i.e. (ii), in slow, careful speech. In other words, the semantic and branching constraints tend to fail to work if the compounds are used in a fast, casual speech.

Secondly, compounds tend to become less sensitive to the constraints in question if they are totally familiar to the speaker. If, for instance, the speaker is a political scientist who uses the compound expression in (85a) very often in his career, then it is not unlikely that he employs the monophrasal pattern even if he generally adopts the bipartite pattern for other compound expressions of the same linguistic structures. Speakers' familiarity with the compound expression can thus mask, as it were, the marked semantic and branching structures involved in it, thereby assigning it the monophrasal accentual pattern which is usually taken by unmarked left-branching compounds.

And last, but not least, it is observed that the identical compound expressions tend to be subject to the constraints in question more readily if pragmatic focus is placed either on the whole compound expression or on one of its component words. Thus, in the context where the compound is highlighted for some reason or other, it is bound to be subject to the semantic and branching constraints to yield a bipartite phrasing pattern. Similarly, if one of its component words is highlighted, the compound tends to be phrased into more than one accentual units, fully subject to the constraints. For instance, if the right-branching compound in (86a), [ni’tibej la’neo zwooyakull] "Japan-US Security Treaty," is contrasted with, say, [le’ihutu la’neo
"Anglo-French Security Treaty," that is, if a contrastive focus is placed on the initial element of the compound, the compound will most probably result in the pattern in (i). By the same token, if the second element of the compound is focused, that is, if the same compound is contrasted with "Japan-US Trade Treaty," then the whole compound will be similarly subject to the branching constraint to yield the same bipartite pattern.

It must be noted in this regard that this focus-related variation must not be taken as implying that pragmatic information directly influences the process of the compound formation. Rather, it must be understood that the focus-related information simply helps to make the internal marked structure of compounds more explicit to language users and, thereby, secures the application of the constraints on the compounding process. That is, pragmatic information influences the constraints on the compounding process rather than the process itself. This can be verified by the fact that the compounding in unmarked left-branching compounds (e.g. (39)) is in no way influenced by the presence or location of a contrastive focus. Thus, the compound expression in (89) invariably takes a monophrasal accentual pattern whether it attracts a focus onto (a) its first element, (b) its second element or (c) its entire expression. (Capitalized words mean that they bear pragmatic focus).
3.6. Summary and Theoretical Implications

3.6.1. Summary

In sections 3.2 through 3.4, I proposed three types of constraints on the process of prosodic compounding in Japanese and showed the essential roles these constraints play in the accentual patterning of complex compounds. The main arguments in the foregoing sections can be summarized in the following five points.

First, it has been shown that the accentual patterns of complex compounds are determined essentially in the same way as those of simplex compounds. The key to the seemingly complicated accentual behavior of complex compounds is whether the prosodic compound formation process applies to a given sequence of two elements constituting (part of) compounds: if the process applies, it yields a compound accent pattern; if it does not, then the two elements retain their respective word accent pattern and subsequently undergo, like phrasal constructions, such phrasal phonological processes as minor phrase formation (MPF) and downstep. Whether the compounding process applies or not to a given sequence is determined by the semantic and syntactic (branching) structures of the sequence, or to be more precise,
by the speaker's lexical interpretation of its semantic/branching structures. There are three major cases where the prosodic process fails to apply: (a) where the two elements constitute a marked semantic relation, notably that of a coordinate structure or of a case relation (Semantic Constraint), (b) where the right-hand element of the sequence branches (Branching Constraint), and (c) where the two elements happen to be the second and third elements of four-element (or more complex) compounds which are uniformly left-branching and involve no marked semantic structure as subject to the semantic constraint (Rhythmic Constraint).

A second point of interest which the foregoing discussion has revealed concerns the accentual variation which complex compounds exhibit. I classified the variation into two types, one which is attributable to pragmatic factors and the other which is due to a rhythmic factor (Rhythmic Constraint). Pragmatic factors have the effect of masking, as it were, the semantic and branching structures of compounds, and prevent the semantic and branching constraints from applying to compounds which would otherwise be subject to them. The rhythmic factor, by contrast, manifests the principle of rhythmic alternation (PRA) by which uniformly left-branching compounds consisting of four (or more) elements are regrouped into two subgroups and yield two accentual units out of a sequence which would otherwise form one long accentual phrase.

A third main point of interest consists in the fact that the compounding processes in Japanese and English show striking
similarities at the abstract level in spite of the considerable differences in phonetic realization. We have seen, for instance, that the compound formation process is blocked in both languages if the right-hand element of a (part of) compound is itself branching (Branching Constraint). In other words, both of the two languages mark the right-branching structure as opposed to other branching structures, and show its markedness by blocking the prosodic process (section 3.3). Moreover, where the process fails to apply, the phrasal pattern is automatically assigned as a default pattern in either language, giving the marked compound structure the same prosodic pattern as a comparable phrasal construction. Besides, the two languages show a considerable similarity as to the content of the semantic constraint: compound nouns of certain semantic structures tend to constitute the 'semantic constraint' on the prosodic process in both languages (section 3.2.1). Furthermore, Japanese and English show a similar variation in uniformly left-branching compounds, which I claimed should be attributable to a common rhythmic principle (section 3.6). These facts seem to suggest that the prosodic process of compound formation is constrained by similar abstract conditions across different languages, albeit different realizations at the phonetic output.

A fourth interesting point that emerges from the foregoing discussion concerns the fact that the right-branching structure is the prosodically marked one. As shown in section 3.3, prosodic compound formation fails to take place in (a part of) compounds whose right-hand element branches, but not in (a part
of) compounds whose left-hand element branches. Accordingly, three-element compound nouns show the following accentual asymmetry between the two constituent structures (unless, of course, they are subject to the semantic constraint):

\[(90) \,(=\,(62))\]

\[(a) \, [[A\,B]\,C]\,\rightarrow\,\text{ABC}\]

\[(b) \, [A\,[B\,C]]\,\rightarrow\,A/BC\]

As mentioned in section 3.3.2, the same asymmetry as this is observed with the process of intonational phrasing (IPF), where the right-branching structure shows a marked behavior by failing to undergo the process (cf. Chapter Four). A prosodic asymmetry of the same kind is found in yet another phonological process called *rendaku* (cf. (63)), in which the right-branching structure shows its markedness by blocking the sequential voicing process. All these facts taken into consideration, it seems appropriate to conclude that the right-branching structure is a marked structure in the phonological system of Japanese in general.

The fact that the right-branching structure exhibits a marked accentual behavior appears more interesting when considered in conjunction with the fact that compounds involving the left-branching structure outnumber those involving the right-branching one (cf. 3.1.1). These two facts combined suggest that syntactically marked structures may be treated as marked structures in prosodic terms too. Interestingly, English compounds exhibit exactly the same correlation as this between the syntactic markedness and prosodic markedness: the right-
branching structure is syntactically marked (at least in the sense that it is relatively rare) in English compounds, and show a marked prosodic behavior by rejecting the normal compound stress pattern in favor of the phrasal stress pattern. Although it may be too early to make a generalization at this stage of research, it is indeed interesting to note that a syntactically marked structure is thus given a marked prosodic treatment in Japanese and English alike. A more extensive inquiry into this issue may provide an interesting insight into the abstract relation between syntax and phonology.

And last, and probably most important, the discussion in the preceding sections has revealed that the two types of structures of compounds, syntactic and phonological, exhibit discrepancies in many instances. The discrepancies thus found can be summed up in the following two cases:

\[(91)\]
\[
(a) \ (\ (62c)) \ [[\ A \ B \ ] \ C ] \rightarrow A/BC
\]
\[
(b) \ (\ (69)) \ [[\ A \ [\ B \ C \ ]] \ D ] \rightarrow A/BCD
\]

In (91a), the second and third elements constitute a single accentual phrase to the exclusion of the first one although the second element forms a syntactic (and semantic) constituent with the first rather than with the last one. Similarly, the last three elements in (91b) constitute a single accentual phrase to the exclusion of the first in spite of the fact that the second and third elements combined forms a syntactic constituent with the first element to the exclusion of the last one.
What must be noted with the two cases in (91) is that the first elements form isolated phrases for different reasons: because of the semantic constraint in (91a), and due to the branching constraint in (91b). Although different factors are thus responsible for the accentual isolation of the first elements, it is all too clear that the unification of the other elements and resultant syntax-phonology discrepancies in the two cases should both be attributed to a single principle.

As mentioned in passing in section 3.2.2, the same kinds of syntax-phonology discrepancies as (91) are observed with the intonational phrasing process (MPF). This suggests that the syntax-phonology discrepancies as illustrated in (91) represent two subcases of a rather general principle in Japanese phonology.

3.6.2. Theoretical Implications

Having summarized the basic facts regarding the prosodic compound formation process, let us next consider the theoretical implications of these facts, especially as regards the interaction (i.e. mapping rules) between the syntactic and phonological structures of Japanese compounds.

One theoretical implication that emerges from the foregoing discussion is that the prosodic compound formation process requires access to the semantic and syntactic structures of compounds. Access to the two kinds of structures is essential for determining whether the prosodic process applies to a given (sequence of a) compound.
One theoretical question that arises from this implication is how then the compounding process refers to the semantic and syntactic information of compounds. The simplest answer to this question may be that the process refers directly to the semantic and syntactic structures defined in the semantic/syntactic components, respectively. However, this is apparently not a preferable solution in current models of phonological theory: models proposed along the line of the generative theory of grammar generally reject such an approach in favor of the notion that the semantic and syntactic structures are mapped onto the (underlying) phonological representation by some well-defined mapping rules (cf. Chomsky & Halle, 1968; Liberman & Prince, 1977, Selkirk, 1984). Provided that phonological rules like accent phrase formation (APF) and the compound accent rules (CARs) are not allowed to directly refer to the semantic/syntactic information across component boundaries, it will follow that the underlying phonological representation must be richly encoded, at least to the extent that it contains such information. To be specific, the hierarchical branching structure of compounds must be mapped onto their phonological representation by some well-defined set of syntax-to-phonology mapping rules, so that the effect of the branching constraint is secured wherever it is applicable. Similarly, the phonological representation of compounds must contain the information on their semantic structures in some way or other in order for the semantic constraint to work properly.
The discussion concerning the relation between the semantics/syntax and phonology of Japanese compounds also provides an interesting implication as to the manner in which phonological processes and rules apply in Japanese. As has been repeatedly mentioned, it often happens that component accentual phrases of Japanese compounds do not form a constituent in the semantic/syntactic representations. Two solutions spring to mind as an account of this general phenomenon, which gives rise to the syntax-phonology discrepancies as illustrated in (91) above.

One solution will be to assume a reanalysis of the syntactic tree to the effect that the right-hand element of the constituent \([A \ B]_n\) forms a new constituent with the element that immediately follows it whenever the compounding process is blocked within the original constituent. Thus, the two structures in (91) are reanalyzed as shown in (92). Since the outputs of this reanalysis involve a structure sensitive to the branching constraint, they readily yield more than one accentual phrase with an accent phrase boundary between the first element and the rest in both cases:

(92) Reanalysis (RA)

\[
\begin{align*}
\text{(91a)} & \quad \text{<Input to RA>} \quad \text{[[A B] C]} & \quad \text{<RA>} \quad \text{[A [B C]]} & \quad \text{<APF>} \quad \text{A/BC} \\
\text{(91b)} & \quad \text{[[A [B C]] D]} & \quad \text{[A [B C] D]} & \quad \text{A/BCD}
\end{align*}
\]

Under this analysis, the syntax-phonology discrepancies are supposed to be completely resolved before the prosodic
compounding process (APF, to be exact) applies. The prosodic process then takes place cyclically along the (now-reanalyzed) syntactic tree, from a lower syntactic domain to a higher one. This is illustrated in (93). (* denotes that the prosodic compounding process is blocked in the relevant domain by the branching constraint (64)):

(93)  

\[
\begin{array}{ccc}
\text{(90b)} & \text{(91a)} & \text{(91b)} \\
\text{Input to APF} & [A [B C]] & [A [[B C] D]] \\
<\text{domain 1}> & [B C] & [B C] \\
<\text{domain 2}> & *[A BC] & [BC D] \\
<\text{domain 3}> & \text{---} & *[A BCD] \\
<\text{output}> & A/BC & A/BCD \\
\end{array}
\]

While the analysis based on the "reanalysis" appears capable of handling the discrepancies observed between the syntactic and phonological structures, it falls into several (at least three) serious difficulties.

The first difficulty relates to the fundamental question of whether it is appropriate to employ the notion of "reanalysis" to account for the phenomena in question which, as has been repeatedly shown, represent a rather general principle. The notion is usually used to handle a handful of exceptions which somehow fail to conform to a general rule, and it is arguably only in this end that the notion should be used in phonological descriptions. Seen in this light, it must be said that resorting
to the notion of "reanalysis" in the context under consideration is not an appropriate solution to take.

A second problem with "reanalysis" concerns the motivation of the reanalysis. As stated above, reanalysis is triggered in the context where APF is blocked by the semantic or branching constraint. Quite apart from this, however, the branching constraint is integrated in the rule of APF itself (cf. (64)). What this means is that the single constraint applies twice in the process of phonological derivation, once in triggering the reanalysis and then in applying APF proper to the reanalyzed structures: cf. (94). This is obviously an unfavorable consequence which should be avoided.

(94) (= (91b))

```
<input>  [[A [B C]] D]
<reanalysis>  <--- Branching Constraint
[A [[B C] D]]
<APF>  <--- Branching Constraint
<output>  A/BCD
```

Our last argument against the analysis based on "reanalysis" comes from a consideration of the significant parallelism found between the process of accent phrase formation (APF) and that of intonational phrase formation (MPF). As noted in various places in the preceding discussion, the two types of phrasing processes show remarkable similarities both in form and function. They are subject, for instance, to essentially the same kinds of constraints — Branching Constraint and Rhythmic Constraint.
Moreover, the two types of phrasing processes yield essentially the same phrasing patterns when they are subject to the constraints: First, they yield an asymmetry between the prosodically marked right-branching structure and the unmarked left-branching structure (cf. (90)); second, they give rise to certain discrepancies between the syntactic (constituent) structure and phonological (phrasing) structure (cf. (91)).

Given that APF and MPF thus exhibit strikingly parallel behavior, it will be more than natural to postulate a reanalysis like (92) in accounting for the syntax-phonology discrepancies in MPF, just as we do for APF. Consider, for example, the phrases in (95), where MPF is blocked between the first and second elements by what I term the "accentual condition" (cf. Chapter Four, section 6). MPF takes place between the last two elements, however, thus yielding a discrepancy between the syntactic branching structure and the output phrasing structure.

(95) Syntax-Phonology Discrepancy in MPF

[[A B] C] → A/BC

[[na'okono aneno] name] → na\ okono a/\neno name

"Naoko-Gen" "sister-Gen" "name"

= "Naoko's sister's name"

[[mazusi'i kunino] hito'bito] → ma\zusi'i ku\nino hito\bito

"poor" "country-Gen" "people"

= "people in poor countries"
An analysis based on "reanalysis" will assume a restructuring of (a) the left-branching phrases into (b) the right-branching ones, thereby neutralizing the two types of branching structures in prior to MPF. This is illustrated in (96), which is equivalent to the case of APF we saw in (93) above.

(96)  

\[ \text{Input} \rightarrow \begin{cases} 
\text{[A B] C} \\
\text{A [B C]} 
\end{cases} \]  
\[ \text{RA} \rightarrow \begin{cases} 
\text{[A [B C]}} 
\end{cases} \]  
\[ \text{MPF} \rightarrow \begin{cases} 
\text{A/BC} \\
\text{A/BC} 
\end{cases} \]

While the analysis on "reanalysis" can apparently handle the syntax-phonology discrepancy in question, it makes a wrong prediction as to the aftermath of MPF. As will be shown in Chapter Five (section 3), the two branching structures in (96) — (a) and (b) — exhibit different intonational patterns as regards downstep, the process which putatively applies to the output of MPF. To be specific, the second element of the left-branching phrases is realized at a significantly lower FO level than that of the right-branching counterparts — or, to put it conversely, the second element of the right-branching phrases has higher FO values than that of the left-branching ones. The fact that the process of downstep requires information on the constituent structures of sentences (phrases) indicates that the two types of branching structures are NOT neutralized at the stage of intonational phrasing, but that the information on the syntactic hierarchy (branching structure in our present
discussion) is somehow retained in the intonational representation to which the downstep process applies. Seen in this light, it is clear that "reanalysis" in (96) makes a wrong generalization and, therefore, that one must seek for other solutions for the syntax-phonology discrepancies in (95). Given this, one is obliged to abandon the analysis based on "reanalysis" insofar as one seeks to capture the significant parallelism between APF and MPF and treats them in the same way.

We have seen three lines of arguments to think that the notion of "reanalysis" cannot be used as an account of the syntax-phonology discrepancies observed in APF. Given this, it seems that there is only one solution left for us to choose, that is, to modify the formulation of APF (64) in such a way that the discrepancies are to be accounted for by the phrase formation rule itself rather than by any other additional machinery. I propose the formulation in (97) as a revised form of (64):

\[(97)\]
\[
\text{In } [... \ X \ Y \ ...], \ XY \text{ belong to the same accentual phrase.}
\]

Conditions:

(i) X and Y are adjacent terminal elements.

(ii) The lowest branching node that dominates Y dominates X.

(iii) X and Y do not constitute a semantic relation sensitive to the semantic constraint.

The fundamental difference between the rule formalism in (64) and (97) lies in that in (97), the two elements undergoing
the rule need not form a syntactic constituent on their own insofar as they are both terminal elements and adjacent to each other. In other words, (97) does not assume the (constituent) structure-dependent application of the rule, but presupposes, instead, a "linear application," whereby the rule is allowed to apply either (i) in a left-to-right fashion or (ii) in a right-to-left fashion. Thus, the accentual phrasing in four cases in (90) and (91) are handled as in the following. (* denotes that the rule is blocked at the relevant stage of rule application due to either of the semantic or branching constraints):

(90) "Linear Application" of Compound Formation Rule

(i) Left-to-Right Application

(90a)        (90b)
[[A B] C]   [A [B C]]

<step 1>  A B      *A B
<step 2>  B C      B C

<output> ABC      A/BC

(91a)        (91b)

<step 1>  *A B       *A B
<step 2>  B C       B C
<step 3>       C D

<output> A/BC      A/BCD
If the formulation in (97) is appropriate, it provides a significant insight into the manner in which phonological rules apply. That is, it constitutes a counter-example (or exception) to the notion of "cyclicity," or the widely accepted hypothesis that phonological rules apply cyclically along the syntactic structure of sentences (cf. McCawley, 1968; Hayata, 1969; Poser, 1984). I will further develop the argument against the notion of "cyclicity" in Chapter Four, where I argue against the hypothesis of "Proper Syntactic Analysis" (Poser, 1984) upon which some previous intonational models of Japanese have been proposed.
1. See Introduction for the methodology adopted in this analysis.

2. In addition to the accentual changes, compounds are differentiated from non-compounds (i.e. simplex words) in undergoing rendaku, literally meaning a 'sequential voicing' process (cf. Section 2.1.1.)

3. See McCawley (1968) and Haraguchi (1977) for the description of exceptional cases.

4. 'Non-Sino-Japanese morphemes' fall into two classes: native Japanese morphemes and morphemes borrowed from foreign languages other than Chinese. In what follows, I will refer to the latter simply as 'foreign morphemes' or 'foreign words,' thereby assuming a tripartite distinction among Japanese morphemes: Sino-Japanese morphemes, native Japanese morphemes and foreign morphemes.

5. Higurashi notes that these compounds fall into two types: those whose N\textsubscript{2} is either a foreign word (e.g. sutora'iki "strike") and those which constitute compounds themselves (e.g. monoga'tari "story" < mono "thing" + katari "narration"). That this generalization is wrong is shown by the existence of quite a few examples in which N\textsubscript{2} is neither a foreign word or a compound: e.g. yamahototo'gisu "mountain cuckoo" < yama "mountain" + hototo'gisu "cuckoo"; yamatonade'siko "Japanese women" < ya'mato "Japan" + nade'siko "wild pink".

6. In addition to this, compounds whose second element is a deverbal noun constitute apparent exceptions. Although compound nouns of this type conform to the general accent rule in most cases (see (a) below), there are some exceptions which result in unaccented compounds (see (b) below). However, since the two elements of these exceptions are both deverbal nouns, they can be interpreted as involving the nominalization of compound verbs, rather than the compounding of two deverbal nouns: i.e. verb + verb \rightarrow compounding \rightarrow nominalization. This interpretation is supported by the fact that compound verbs generally result in unaccented words when deverbalized (cf. Akinaga, 1966: 48):

(a) yama nobori \rightarrow yamano'bori

"mountain" "to climb" = "mountain climbing"

(b) iki domari \rightarrow ikidomari

"to go" "to stop" = "dead end (of a road)"

191
7. All the initially-accenting morphemes are two morae long. If they are of Sino-Japanese origin, they invariably consist of two morphemes. (Since most Sino-Japanese morphemes are monosyllabic items consisting of either one or two morae, the Sino-Japanese words under consideration are disyllabic-bimoraic words.) Moreover, no foreign morpheme seems to belong to the category of deaccenting morphemes.

8. Exceptions to this are the deaccenting processes outlined in Chapter One (section 5.1).

9. Foreign names show an exceptional behavior: e.g. ronardore'egan -> ronardore'egan "Ronald Reagan"; ma'agaretto sa'ttyaa -> maagaretto sa'ttyaa "Margaret Thatcher". Since personal names of Chinese and Koreans do not generally show such a behavior (e.g. te'i e'ikan, tyo'o ti'kun), it seems that this exceptional behavior has something to do with the ordering of the two component words: the word order of [family name + given name], to which Japanese, Chinese and Korean personal names conform, undergoes the compounding process while that of [given name + family name] fails to do so.

10. "Coordinate structures" refer to the combination of two elements denoting a unified concept which stand in equal semantic relation with each other. They fall into the following three groups according to the precise semantic relation the two elements form: (a) those which involve the sequence of two semantically identical (or similar) elements (e.g. hikaku taisvoo); (b) those in which a pair of elements of semantically different contents denotes one unified concept (e.g. j'rei tasa); and (c) those which are made up of two elements of opposite semantic contents (e.g. j'ssin ittai).

11. By 'case relation' I mean those two words typically involving a noun followed by a 'verbal noun' (i.e. a noun which forms a predicate by attaching the auxiliary verb suru (cf. Martin, 1975:869)) or 'adjectival noun'. In semantic terms, these nominal combinations typically form the 'subject-verb relation,' 'object-verb relation' or 'adverb-verb relation' in the underlying semantic structure. Most, if not all, of the "verbal nouns" and "adjectival nouns" in Japanese are Sino-Japanese morphemes, which tend to be unaccented (cf. Okumura, 1977) — This leads the second elements of the compounds to be mostly unaccented.

12. It is interesting to note that nominal combinations which denote a status in a given organization undergo the compounding process if they do not rigidly involve the semantic relation in question. Thus, booeitvo'okan "defense secretary" (<boocj "defense" + tyo'okan "chief") and seitoka'ityoo "student (union) president" (<se'ito "student" + kaitvoo "president") show the compound accent pattern whereas their pseudo-synonymous counterparts, booe'ityoo tyo'okan "defense agency secretary" and seitokai kaitvoo "student union president" show the phrasal
accent pattern. This confirms the view that whether or not a
given compound expression undergoes the compounding process is
determined by the semantic relation between the component words,
and not by the semantic content of the whole expression.

13. It is interesting to note that the combination of [non-
proper (non-personal) name + social/organizational status or
position] does undergo the compounding process: e.g. 
bungaku 'kase "doctor of literature" (< bu'ngaku "literature" +
ba'kase "doctor"); meiyoko 'ozvu "professor emeritus" (< me'iyo
"honour" + kyoozvu "professor").

14. If this word order is reversed, the nominal combinations
somehow undergo the compounding process: e.g. nanbuku 'syuu
"southern Kyusyu" (< na'nbu "southern part" + kyu'usyuu "Kyusyu"
(name of an area))

15. ni'tibei may look like a compound on its own since it
consists of two Sino-Japanese morphemes: niti, which means Japan,
and bei, which means America. Although this word can be seen as
a compound in etymological terms, it is a simplex word in the
sense that neither of its components is used independently and,
moreover, it follows the accentuation of simplex words, not of
compounds. There are a number of Sino-Japanese words like this
in Japanese, which I treat as simplex words in this thesis.

16. It may be desirable to sketch here the general principles
of Kanji (Chinese characters, or Sino-Japanese morphemes)-based
abbreviations in Japanese. Given the sequence of two words of
Sino-Japanese origin, the most general principle of abbreviation
is to form a disyllabic word by combining the first syllables of
the component words. Each of these component syllables is
usually a bound form on its own, and the resultant disyllabic
words generally follow the accentuation of simplex (non-compound)
words: e.g. (20d) zivu'u + mi'nsyu -> (23a) zi'min; (22b)
ko'ovoo + daigaku -> (23a) ko'dai.

Another general principle of abbreviation in Japanese is to
put the sequence of non-Sino-Japanese words (i.e. native Japanese
words or foreign words) into a corresponding Sino-Japanese word.
The abbreviation from (20e) to (23b) is a typical case of this in
which the sequence of two foreign words, i'ndu' voop'pa, is
abbreviated into a disyllabic Sino-Japanese word, i'no. Like
the abbreviation of two Sino-Japanese words, each component
element of the resultant disyllabic words (e.g. i'n or o) is
seldom used independently and, moreover, the resultant disyllabic
words follow the accentuation of simplex words.

A third principle of Kanji-based abbreviation, which may not
be as general as the two principles just mentioned, is to omit an
entire component word, thus yielding a two-element compound out
of a three-element compound: e.g. (22a) ni'tibei + a'npo +
zvoozvu -> (23c) ni'tibela'npo. The resultant two-element
compounds follow the accentuation of ordinary compounds as
outlined in section 1.2 above.
17. See Chapter Four for the definition of "minor phrase".

18. While the two component words of prosodically non-unified compounds are often fused into one (minor) intonational phrase if the initial word is unaccented, they usually form separate intonational phrases if the initial word is accented: e.g. \textit{mi'nami a'kira} \rightarrow \textit{mīnami あきら}. The latter type of intonational patterns are identical to those shown by phrasal constructions of the same accentual properties (e.g. \textit{na'okono o'obaa} "Naoko's overcoat" \rightarrow \textit{なおここおばあ}), and undergo, just as the phrasal constructions, the process of downstep to be discussed in Chapter Five.

19. This is true not only of compound nouns but also of 'compound verbs' and 'compound adjectives' as well. That is, the initial component of two-element compound verbs and adjectives undergo the morphological (and accentual) process of nominalization in prior to the prosodic compounding process: e.g. \textit{yomituzyke’ru} "continue reading" "read on" < \textit{yomi} "to read" + \textit{tuzuke’ru} "to continue"; \textit{yomivasu’i} "easy to read" < \textit{yomi} "to read" + \textit{vasu’i} "easy," where \textit{yomi} is a nominalized form of the verb \textit{yo’mu} "to read".

20. According to Ladd (personal communication), such right-branching compounds as the following can be found in French, although compounds of more than two members are generally rare in the language: [\textit{voiture} [\textit{nouvelle model}]] "car"-"new"-"style" = "a new-style car"; [\textit{version} [\textit{canape} [\textit{two places}]]] or [[\textit{version} \textit{canape}][\textit{two places}]] "version"-"settee"-"two"-"seats" = "two-seat settee version"

21. My observation squares with the report by Nomura (1977:279) that Sino-Japanese words are the main source of the component words of Japanese compounds. His analysis of over 2400 compounds (which apparently include compound verbs and adjectives as well as nouns, and also complex compounds as well as two-element compounds) shows that compounds consisting of Sino-Japanese words account for 41.6 per cent of all, followed by those made up of foreign words (34.4 %), those involving the blend of two (or more) words of different origins (21.7 %) and those consisting of native Japanese words (2.3 %).

22. The coordinate structure blocks the prosodic compounding process in complex compound expressions too: e.g. Parent-TEACHER Association (PTA), east-WEST relation.

23. In English, the prosodic compound formation process is blocked not just in compounds involving a personal name as in (45b) and (45c), but in compounds representing a proper noun in general: e.g. Lake HURON, River Thames, Loch NESS, Eiffel TOWER, New York CITY, Madison AVENUE. This suggests that the prosodic process is blocked in a wider context in English than in Japanese, or that the semantic constraint applies in a wider context in English than in Japanese.
24. This semantic structure forms a subpart of a more general principle in English whereby the prosodic compound formation is blocked if the first element of compound nouns represents either a time or a place: e.g. city HALL, summer HOLIDAY. The fact that the prosodic process is not blocked in comparable compound expressions in Japanese (e.g. *sii* "city" + *vakusvo* "office" → *siva'kusyo* "city hall"; *natu*' "summer" + *yasumi' "holiday" → *natuva'sumi* "summer holiday") also suggests that the semantic constraint applies in a wider context in English than in Japanese.

25. Having said this, I must hasten to add that this bipartite accentual pattern does not account for all the three-element compound nouns whose first two elements constitute the semantic relationships in question. Since the semantic constraint admits of quite a few exceptions (e.g. (16)), there are compound nouns yielding one accentual unit despite that they apparently involve one of the marked semantic structures. That is, if a given compound involve in the initial position two elements which constitute an exception to the semantic constraint, it readily form one accentual unit even if a third element is added:

```
[[A B] C] → ABC

a) [[yukue humei] zyootai] → yukuehumeizyo'otai
   "whereabout" "being unknown" "state"
   = "state of being missing"

b) [[kioku soositu] syoo] → kokuusositu'syoo
   (+DeAcc)
   "memory" "loss" "syndrome" = "amnesia (syndrome)"

c) [[bu'nka kooryuu] keikaku] → bunkakooryuuke'ikaku
   "culture" "exchange" "program"
   = "culture exchange program"

   cf. [bu'nka kooryuu] → bunkako'oryuu

d) [[ki'noo kaihuku] ku'nren] → kinookaihukuku'nren
   "function" "recovery" "training" = "rehabilitation"

   cf. [ki'noo kaihuku] → kinooka'ihuku
```

26. The compounds of the type in question can yield a monophrasal accentual pattern as a variant accentual pattern (cf. (17)-(19)), depending on various pragmatic factors to be discussed in section 3.5 below: E.g.
a) [[ziyu'u minken] undoo] → ziyuuminkenu'ndoo

b) [[ko'omu sikkoo] boogai] → koomusikkoobo'ogai

It must be emphasized in this connection that the existence of these variant pronunciations does not cast any doubt on the notion of the semantic constraint and the analysis based on it. For one thing, the accentual pattern in (46)-(48) seems to be the more preferred pattern for most expressions in question as well as for most speakers. That is, the informants on whose pronunciations my present analysis is based all agree that the bipartite accentual pattern is the more natural pronunciation, particularly in careful speech, for most of the compound expressions tested (cf. section 3.5). Second, and more important, semantically unmarked left-branching compounds as in (39) are never phrased into two accentual units: E.g.

(39a) [[sya'kai syu'gi] ko'kka] → *sya'kai syugiko'kka

27. See Note <25> above.

28. This expression is semantically ambiguous in that it can mean "next candidate for the presidency" as well as "candidate for the next president". The first reading is that of the right-branching constituent structure, i.e. [zi'ki [daito'oryoo ko'o'oho]], which is realized in the same biphrasal accentual pattern as the second reading, i.e. that of the left-branching structure. That is, the two types of branching structures, left-branching and right-branching, are neutralized at the accentual level in these cases.

29. Many of the 'right-branching' compounds quoted by these scholars, including those in (55b)-(55d), can be interpreted as left-branching compounds too.

30. I owe to Bob Ladd the examples in (59ii) and the judgment on their stress patterns. Note that the last example in (59ii) can also be analyzed as having the structure [A [[B C] D]].

31. This accentual pattern is exactly identical to that of noun phrases consisting of a modifier and a two-element compound noun: E.g. [ka'nadano [minken undoo]n]np → ka'nadano minkenu'ndoo "Canadian civil rights movement"; [hubyo'odoona [byoodoo hooan]n]np → hubyo'odoona byoodoooho'oan "unfair equality bill".

32. Just as the compounds in (46)-(48) are phrased into one accentual unit under certain circumstances (see Note <26>), so many of the compounds in (60) admit, under similar circumstances, of a variant pronunciation whose accentual (and intonational) patterns are indistinguishable from those of unmarked left-branching compounds: cf. (39). Thus,
Variant Phrasing to (60): \([A \ [B \ C]] \rightarrow ABC\)

a) \([ni'tibei \ [a'npo \ zyooyaku]\] \rightarrow nitibeianpozyo'oyaku\)
b) \([na'goya \ [ko'ogyoo \ daigaku]\] \rightarrow nagoyakoogyooda'igaku\)
c) \([tiho'o \ [kookyoo \ dantai]\] \rightarrow tihookookyooda'ntai\)

It must be emphasized here again that the existence of a variant pronunciation (variant accentual pattern, to be exact) of this kind does not constitute any evidence against the notion of branching constraint I have proposed here, for, as suggested in Note (26), left-branching compounds are never decomposed into two accentual units (unless of course they are subject to the semantic constraint). I will discuss the various factors which contribute to the variant phrasing pattern in full depth in section 3.5 below.

33. It is interesting to note that the same tendency as this is observed with the right-branching compounds in English: The initial elements in (55), for example, are mostly those nouns which denote 'place' or 'time'. In the absence of sufficient data, it is uncertain whether this is a mere coincidence or not. A semantic approach to this issue may give some insight into the relation between the semantics and syntax of compounds.

34. See Note 15 for the reasons why disyllabic (and bimorphemic) Sino-Japanese expressions like \(ni'tibei\) "Japan-US" in (61a) and \(ni'ttvuu\) "Sino-Japanese" in (61d) are treated as simplex words, not as compounds.

35. Itô and Mester (1986) argue against Otsu's generalization in terms of branching structure. They claim that the failure of the voicing rule to apply in right-branching compounds is attributable to Lyman's Law, a constraint which has long been believed to condition the voicing rule. However, Lyman's Law has not been properly formulated in the literature, and it has been known to admit a number of exceptions. As for the right-branching compound nouns in question now, there seem to be a couple of examples which cannot be properly accounted for by this law, which suggests that Itô and Mester's claim that the branching constraint can be totally dispensed with may be too strong. In any case, the fact seems to remain that the voicing rule is blocked between the first and second elements of right-branching compounds while it is not blocked in the comparable position of left-branching counterparts.

36. The structure of the compound expression in (67-a-ii), i.e. "New York Yankees," is ambiguous in Japanese in that it can be interpreted either as a left-branching three-element compound or a simplex two-element compound. In either case, the compound is not subject to the branching constraint (or any other constraint), and results in one accentual phrase.
37. These compound expressions result in one accentual phrase if the right-branching structure is 'resolved' with one of the components removed:

(68a') [[ke'izai taisaku] ka'igi] → keizaitaisakuka'igi
   "economy" "measures" "meeting"
   = "meeting on economic measures"

(69a') [[yo'ron tyo'osa] kekka] → yoronyoosake'kka
   "public opinion" "survey" "result"
   = "result of an opinion poll"

38. As mentioned in section 3.1.1, components of Japanese complex compounds are mostly those of Sino-Japanese origin while the native Japanese words or words of foreign origin tend to appear rarely.


40. The PRA also seems to govern sequences of morae, which have been believed to form a linear structure in the literature. The process of high vowel devoicing, for instance, tends to produce an alternating pattern between a devoiced mora and an undevoiced mora instead of yielding a sequence of devoiced morae. Thus, as Han (1962) reports, the onomatopaeic word pukupuku is pronounced as in (a) below although all the four vowels are in theory subject to devoicing. Interestingly, 'non-alternating' patterns as in (b) are also generally impermissible.

   (a) [pukupuku], [pukupuku]

   (b) [pykypu], [pykypu], [pukupuku], [pykypu], etc.

The effect of the PRA is found in the structure of long (i.e. bimoraic) syllables which yield a syllable-internal alternation between the 'syllabic mora' and the 'non-syllabic mora' (cf. Kubozono, 1986). See Kubozono (in preparation) for a detailed analysis of the hierarchical organization of morae sequences and the role of the PRA therein.
CHAPTER THREE
WORD ACCENT IN SENTENCE PERSPECTIVE

In the preceding chapter, I considered the linguistic conditions on the prosodic process of compound formation. In this and the next two chapters, I will explore the roles of word accent in a wider context of speech. In this first chapter, I will discuss three topics on this subject: 'accentual fall,' 'accentual boost' and 'accent clash.' In discussing these topics, I will provide some new experimental evidence on the nature and behavior of Japanese accent and tone, and by so doing, attempt to solve some of the most controversial and unsettled problems, both empirical and theoretical.

Section 1 deals with the phonetics and phonology of accent-induced FO drop, an issue on which very little light has hitherto been shed despite the general belief that it is the primary acoustic correlate of the underlying accent. Experimental evidence will be presented to demonstrate that this phenomenon involves pitch fall not only between the accented mora and the following mora, as has been implicitly assumed in the literature, but also over the sequence of Low-toned morae in the post-accentual position.

This is followed by the discussion of 'accentual boost' (section 2), which is another phonetic manifestation of the underlying accent. It has been believed that accent has a phonetic effect on the peak of the element which bears it. I will first show evidence that this phenomenon involves the
raising of the entire element bearing the accent, and not just its peak. I will then consider the theoretical implications of this evidence, specifically in regard to the nature of phonetic realization rules, the abstractness of tonal representation, and the tonal correlate of the underlying accent.

The last section (section 3) will discuss the 'accent clash,' or the reduction of accents in the sequence of two (or more) accented elements. The main discussion focuses on the finding that 'reduced accents' are not 'unrealized,' as has been widely supposed, but are often realized at the phonetic level of speech. This, it will be claimed, casts doubt on the relevance of the purely impressionistic data upon which most, if not all, previous phonological analyses are proposed, as well as on the validity of such theoretical notions as 'accent deletion' and 'minimal minor phrase.' It will also be claimed that accent reduction is an extreme case of 'downstep' and, accordingly, that its effect should be defined, like ordinary cases of the intonational phenomenon, at the phonetic level, not at the phonological level.
1. On Accentual Fall

1.1. Overview

As has been mentioned in Chapter One, it is widely believed that the primary phonetic correlate of Japanese word accent is a sudden drop in pitch, or a sudden pitch fall putatively observed immediately after the accented mora. In contrast to the popularity of this view, comparatively little is known about the structure of this accent-induced FO fall. Recall now that the conventional tonal and phonetic representations of accented words and phrases uniformly assign Low tones and low pitch to the morae following the accented mora:

\[(1)\]

\begin{align*}
\text{Accentual Rep.} & \quad i'noti\ ga \quad koko'ro\ ga \quad otoko'\ ga \\
\text{Tonal Rep.} & \quad H L L L \quad L H L L \quad L H H L \\
\text{Phonetic Output} & \quad /i\noti\ ga/ \quad \langle k/o\ro\ga \rangle \quad o/t\ok/o\ga/
\end{align*}

As may be clear from these representations, traditional descriptions of Japanese accent assume that accentual fall takes place between the accented mora and the next mora. As for the sequence of Low-toned morae in the post-accentual position, it has been implicitly assumed that pitch stays level or declines mechanically at a rather moderate rate (cf. Kawakami, 1973; Vance, 1987). (2a) and (2b) illustrate these assumptions:
While traditional descriptions thus restrict accentual boost to the narrow domain immediately following the accent(ed mora), my impressionistic observation is that pitch falls steadily in the post-accentual position, as illustrated in (3), without any discrete change in the rate of declination.

To test this observation, I conducted an experiment on the F0 fall, the results of which have turned out to support my impression that the accent-induced F0 drop continues throughout the post-accentual sequence at apparently a constant rate. To be more specific, F0 drops further essentially with the number of Low-toned morae in the post-accentual position although there is a certain limit to the degree of the drop.
1.2. Evidence

1.2.1. General Observation

The test phrases in Dataset V consist of two simple phrases: a noun preceded by an adjective or by the sequence of a noun plus the genitive particle no. In accentual terms, these phrases mostly fall into two groups: those which consist of two accented components and those which are made up of an accented component plus an unaccented one.

In the data obtained, these phrases exhibited an FO contour, as illustrated in Figures 3.1 and 3.2, in which each of the two component phrases forms an independent minor intonational phrase. To be specific, FO rises to reach a peak within the first component, which is followed by a sudden drop caused by accent (i.e. accentual fall). The FO drop thus initiated continues throughout the remaining part of the component phrase, until FO starts to rise again somewhere between the two components. In the test phrases where the second component is accented, the FO suddenly falls again in the second component whereas FO stays relatively level in the same position in the unaccented counterparts.

This configuration of pitch contour is observed not just in the two phrases in Figures 3.1 and 3.2, but in all the test phrases in my data: Figure 3.5–3.17. As for the FO fall in the post-accentual position, there is apparently no discrete change in the rate of declination such that pitch falls at a constant rate until it starts to rise again. A glance at these FO
patterns suggests that it is (3) that represents the true picture of what happens at the phonetic level of speech. That is, accent causes a drop in pitch not only over the accented mora and the immediately following unaccented mora (i.e. .. HLL..), but also throughout the stretch of the unaccented morae in the post-accentual position (i.e. .. HLLL ..). Moreover, the FO declination in the post-accentual position apparently takes place at a constant rate, without any noticeable change in declination rate between the sequence of H-L tones and the subsequent sequence of Low tones. What follows from these observations is that the FO peak of the first component and the FO valley between the two components represent the onset and terminal of accentual fall respectively, while the difference between the two parameters shows the degree of the FO drop.

1.2.2. Dataset V (1)

Having characterized accentual fall in this way, let us next consider if the FO drop is constrained by any linguistic factors. A closer examination of the data gives an interesting insight into the mechanism of this intonational phenomenon.

Dataset V contains the five phrases illustrated in (4). In tonal terms, these five phrases differ (in the orthodox tonal representation) only in the number of post-accentual Low-toned morae ('PALM') of the first component elements.
(4) Dataset V: Subset (1)

<table>
<thead>
<tr>
<th>Accentual Representation</th>
<th>Tonal Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) umae'i me'ron</td>
<td>% LHL % HLL %</td>
</tr>
<tr>
<td>(b) na'mano u'ni</td>
<td>% HLL % HL %</td>
</tr>
<tr>
<td>(c) o'okina me'ron</td>
<td>% HLL % HLL %</td>
</tr>
<tr>
<td>(d) yo'nmaino o'obaa</td>
<td>% HLL % HLL %</td>
</tr>
<tr>
<td>(e) o'onosanno i'rui</td>
<td>% HLL % HLL %</td>
</tr>
</tbody>
</table>

Table 1 shows the mean F0 values of eleven tokens for [Peak1], [Valley2] and [Peak1−Valley2], which respectively refer to the peak of the first component phrase, the valley between the two component phrases, and the difference between the peak and valley. As was mentioned above, the first two phonetic parameters show the F0 values at the onset and terminal of accentual fall, respectively, whereas the third parameter represents the degree of the phonetic phenomenon.

Table 1 Summary of Mean F0 Values and (SD)

<table>
<thead>
<tr>
<th>Phrase</th>
<th>PALM</th>
<th>Peak1</th>
<th>Valley2</th>
<th>Peak1−Valley2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(4a)</td>
<td>1</td>
<td>158.0</td>
<td>132.1</td>
<td>25.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.45)</td>
<td>(3.96)</td>
<td>(3.56)</td>
</tr>
<tr>
<td>(4b)</td>
<td>2</td>
<td>160.4</td>
<td>123.6</td>
<td>36.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.67)</td>
<td>(2.80)</td>
<td>(3.66)</td>
</tr>
<tr>
<td>(4c)</td>
<td>3</td>
<td>162.6</td>
<td>119.7</td>
<td>42.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.72)</td>
<td>(3.00)</td>
<td>(3.70)</td>
</tr>
<tr>
<td>(4d)</td>
<td>4</td>
<td>163.1</td>
<td>115.5</td>
<td>47.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.18)</td>
<td>(1.97)</td>
<td>(4.23)</td>
</tr>
<tr>
<td>(4e)</td>
<td>5</td>
<td>162.0</td>
<td>116.0</td>
<td>46.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.74)</td>
<td>(2.65)</td>
<td>(4.07)</td>
</tr>
</tbody>
</table>
The data in Table 1 suggest several things. First, the value of \([\text{Peak1}]\) tends to remain more or less constant, suggesting that there is a certain target value for this parameter.\(^1\) Second, the mean values for \([\text{Valley2}]\) and \([\text{Peak1-Valley2}]\) vary considerably from one phrase to another. These two parameters apparently covary with the value of PALM in such a way that the increase in the value of PALM induces an increase in the degree of accentual fall, i.e. \([\text{Peak1-Valley2}]\), and, accordingly, a decrease in the value of \([\text{Valley2}]\). This can be seen from Figure 3.18 as well as from Figure 3.19, where FO contours representing accentual fall are illustrated in time-normalized schemata. That the values of \([\text{Valley2}]\) and \([\text{Peak1-Valley2}]\) covary with each other can be seen from Figure 3.20.

A third point to note with the results in Table 1 is that phrase in \((4e)\) does not show any significant difference from \((4d)\): \((p(T=0.503, 20\text{df})>.10)\) for \([\text{Valley2}]\); \((p(T=0.875, 20\text{df})>.10)\) for \([\text{Peak1-Valley2}]\). This suggests that pitch drop induced by accent is limited such that it is not allowed to drop below a certain FO depth: Compare Figure 3.18 and Figure 3.21.\(^2\) It may be possible to interpret this as suggesting that the terminal point of accentual fall has a certain target value below which pitch does not drop further.

1.2.3. Dataset V (2)

While the data given so far have clearly shown that pitch drops further as the number of post-accentual Low-toned morae increases, it remains unclear whether the effect of accentual
fall should be defined within the phrases concerned or is influenced by the phonological structure of the following phrases. This question can be solved by the analysis of another set of phrases from the same dataset, listed in (5), which differ in the tonal structure of second component elements.

(5) Dataset V: Subset (2)

<table>
<thead>
<tr>
<th>Accentual Representation</th>
<th>Tonal Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) uma'i me'ron</td>
<td>% LHL % HLL %</td>
</tr>
<tr>
<td>b) uma'i nomi'mono</td>
<td>% LHL % LHL %</td>
</tr>
<tr>
<td>c) nau'i iromo'yoo</td>
<td>% LHL % LHHLL %</td>
</tr>
<tr>
<td>d) uma'i maamare'edo</td>
<td>% LHL % LHHLL %</td>
</tr>
</tbody>
</table>

(5a) involves an initially accented phrase as its second element which (in the orthodox tonal representation) begins with a High tone, whereas (5b)-(5d) contain in the same position medially accented phrases which begin with a Low tone. If the effect of accentual fall is independent of the phonological structure of the second phrase, it will be anticipated that (5a) should exhibit basically the same degree of accentual fall as (5b)-(5d). If, on the other hand, the effect of accentual fall spreads over two minor phrases across a phrase boundary, then it will be that (5a) shows a smaller degree of accentual fall over the two minor phrases and, accordingly, a higher pitch level for the inter-phrase valley (i.e. offset of the first accentual fall). Table 2 gives a summary of the mean FO values of eleven tokens for the same three parameters in Table 1.
Table 2 Summary of Mean FO Values and (SD)

<table>
<thead>
<tr>
<th>Phrase</th>
<th>PALM</th>
<th>Peak1</th>
<th>Valley2</th>
<th>Peak1-Valley2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(5a)</td>
<td>1</td>
<td>158.0</td>
<td>132.1</td>
<td>25.9</td>
</tr>
<tr>
<td></td>
<td>(4.45)</td>
<td>(3.96)</td>
<td>(3.56)</td>
<td></td>
</tr>
<tr>
<td>(5b)</td>
<td>2</td>
<td>157.4</td>
<td>124.5</td>
<td>32.9</td>
</tr>
<tr>
<td></td>
<td>(3.23)</td>
<td>(5.61)</td>
<td>(3.70)</td>
<td></td>
</tr>
<tr>
<td>(5c)</td>
<td>2</td>
<td>159.2</td>
<td>124.2</td>
<td>35.0</td>
</tr>
<tr>
<td></td>
<td>(4.81)</td>
<td>(2.36)</td>
<td>(4.17)</td>
<td></td>
</tr>
<tr>
<td>(5d)</td>
<td>2</td>
<td>156.0</td>
<td>126.6</td>
<td>29.4</td>
</tr>
<tr>
<td></td>
<td>(3.62)</td>
<td>(4.10)</td>
<td>(2.06)</td>
<td></td>
</tr>
</tbody>
</table>

As the five phrases in Table 1, the four phrases in Table 2 show no noticeable difference with respect to [Peak1]. The greatest difference observed was that between (5c) and (5d), and was not statistically significant: (p (T=1.728, df=20) >.05).

In regard to [Valley2] and [Peak1-Valley2], by contrast, there is a considerable difference between (5a) and (5b)-(5d), with (5a) having a comparatively higher valley and a smaller degree of accentual fall (cf. Figure 3.22). These differences are statistically significant as shown in Table 3.

Table 3 Comparison of (5a) and (5b)-(5d) (df=42)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Phrase</th>
<th>Mean(Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>[Valley2]</td>
<td>(5a)</td>
<td>132.1</td>
<td>3.96</td>
<td>3.535</td>
<td>&lt;.01</td>
</tr>
<tr>
<td></td>
<td>(5b-d)</td>
<td>125.1</td>
<td>4.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[P1-V2]</td>
<td>(5a)</td>
<td>25.9</td>
<td>3.56</td>
<td>3.939</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>(5b-d)</td>
<td>32.4</td>
<td>4.08</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
What the results in Table 3 suggest is that the effect of accentual fall cannot be defined within a single phrase but varies depending upon the phonological structure of the phrase that immediately follows it. To be more specific, it suggests that the extent to which accent induces pitch to fall is determined by the number of Low-toned morae in the post-accentual position, regardless of whether the sequence of the Low-toned morae involves a phrase boundary or not.

1.2.4. Dataset V (3)

Although we have so far concentrated on the sequences of two accented (minor) phrases, sequences of an accented phrase plus an unaccented phrase show essentially the same results in regard to accentual fall. Dataset V contains the following five phrases, which are comparable to those in (4) above in involving varying tonal structures in first elements.

(6) Dataset V: Subset (3)

<table>
<thead>
<tr>
<th>Accentual Representation</th>
<th>Tonal Representation</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) uma'i oimo</td>
<td>% LHL % LHH %</td>
</tr>
<tr>
<td>b) na'mano oimo</td>
<td>% HLL % LHH %</td>
</tr>
<tr>
<td>c) o'okina oimo</td>
<td>% HLLL % LHH %</td>
</tr>
<tr>
<td>d) yo'nmaino nurie</td>
<td>% HLLLL % LHH %</td>
</tr>
<tr>
<td>e) o'onosanno namae</td>
<td>% HLLLLL % LHH %</td>
</tr>
</tbody>
</table>

Table 4 gives the mean FO values of the parameters relating
to accentual fall. Like (4e), (6e) does not seem to conform to the general tendencies, showing no significant difference from (6d): \( p(T=1.789, 20df)>.05 \) for [Valley2]; \( p(T=0.299, 20df)>.20 \) for [Peak1-Valley2]. (Compare Figure 3.23 and Figure 3.24).

<table>
<thead>
<tr>
<th>Phrase</th>
<th>PALM</th>
<th>Peak1</th>
<th>Valley2</th>
<th>Peak1-Valley2</th>
</tr>
</thead>
<tbody>
<tr>
<td>(6a)</td>
<td>2</td>
<td>158.0</td>
<td>125.6</td>
<td>32.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(5.37)</td>
<td>(2.91)</td>
<td>(3.78)</td>
</tr>
<tr>
<td>(6b)</td>
<td>3</td>
<td>161.0</td>
<td>121.7</td>
<td>39.3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.56)</td>
<td>(1.40)</td>
<td>(3.80)</td>
</tr>
<tr>
<td>(6c)</td>
<td>4</td>
<td>162.1</td>
<td>120.1</td>
<td>42.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.32)</td>
<td>(4.25)</td>
<td>(2.45)</td>
</tr>
<tr>
<td>(6d)</td>
<td>5</td>
<td>160.4</td>
<td>110.5</td>
<td>49.9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4.15)</td>
<td>(2.91)</td>
<td>(3.28)</td>
</tr>
<tr>
<td>(6e)</td>
<td>6</td>
<td>162.6</td>
<td>112.5</td>
<td>50.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3.29)</td>
<td>(2.30)</td>
<td>(2.64)</td>
</tr>
</tbody>
</table>

Although the maximum degree of accentual fall may thus be subject to a certain limit, the fact remains that pitch tends to fall further with the number of post-accentual Low-toned morae (PALM) just as in the sequences of two accented phrases in Table 1. This point can be seen from Figures 3.23 and 3.25. That the two parameters, [Valley2] and [Peak1-Valley2], covary with each other can be seen from Figure 3.26.
1.3 Summary and Theoretical Implications

The foregoing discussion can be summed up in the following three points. First, pitch drop induced by accent is not restricted to the position immediately following the accent but continues over the post-accentual Low-toned morae. Second, the degree of the pitch drop induced by accent and the pitch value of the resultant valley (terminal point) can be generalized on the basis of 'PALM,' or the number of post-accentual Low-toned morae as shown in the tonal representation of phrases. Although there may be a certain limit on the maximum extent to which pitch can fall, pitch drops further as the value of PALM increases, to reach a lower FO point. Third, (minor) phrase boundaries are not relevant in characterizing accentual fall in that the notion of PALM should be defined in reference to the post-accentual Low-toned morae across the whole sequence of the two phrases (accented phrase plus another phrase), and not in reference to the Low-toned morae within the accented phrase.

These findings have a couple of theoretical implications to note in modelling Japanese phonology. The first finding, for instance, indicates the discrepancy between phonetic facts and tonal representations. If one should take the view that tonal representations should be as concrete as to reflect every detail of the phonetic output of speech, one would have to recognize, as (7) illustrates, many levels of Low-tones (or many distinctive tones) for what has been unitarily described as the 'Low' tone. Obviously, this consequence is not a preferable one, and it therefore follows that tonal representations should involve some
extent of abstractness although it remains an open question how abstract this 'abstract' is to be.

(7) a) (=4e))

\[
\begin{align*}
&H \\
&L' \\
&L'' \\
&L''' \\
&L'''
\end{align*}
\]

b) (=6e))

\[
\begin{align*}
&H \\
&L' \\
&L'' \\
&L''' \\
&L''''
\end{align*}
\]

% o' onosanno % i'rui % % o' onos anno % namae %

In addition, the fact that the mora is a relevant unit in characterizing accentual fall can be taken as indirect evidence to show the phonetic basis of the phonological concept. It will also support the traditional assumption that the mora should constitute the primitive descriptive unit in the tonal representation of Japanese.
2. On Accentual Boost

2.1. Overview

Having considered the structure of accentual fall in the preceding section, I will discuss in this section the phonetics and phonology of another accent-related pitch phenomenon which I call 'accentual boost,' or the accent-induced pitch boost outlined in passing in Chapter One (sections 2.1 and 3.1).

It was mentioned in passing in Chapter One (sections 1.2.1 and 1.3) that much of the phonetic and phonetics-oriented phonological work on Japanese intonation assumes that accented words and phrases have a higher pitch peak than their unaccented counterparts in connected speech. Poser (1984), for example, corroborates this by comparing the height of such pairs as uma'i and amai put in phrases (cf. Table 5).

Table 5  Poser's Measurements of [uma'i] and [amai]
Nine Tokens from a Single Speaker
(All 16 df)

<table>
<thead>
<tr>
<th></th>
<th>Mean (Hz)</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>uma'i mi'ruku</td>
<td>175.9</td>
<td>2.89</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>amai mi'ruku</td>
<td>171.1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>u'mai mirin</td>
<td>174.0</td>
<td>6.46</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>amai mirin</td>
<td>166.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

While Poser's experimental evidence can be fully reproducible, as will be shown shortly, the past work has not gone further to ask how this phonetic difference actually results, that is, what precisely the F0 boost induced by accent (i.e. 'accentual boost') involves. Consider the three pictures schematized in (8) below, for example, which are all logically
possible as an interpretation of accentual boost.

(8) Three Interpretations of Accentual Boost

\[ \begin{array}{c}
\text{accented} \\
\text{--- unaccented}
\end{array} \]

(a) \hspace{1cm} (peak) \hspace{1cm} (b) \hspace{1cm} (c)

\[ \begin{array}{c}
\text{(onset)} \\
\end{array} \]

The differences between these three pictures stem from the different views they hold as to the way in which the peak FO difference is yielded. (8a) and (8b) assume that the peak FO difference between the two classes of words and phrases results from (a) the greater degree of 'initial lowering' ('initial rise,' in phonetic terms) at the onset of accented phrases, and (b) the greater FO value in the same position, respectively, while (8c) attributes the peak difference to the combinatory effect of (a) and (b).

These three interpretations of accentual boost are based on different assumptions as to the nature of accentual boost and initial lowering. (8b) and (8c) assume that accentual boost involves the raising of the whole accented phrase while (8a) implies that the boost simply affects the high portion of the phrase. Moreover, (8a) and (8c) assume that the initial lowering as observed at the phonetic level involves at least two factors, 'initial lowering' proper and an effect of accentual boost, while
(8b) assumes no effect of accentual boost on the degree of initial lowering.

In this section, I will first present some experimental evidence to show that (8c) represents the true picture of what actually happens. I will then discuss its implications for the phonological theory of Japanese, especially in regard to the phonetics and phonology of initial lowering, the abstractness of tonal representations, and the nature of phonetic realization rules.

2.2. Evidence

2.2.1. Peak Level

To begin with, let us examine the traditional claim that the FO peak is higher in accented phrases than in unaccented phrases. The validity of this claim has been confirmed throughout my experiments, particularly by the data from Datasets V, VI and VII.

Datasets V and VI contain several pairs of phrases, as listed in (9), which differ in the accentedness of the first component phrases: The two members of each pair have the same phonological length, i.e. the same number of morae. (Figures 3.1 through 3.4 illustrate the typical FO contours of the four possible accentual combinations.) The presence or absence of accent in the first words yields mean FO differences ranging between 7 Hz and 13 Hz with respect to its peak, which are all statistically significant as shown in Table 6 (cf. Figure
3.27. <4>

(9) Accentedness of First Component Phrase

\[[+A(cented)] \quad [-A(cented)]\]

a) uma'i me'ron \quad amai me'ron
b) uma'i oimo \quad amai oimo
c) uma'i nomi'mono \quad amai nomi'mono
d) na'okono o'obaa \quad naomino o'obaa
e) na'okono eri'maki \quad naomino eri'maki
f) uma'i yamaimo \quad amai yamaimo
g) na'okono omamori \quad naomino omamori

Table 6 Summary of Statistics: Datasets V & VI
(Peak 1: all 20 df)

<table>
<thead>
<tr>
<th>Accent</th>
<th>Mean (Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(9a)</td>
<td>[+A]</td>
<td>158.0</td>
<td>4.45</td>
<td>4.884</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>149.6</td>
<td>3.59</td>
<td>4.084</td>
</tr>
<tr>
<td>(9b)</td>
<td>[+A]</td>
<td>158.0</td>
<td>5.37</td>
<td>5.683</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>147.6</td>
<td>2.84</td>
<td>6.733</td>
</tr>
<tr>
<td>(9c)</td>
<td>[+A]</td>
<td>162.3</td>
<td>2.10</td>
<td>6.733</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>155.5</td>
<td>2.62</td>
<td>6.733</td>
</tr>
<tr>
<td>(9d)</td>
<td>[+A]</td>
<td>168.5</td>
<td>4.70</td>
<td>4.712</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>159.5</td>
<td>4.25</td>
<td>5.712</td>
</tr>
<tr>
<td>(9e)</td>
<td>[+A]</td>
<td>168.6</td>
<td>3.38</td>
<td>7.163</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>158.5</td>
<td>3.21</td>
<td>7.163</td>
</tr>
<tr>
<td>(9f)</td>
<td>[+A]</td>
<td>160.9</td>
<td>3.81</td>
<td>4.862</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>152.1</td>
<td>4.66</td>
<td>4.862</td>
</tr>
<tr>
<td>(9g)</td>
<td>[+A]</td>
<td>168.7</td>
<td>3.41</td>
<td>7.471</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>155.7</td>
<td>4.65</td>
<td>7.471</td>
</tr>
</tbody>
</table>

Similarly, accented phrases have a higher pitch than unaccented phrases when they stand as the second element in the
sequences. The same datasets provide the pairs as in (10), in all of which mean differences ranging between 5 Hz and 12 Hz result due to the difference in accentedness (cf. Figure 3.28).<sup>5</sup> These differences are statistically significant as Table 7 shows.

$$\text{(10) Accentedness of Second Word}$$

$$\begin{align*}
\text{[+A(accented)]} & \quad \text{[-A(accented)]} \\
a) & \quad \text{uma'i me'ron} \quad \text{uma'i oimo} \\
b) & \quad \text{amai me'ron} \quad \text{amai oimo} \\
c) & \quad \text{uma'i nomi'mono} \quad \text{uma'i yamaimo} \\
d) & \quad \text{na'okono o'obaa} \quad \text{na'okono omamori} \\
e) & \quad \text{na'okono eri'maki} \quad \text{na'okono omamori} \\
f) & \quad \text{amai nomi'mono} \quad \text{amai yamaimo}
\end{align*}$$

Table 7 Summary of Statistics: Datasets V & VI (Peak 2: all 20 df)

<table>
<thead>
<tr>
<th>Accent</th>
<th>Mean (Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(10a) [+A]</td>
<td>141.5</td>
<td>4.39</td>
<td>6.748</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>[-A]</td>
<td>130.5</td>
<td>3.14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10b) [+A]</td>
<td>152.3</td>
<td>3.50</td>
<td>3.456</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>[-A]</td>
<td>147.6</td>
<td>2.84</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10c) [+A]</td>
<td>146.5</td>
<td>4.41</td>
<td>5.195</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>[-A]</td>
<td>138.5</td>
<td>2.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10d) [+A]</td>
<td>145.3</td>
<td>5.02</td>
<td>6.506</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>[-A]</td>
<td>134.5</td>
<td>2.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10e) [+A]</td>
<td>143.0</td>
<td>3.79</td>
<td>6.391</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>[-A]</td>
<td>134.5</td>
<td>2.25</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10f) [+A]</td>
<td>158.1</td>
<td>3.56</td>
<td>6.012</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>[-A]</td>
<td>147.7</td>
<td>4.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The effect of the accent on the peak P0 value of phrases is observed not only in constructions consisting of two simple
phrases but in more complex constructions as well. Dataset X, for example, includes the two sentences given in (11) which differ in the accentedness of the second elements. These two sentences exhibit F0 contours as given in Figures 3.29 and 3.30, which differ substantially in the height of the second phrase, as illustrated in Figure 3.31. And this difference is statistically significant, as shown in Table 8.\(^6\)

\(11\) Dataset X

a) \([+A,+A,+A,+A]\) na'okono a'nino ao'i eri'maki

"Naoko's brother's blue muffler"

b) \([+A,-A,+A,+A]\) na'okono aneno ao'i eri'maki

"Naoko's sister's blue muffler"

<table>
<thead>
<tr>
<th>Phrase</th>
<th>Accent</th>
<th>Mean(Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(11a)</td>
<td>[+A]</td>
<td>153.6</td>
<td>4.36</td>
<td>7.347</td>
<td>&lt; .001</td>
</tr>
<tr>
<td>(11b)</td>
<td>[-A]</td>
<td>141.8</td>
<td>3.46</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

All in all, accented phrases show, ceteris paribus, a higher peak value than unaccented counterparts, irrespective of such factors as (i) the location of the accent, (ii) the position they occupy in the entire construction, and (iii) the syntactic configuration of the entire construction in which they appear (cf. Note 6).
The data presented so far have demonstrated that accentual boost involves a higher FO peak. In addition, our second evidence shows that the effect of accentual boost spreads farther leftward than has been expected, raising the very onset of accented phrases higher than the onset of unaccented counterparts. Tables 9 and 10 compare the pairs of phrases in (9) and (10) respectively, in regard to the FO value at the relevant valley, the phonetic parameter representing the onset of the phrases. Figures 3.32 and 3.33 schematize the differences between the two pairs of phrases.

Table 9 Datasets V & VI: Valley 1
(All 20 df)

<table>
<thead>
<tr>
<th>Phrases</th>
<th>Accent</th>
<th>Mean(Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(9a)</td>
<td>[+A]</td>
<td>144.5</td>
<td>4.93</td>
<td>2.086</td>
<td>=.05</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>140.6</td>
<td>3.78</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9b)</td>
<td>[+A]</td>
<td>144.7</td>
<td>5.93</td>
<td>2.127</td>
<td>&lt;.05</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>140.0</td>
<td>4.31</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9c)</td>
<td>[+A]</td>
<td>150.8</td>
<td>2.32</td>
<td>2.957</td>
<td>&lt;.01</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>147.4</td>
<td>3.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9d)</td>
<td>[+A]</td>
<td>156.4</td>
<td>4.67</td>
<td>4.107</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>149.5</td>
<td>3.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9e)</td>
<td>[+A]</td>
<td>154.8</td>
<td>3.92</td>
<td>3.822</td>
<td>&lt;.01</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>148.8</td>
<td>3.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9f)</td>
<td>[+A]</td>
<td>149.5</td>
<td>2.84</td>
<td>2.975</td>
<td>&lt;.01</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>144.8</td>
<td>4.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9g)</td>
<td>[+A]</td>
<td>154.9</td>
<td>2.39</td>
<td>4.713</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>147.5</td>
<td>4.61</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 10 Datasets V & VI: Valley 2
(All 20 df, except in (f) where df=15)\(^7\)

<table>
<thead>
<tr>
<th>Phrases</th>
<th>Accent</th>
<th>Mean(Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(10a)</td>
<td>[+A]</td>
<td>132.1</td>
<td>3.96</td>
<td>4.392</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>125.6</td>
<td>2.91</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10c)</td>
<td>[+A]</td>
<td>130.5</td>
<td>3.59</td>
<td>4.098</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>125.5</td>
<td>1.86</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10d)</td>
<td>[+A]</td>
<td>123.3</td>
<td>4.61</td>
<td>2.135</td>
<td>&lt;.05</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>119.2</td>
<td>4.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10e)</td>
<td>[+A]</td>
<td>124.1</td>
<td>4.16</td>
<td>2.692</td>
<td>&lt;.02</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>119.1</td>
<td>4.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(10f)</td>
<td>[+A]</td>
<td>151.6</td>
<td>2.92</td>
<td>3.319</td>
<td>&lt;.01</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>143.9</td>
<td>5.94</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

It is understood from these data that accented phrases begin at a higher FO point than unaccented phrases. Since initially accented phrases begin with a High tone in the conventional tonal representation (cf. (12)), it may come as no surprise that they have a higher onset than unaccented phrases, which begin with a Low tone: cf. (d), (e) and (g) in Table 9; (a) and (d) in Table 10. It is important to emphasize, however, that phrases accented on other syllables also have a higher onset than unaccented phrases although they putatively begin with a Low tone and, hence, involve no tonal difference at the initial position from unaccented phrases: cf. (a), (b), (c) and (f) in Table 9; (c), (e) and (f) in Table 10.

The pair of phrases in Dataset X — (11) — also provide evidence for the effect of accent on the height of the immediately preceding valley (cf. Figure 3.31).\(^8\)
All in all, accented phrases have a higher onset than unaccented ones. In other words, the effect of accent spreads leftward throughout the phrase, thereby raising the FO range of the entire phrase.

2.2.3. Initial Lowering

From the foregoing discussion, it will be understood that accent triggers the raising of the entire phrase to which it is assigned, not just of its peak. In addition to this, my experimental data suggest that the accent-induced FO boost also affects the degree of initial lowering (IL), i.e. the FO rise characterizing the onset of the phrases. Although the differences in terms of absolute value are small as compared with the differences in the two parameters we saw in the preceding subsections, they are nevertheless statistically significant in most cases. Tables 12 and 13 summarize statistical results with the same pairs of phrases as Tables 6 and 7 respectively: cf. Figures 3.34 and 3.35
### Table 12  Summary of Statistics: Datasets V & VI
(IL of First Component: all 20 df)

<table>
<thead>
<tr>
<th>Phrase Pair</th>
<th>Accent</th>
<th>Mean (Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(9a)</td>
<td>[+A]</td>
<td>13.2</td>
<td>1.75</td>
<td>2.528</td>
<td>=.02</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>11.6</td>
<td>1.63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9b)</td>
<td>[+A]</td>
<td>12.6</td>
<td>2.06</td>
<td>5.051</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>7.6</td>
<td>2.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9c)</td>
<td>[+A]</td>
<td>11.6</td>
<td>2.34</td>
<td>3.264</td>
<td>&lt;.01</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>8.2</td>
<td>2.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9d)</td>
<td>[+A]</td>
<td>12.2</td>
<td>2.40</td>
<td>1.983</td>
<td>&lt;.10</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>9.9</td>
<td>3.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9e)</td>
<td>[+A]</td>
<td>13.8</td>
<td>4.40</td>
<td>2.733</td>
<td>&lt;.02</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>9.7</td>
<td>2.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9f)</td>
<td>[+A]</td>
<td>11.4</td>
<td>3.17</td>
<td>3.727</td>
<td>&lt;.01</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>7.3</td>
<td>1.79</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(9g)</td>
<td>[+A]</td>
<td>13.8</td>
<td>2.32</td>
<td>5.236</td>
<td>&lt;.001</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>8.3</td>
<td>2.65</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 13  Summary of Statistics: Datasets V & VI
(IL of Second Component: all 20 df)

<table>
<thead>
<tr>
<th>Accent</th>
<th>Mean (Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(10a)</td>
<td>[+A]</td>
<td>9.4</td>
<td>3.78</td>
<td>3.237</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>4.9</td>
<td>2.63</td>
<td></td>
</tr>
<tr>
<td>(10b)</td>
<td>[+A]</td>
<td>11.7</td>
<td>1.63</td>
<td>4.505</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>7.6</td>
<td>2.54</td>
<td></td>
</tr>
<tr>
<td>(10c)</td>
<td>[+A]</td>
<td>16.0</td>
<td>3.24</td>
<td>2.381</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>13.0</td>
<td>2.63</td>
<td></td>
</tr>
<tr>
<td>(10d)</td>
<td>[+A]</td>
<td>22.0</td>
<td>3.00</td>
<td>4.963</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>15.3</td>
<td>3.29</td>
<td></td>
</tr>
<tr>
<td>(10e)</td>
<td>[+A]</td>
<td>18.9</td>
<td>3.24</td>
<td>2.590</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>15.3</td>
<td>3.29</td>
<td></td>
</tr>
<tr>
<td>(10f)</td>
<td>[+A]</td>
<td>6.3</td>
<td>3.13</td>
<td>3.077</td>
</tr>
<tr>
<td></td>
<td>[-A]</td>
<td>2.7</td>
<td>2.28</td>
<td></td>
</tr>
</tbody>
</table>
The pair of phrases in Dataset X, given in (11) above, provide additional evidence for the claim that FO rise is greater at the onset of accented phrases than at the onset of unaccented phrases (cf. Figure 3.31).

Table 14 Summary of Statistics: Dataset X
(IL of Second Component: df=22)

<table>
<thead>
<tr>
<th>Phrase Pair</th>
<th>Accent</th>
<th>Mean(Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>(11a) [+A]</td>
<td>21.0</td>
<td>3.46</td>
<td>3.712</td>
<td>&lt;.01</td>
<td></td>
</tr>
<tr>
<td>(11b) [-A]</td>
<td>16.1</td>
<td>2.98</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Incidentally, the results summed up in Tables 12-14 reveal another interesting fact about initial lowering. As we saw in Chapter One, the traditional tonal analysis describes initially accented phrases as beginning with a High tone. While this may be correct as a phonological interpretation, my data support Poser's claim (cf. Chapter One, section 3) that phrases of the type in question involve an initial FO rise at the phonetic level as do the phrases accented otherwise. In fact, initially accented phrases show a greater degree of initial FO rise than unaccented phrases, which putatively begin with a Low-High sequence: cf. (d) and (e) in Table 12 — (9d) and (9e) —, and (a) and (d) in Table 13 — (10a) and (10d). (See Figures 3.36 (a) vs. (b); Figures 3.37 (a) vs. (b); Figures 3.38 (a) vs. (b)). This reveals another discrepancy between the phonetic fact and the conventional phonological (tonal) representation:
2.3. Summary and Theoretical Implications

The experimental results presented in the preceding section show that the picture illustrated in (8c) represents the effect of accentual boost most precisely. This can be seen from Figures 3.39-3.42, where the FO contours of some pairs of phrases from (9) and (10) are schematically compared on the basis of the averaged FO values of peaks and valleys. These results can be summarized in the following two points:

\[(13)\]

a) Accented phrases, whether initially accented or accented on other syllables, are realized at a higher pitch level than unaccented counterparts.

b) Accented phrases tend to show a greater degree of initial FO rise than unaccented counterparts, irrespective of the location of the accent within the phrases.

These findings have the following three implications as to the nature and interpretation of initial lowering. First, the
first finding suggests that the FO rise characterizing initial lowering in accented phrases should be partly attributable to the effect of accentual boost. In other words, what is observed as initial lowering at the phonetic output is not generated by a single principle but by a combination of at least two principles, one of 'initial lowering' proper ('true initial lowering') and the effect of accentual boost ('pseudo-initial lowering'). This point is schematically shown in Figure 3.43 and will further be developed in Chapter Four where some other factors contributing to the surface initial lowering are discussed.

Second, the same finding points to a discrepancy between the phonological and phonetic structures of initially accented phrases, which are analyzed as involving no initial lowering at the tonal level, but do in fact involve an FO rise at the phonetic level: cf. (14). This discrepancy reflects the abstractness of the conventional tonal representation, or, to be more exact, the tacit hypothesis underlying the conventional tonal analyses that tonal representation can (or should) be somewhat abstract and different from what is actually observed at the output of speech.

(14) Phonetics and Phonology of Initially Accented Phrases

Tonal Representation     H L L L ...

Simplified FO Shape / \n
Similarly, one finds another discrepancy between phonetics
and phonology in the fact that both non-initially accented phrases and unaccented phrases are analyzed as having the same tonal representation at their onset, although the former involve a greater degree of initial FO rise at the phonetic level.

(15) Phonetics and Phonology of Other Accent-Type Phrases

<table>
<thead>
<tr>
<th>Tonal Rep.</th>
<th>FO Shape</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Unaccented</td>
<td>L H H H ..</td>
</tr>
<tr>
<td>b) Accented</td>
<td>L H ..L L ..</td>
</tr>
</tbody>
</table>

Apart from the discussion relating to initial lowering, the experimental results as summarized in (13) above reveal a significant fact about the mechanism of accentual boost, which in turn has far-reaching implications for the tonal and intonation theories of Japanese. Note first that the effect of accentual boost extends as far as the onset of accented phrases. That is, accent exerts its boosting effect not simply on the relatively high stretch of accented phrases but on the entire phrases, raising the whole phrases one step higher than unaccented phrases, as illustrated in (8c). This fact argues for the interpretation of accentual boost as a phonetic phenomenon rather than as a tonal one: the tonal interpretation of accentual boost, illustrated in (16) below, would require us to posit, for the only sake of physical description and nothing else, two levels of Low tones (or two distinctive tones) for what has been described as the Low tone, as well as the distinction between High and Mid...
tones:

(16) Tonal Interpretation of Accentual Boost

a) Accented: HLL, LHLL, etc.    b) Unaccented: L'MMM...

This leaves us with the phonetic interpretation of accentual boost, whereby the kinds of intonational (FO) differences we saw between accented and unaccented phrases are attributed to the effects of phonetic realization rules. This consequence has several important implications about some theoretical issues.

Two implications emerge from the very basic notion underlying the interpretation, that phonetic realization rules (PRRs) raise the FO range of accented phrases as compared with unaccented ones by referring to some property distinguishing between the two classes of phrases. Given the orthodox idea that accentual information (accentedness and accent location) is all encoded into tonal representation before PRRs interpret the phonological representation (cf. Chapter One), and also that the tonal representation of accented phrases differs from that of unaccented ones only in involving a Low tone following High tone(s), this means that PRRs make reference to the Low tone in accented phrases and manifest both the word-initial Low tones and
High tones of this class of phrases at a higher F0 level than those of the other class of phrases.

(17) Accentual Boost & Tonal Representation

Accented Phrases: \( \% \text{ LH}.. \text{ HL} \% \)

Unaccented Phrases: \( \% \text{ LH}.. \text{ HH} \% \)

This characterization of accentual boost has two important implications. First, it implies that PRRs look ahead. In the discussion under consideration, PRRs look ahead in the tonal representation of phrases and react positively to the accent-related Low tone (or sequence of High-Low tones). If this is the case, it speaks against the proposal made by Pierrehumbert (1980) that phonetic realization rules operate in a strictly left-to-right fashion without looking ahead. This point will be confirmed in Chapter Four, where another piece of evidence will be given for the claim that PRRs do look ahead (even though they operate essentially in a left-to-right fashion).

The other implication that emerges from the characterization of accentual boost given above concerns the fact that the Low tone assigned to the mora immediately following the accented mora is the only tonal clue that shows the presence of the underlying accent. What this implies is that High tones are assigned to both accented and unaccented phrases, irrespective of the presence or absence of accent in the underlying phonological representation of the phrases. To put it differently, the principle by which High tones are assigned to phrases should be
different from the principle governing the location of the underlying accent. This speaks against Haraguchi's tonal analysis whereby the High tone in the basic melody is associated with the underlying accent (or the vowel bearing it) while the same High tone is associated with the morae constituting unaccented phrases by a default rule. Rather, it supports the analysis proposed by McCawley whereby the underlying accent induces post-accentual morae to bear Low tones, rather than inducing the accented mora itself to be given a High tone (cf. Chapter One, section 4.4).

Finally, the phonetic interpretation of accentual boost points to the view that Japanese accent has a phonetic prominence if it does not have a tonal prominence. That is, accented words and phrases enjoy phonetic boost when they are phonetically implemented by PRRs although they cannot be said to be more prominent than unaccented words and phrases at the tonal level — cf. (17). It may be important to add, in this regard, that the phonetic prominence accompanying Japanese accent does not manifest itself on a certain syllable (or mora) or a certain portion of the phrase concerned, but spreads throughout the phrase bearing the phonological feature. This may lend additional support to the idea suggested in Chapter One (section 2.3) that Japanese accent should be given a dual interpretation in regard to its domain, one as a property of a particular type of words and phrases, and the other as a property of a particular syllable.
3. On Accent Clash

3.1. Overview

It was suggested in Chapter 1 (section 5) that two cases are reported in the literature where word accents are modified in the domain beyond word. One of them is the case whereby accents are removed by "deaccenting morphemes" which we saw in Chapter 1.

The other case which putatively involves the modification of word accents is the reduction of accents in the concatenation of two or more accented words: e.g. (18a). The literature appears to share the following two assumptions about this phenomenon.

First, it is agreed that the accents of lexical items reduce those of the particles that follow them, with the exception of the cases where deaccenting morphemes override the accent of lexical items to which they are attached: cf. Akinaga (1966:57-8); Kindaichi (1981, 1275-82); McCawley (1968: 139-40); Haraguchi (1977:9-10); Poser (1984:188). In other words, phrasal constructions consisting of a lexical item plus any particles putatively constitute what Poser calls "minimal minor phrase", or the "class of sequences of morphemes that must form a single minor phrase" (Poser, p.147). Since 'minor phrases' are defined as an intonational unit in which "at most one accent may be realized" (p.166), the accent clash between lexical items and the following particles is to be resolved by the reduction of the accents of the latter. As a consequence of this phenomenon, the sequences of an accented lexical item and an accented particle are believed to be neutralized at the phonetic level.
with those of an accented lexical item plus an unaccented particle: cf. (18a) vs. (18c).

(18) a) ro'ndon-ma'de "as far as London"
    \[\rightarrow \text{ro} \text{ndonmade}\]

b) amerika-ma'de "as far as America"
    \[\rightarrow \text{a} \text{merikama} \text{de}\]

c) ro'ndon-kara "from London"
    \[\rightarrow \text{ro} \text{ndonkara}\]

d) amerika-kara "from America"
    \[\rightarrow \text{a} \text{merikakara}\]

The other assumption which appears to be commonly held in the literature is that sequences of two accented minimal minor phrases can take either of the two intonational patterns as illustrated in (19), that is, (a) a pattern in which the two minimal minor phrases constitute separate minor phrases, and (b) a pattern in which the two phrases are unified into a single minor phrase in which the accent of the lefthand (leftmost) phrase survives (% denotes a minor phrase boundary):

(19) uma'i nomi'mono "tasty drink"
    a) %uma'i% nomi'mono% \[\rightarrow \text{u} \text{ma'i nomi'mono}\]
    b) %uma'i nomimo%ono% \[\rightarrow \text{u} \text{ma'i nomi'mono}\]

Putting aside the principles and factors governing the choice between the two intonational patterns (cf. Chapter Four), the accent clash within a single intonational phrase is resolved
by the reduction of the righthand component phrase, as shown in (19b). In other words, the accent of the leftmost element dominates in the entire phrase just as in the case of minimal minor phrases (cf. (18a)). This idea has led to the generalization that when two or more accents clash at the phrasal level, "it is invariably the case that it is leftmost accent that is manifested" (Poser, p. 141), with the other accents all reduced both phonologically and phonetically.

While the past work agrees on these basic assumptions regarding the accent reduction, there are a couple of issues in which opinions seem to differ. One of them concerns the level at which the accent reduction is to be defined in the phonological system of Japanese. Two different accounts can be found in the literature. One account, which is put forward by Poser,\(^{14}\) defines the phenomenon as an accent assignment process, and postulate an accent deletion rule (ADR) (Poser's 'Accent Resolution Rule') that "deletes all but the leftmost accent within a minor phrase" (Poser, p. 188) in prior to the application of tone assignment rules (TAR). This analysis is illustrated in (20) below:
(20) Accentual Account

(18a) % ro'ndon ma'de % % uma'i nomi'mono %
(19b) % ro'ndon made % % uma'i nomimono %

ADR % ro'ndon made % % uma'i nomimono %
TAR % H L L L L L % % L H L L L L L %

Phonetic  ro'ndon made  uma'i nomimono
Output

The other account of the accent reduction to be found in the literature is to define the phenomenon at the tonal level. This account is adopted by McCawley (1968) and Haraguchi (1977). Under Haraguchi's autosegmental account, for instance, no accentual rule needs to be posited, but independently motivated tonal rules assign correct tonal patterns to the phrases concerned, with the non-leftmost accents tonally 'masked,' as it were. That is, the TA Rule associates the High tone in the basic melody with the leftmost accent, whereas the other accents are associated with the Low tone by Universal Tone Association Convention (UTAC). This is illustrated in (21) where *//* is employed as an accent marker:
Essentially the same approach as (21) is adopted by McCawley (1968:174), who assumes a tone (his 'pitch') assignment rule to the effect that "everything after the first mora of the strongest accented syllable (i.e. the leftmost accent within a minor phrase: HK) becomes low pitched". By comparison, the tonal account in (21) appears to be preferable to the accentual one in (20) since it can dispense with the accent deletion rule at no additional cost.

While the accentual and tonal accounts commonly assume that all but the leftmost accent within a minor phrase are phonologically reduced, and are phonetically unrealized at the
subsequent phonetic level, it seems perfectly acceptable to view
the reduction of non-leftmost accents as a phonetic process
rather than as a phonological one. Under this new analysis,
lexically accented elements are all given independent tonal
patterns at the tonal level, and all the accents but the leftmost
one in a minor phrase are phonetically reduced (i.e. unrealized)
at the stage where the tonal patterns are phonetically
interpreted by phonetic realization rules: i.e. (22). Although
no one seems to have proposed this line of analysis, there is
apparently no reason why it should be considered implausible as
compared with the two analyses illustrated in (20) and (21)
above. This issue will be discussed in section 3.4 below, where I
will present some evidence in favor of this analysis. I will
also challenge the general belief that accents of non-leftmost
elements are in fact unrealized in phonetic output.

\[(22)\]

\[(18a)\]

\[(19b)\]

\[
\begin{array}{|c|c|c|}
\hline
\text{Accent} & \text{ro'ndon ma'de} & \text{uma'i nomi'mono} \\
\text{Output} & \% HLLL HL \% & \% UHL UHL \% \\
\hline
\text{Tonal} & & \\
\text{Output} & \text{HLLL HL} & \text{UHL UHL} \\
\hline
\text{Phonetic} & \text{HLLL HL} & \text{UHL UHL} \\
\text{Output} & & \\
\hline
\end{array}
\]

Apart from the question of the level where the accent
reduction phenomenon should be defined, there is another
unsettled issue in the previous discussion of accent reduction.
As suggested above, quite a few people postulate a certain type
of syntactic phrase structure which always constitutes a single
minor intonational phrase, that is, a phrase in which non-lefmost accents are invariably reduced. Besides the difference in the naming of this syntactic unit (which we call "minimal minor phrase": cf. Chapter Four), the definition of this unit shows a slight variation in the literature.

McCawley (1968:177), for example, treats auxiliary verbs in the same way as nouns, verbs and other lexical items, whereas the same syntactic units are characterized as dependent words (particles or units analogous to them) by most others, including Hashimoto (1948), Hayata (1969) and Poser (1984). Under McCawley's view, auxiliary verbs either (i) constitute an independent minor phrase (with or without the particle(s) attached to them), or (ii) constitute a minor phrase together with the main verbs and adjectives to which they are attached. If the first option is chosen, the accent of auxiliary verbs can survive alongside the accent (if any) of their preceding main verbs, i.e. (23a), whereas auxiliary verbs get their accents reduced if the second option is chosen, i.e. (23b):

(23)

i) ayama'ru daro'o

"apologize" "will" = "will apologize"

a) % ayama'ru % daro'o %

% LHHL % LHL %

% ayama'ru daro'o %
b) % ayama'ru daro'o %
   (Accent Deletion or Tonal Masking)
   % LHLLLL %
   a[yama rudaroo]

ii) utukusi'i yo'oda
    "beautiful" "seem" = "(It) seems beautiful"

   a) % utukusi'i % yo'oda %
      % LHHL % HLL %
      utukusu[i yi oda

   b) % utukusi'i yo'oda%  
      (Accent Deletion or Tonal Masking)
      % LHLLLL %
      utukusu[i yo oda

Meanwhile, if auxiliary verbs are regarded as particles (or their analogues), not as lexical items, then they have no choice but to take the intonational pattern in (23b), with their accents always reduced by the accents of the main verbs or adjectives that precede them.

Overall, the notion of 'minimal minor phrase' is defined more or less vaguely in the literature and, because of this, opinions can and actually do differ considerably as to where the boundary is to lie between the syntactic constructions which can form a minimal minor phrase on their own and those which cannot.

It must be emphasized nevertheless that most of the previous analyses have recognized, explicitly or implicitly, a unit
equivalent to the minimal minor phrases, and that they adopted a syntactic criterion in one way or another in defining the notion.

3.2. Evidence

As has been just mentioned, it is generally assumed that accent clashes caused by the concatenation of two or more accented elements are solved by the reduction of non-leftmost accents, and that these 'reduced accents' are not realized at the phonetic output of speech. Let us begin our discussion of the accent clash and subsequent accent suppression by considering if these assumptions are experimentally justifiable.

Datasets I and II contain a set of phrases, some of which are given in (24) below, in which accented bimoraic particles (ma'de 'as far as, to, until' and vo'ri 'from, in preference to') are attached to accented nouns to constitute a simple form of phrases. Since phrases of this type putatively represent "minimal minor phrases," or the "class of sequences of morphemes that must form a single minor phrase" (Poser, 1984:147), it should invariably be the case that the accents of the particles are phonologically depressed and subsequently unrealized at the phonetic output.
(24) "Minimal Minor Phrase"

a) o'oman ma' de (aru' ita)  
"(she walked) as far as Oman"

b) (kono) ra' nnaa yo' ri mo  "than (this) runner"

What is actually observed in the experimental data does not necessarily accord with this conventional hypothesis. Instead, the data show that the "minimal minor phrases" yield the two FO patterns illustrated in (25a) and (25b) alongside the expected pattern in (25c): cf. Figures 3.44-4.46. In (25a), the accented particles form a separate minor phrase from the nouns to which they are attached, with their own initial lowering (IL) and accent (accentual fall: AF) both realized: cf. Figure 3.44. (25b) represents what Poser calls 'total catathesis' (total downstep), that is, the FO pattern in which the second accented element manifests its accent without manifesting its initial lowering: cf. Figure 3.45. Table 15 gives the frequencies with which these FO patterns occur as opposed to the one in (25c).

(25)

a) b) c)

... ma'de ... ma'de ... ma'de
  yo'ri  yo'ri  yo'ri
Table 15 FO Patterns and Frequencies

<table>
<thead>
<tr>
<th>FO Pattern</th>
<th>(25a)</th>
<th>(25b)</th>
<th>(25c)</th>
<th>(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
<td>7</td>
<td>7</td>
<td>66</td>
<td>80</td>
</tr>
</tbody>
</table>

Not surprisingly, the FO pattern in (25c) is observed far more frequently than the other two patterns. However, it deserves a special remark that the two patterns in (25a) and (25b) are actually observed in natural speech. This fact implies that what has been analyzed as "accent reduction" due to accent clash might involve neither 'accent deletion' nor a phonetic reduction of accents. In other words, it suggests that human 'ears' are not accurate enough to perceive the reduced but realized accents at the relatively low level of pitch register. If this is the case, it follows that the impressionistic descriptions widely accepted in the literature fall short of empirical justification, and so do the theoretical analyses which have been proposed on them.

The notion that reduced accents survive at the phonological level of speech and are often realized at the phonetic level can be further confirmed by other data from Datasets I and II. The datasets contain the two types of phrases shown in (26): (a) those consisting of an accented verb plus an accented auxiliary verb, and (b) compound-like verbal combinations consisting of a main verb and another verb generally known as hozvo-doosi. <15>
(26)  
a) (naomi wa) avama'ru da'roo  
"(Naomi) will apologize"

b) (ramune o) no'nde mi'ru  
"try drinking (the lemonade)"

The impressionistic descriptions in the literature assume that the underlined phrases generally constitute a single minor phrase in natural connected speech with the non-leftmost accents entirely reduced at the phonological (accentual or tonal) level, and subsequently unrealized at the phonetic level.¹⁶ My experimental data show, contradicting this general belief, that the accent of the second element is often realized along with that of the first element, yielding either of the two FO patterns in (25a) (cf. Figures 3.47 & 3.50) and (25b) (cf. Figures 3.48 & 3.51). In fact, as shown in Table 16, the two FO patterns combined account for the majority of all the instances analyzed.

Table 16  FO Patterns and Frequencies

<table>
<thead>
<tr>
<th>F0 Pattern Phrase Type</th>
<th>(25a)</th>
<th>(25b)</th>
<th>(25c)</th>
<th>(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(26a)</td>
<td>9</td>
<td>7</td>
<td>24</td>
<td>40</td>
</tr>
<tr>
<td>(26b)</td>
<td>18</td>
<td>6</td>
<td>6</td>
<td>30</td>
</tr>
</tbody>
</table>

Another source of data from Dataset I provides additional evidence to show that the impressionistic descriptions adopted in the literature are not as accurate as have been supposed. The dataset contains the sentences given in (27) which, according to
McCawley (1968:179) and Poser (1984:154), can show the intonational phrasing patterns listed in (28).<17> In (28a), each of the three phrases constituting the sentence forms an independent minor phrase with its own accent manifested. In (28b) and (28c), on the other hand, some or all of the component phrases constitute a unified intonational phrase with only the leftmost accent in each unified phrase manifested.<18>

(27) i) [[[na'ni o] no'ndara] i'i desu ka]
    "What would it be best to drink?"

ii) [[[na'ni o] a'ndara] i'i desu ka]
    "What would it be best to knit?"

(28) a) % na'nio % no'ndara % i'idesuka %
b) % na'nio nondara % i'idesuka %
c) % na'nio nondara iidesuka %

The experiment involved an analysis of twenty utterances of the two sentences (ten utterances for each) made by a single speaker. The result is that the accents of the three component phrases are clearly manifested in all of the utterances although accents other than that of the leftmost phrases are often very difficult to hear unless listened to extremely carefully. The only variation found is the one between the patterns in (29a) and (29b) — cf. Figures 3.53 and 3.54 —, in the latter of which the first and second component phrases yield an FO pattern characterizable as total downstep. Table 17 gives the frequencies with which the two patterns were observed.<19>
Table 17  FO Patterns and Frequencies

<table>
<thead>
<tr>
<th>FO pattern</th>
<th>(29a)</th>
<th>(29b)</th>
<th>(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(27-i)</td>
<td>7</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>(27-ii)</td>
<td>8</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>total</td>
<td>15</td>
<td>5</td>
<td>20</td>
</tr>
</tbody>
</table>

3.3. Discussion

The data presented so far will be enough to suspect, notwithstanding the conventional impressionistic descriptions, that "reduced accents" are manifested at the phonetic level in many, if not all, cases. Apart from this, the data give an interesting insight into the mechanism of accent reduction.

A glance at the data gives the impression that the FO patterns which reduced accents exhibit form free variation (cf. Figures 3.44-3.46; Figures 3.47-3.49; Figures 3.50-3.52). This is certainly true to some extent since reduced accents are sometimes realized and sometimes unrealized under apparently the
same linguistic conditions. The phrase in (24a), for instance, yields two instances where the second accent is realized (i.e. (25b)), alongside eight instances in which the accent is unrealized (i.e. (25c)). Likewise, the phrase in (26a) realizes its second accent (i.e. (25a) or (25b)) in five instances out of ten, with the accent unrealized in the remaining instances.

While the variation between realized and unrealized accents can thus be viewed as phonetic variation, a closer examination of the data suggests that the variation is not entirely arbitrary, but is governed by some linguistically definable factors. One such factor relates to the notion of 'PALM' defined in section 1 above, that is, the number of Low-toned morae in the post-accentual position. <20> Generally speaking, reduced accents are more likely to be manifested as the value of PALM increases. Table 18 shows this by reanalyzing the results in Tables 15 and 16, respectively, this time in terms of the relation between PALM and the realization of reduced accents.
Another factor that appears to contribute to the realization of depressed accents is one of the morphological complexity of the phrase in which the reduced accents are contained. In the case of the phrase type in (24), for example, the accented particle is more likely to manifest its accent when it is itself followed by another particle than when it is not: o'oman vo'ri mo vs. o'oman vo'ri. The same is true of the sequences of two accented verbs, i.e. (26b) type phrases: the second verb manifests its accent at a considerably higher rate when it is followed by a particle (e.g. no'nde mi'ru ma'de) than it is not (e.g. no'nde mi'ru). Table 19 summarizes this correlation with respect to the two phrase types now mentioned.²¹
Table 19 Morphological Complexity (MC) & Accent Realization

<table>
<thead>
<tr>
<th>Phrase type</th>
<th>Accent Realized (25a/b)</th>
<th>Unrealized (25c)</th>
<th>(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>simplex (24)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>55</td>
<td>60</td>
</tr>
<tr>
<td>complex (24)</td>
<td>9</td>
<td>11</td>
<td>20</td>
</tr>
<tr>
<td>(total)</td>
<td>(14)</td>
<td>(66)</td>
<td>(80)</td>
</tr>
<tr>
<td></td>
<td>simplex (26b)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>complex (26b)</td>
<td>19</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td>(total)</td>
<td>(24)</td>
<td>(6)</td>
<td>(30)</td>
</tr>
</tbody>
</table>

In addition to 'PALM' and the morphological complexity of the phrase involved, there is a third factor which accounts for the variation regarding the manifestation of reduced accents. A comparison of Tables 15 and 17, given in Table 20 below, suggests that the rate at which reduced accents are realized varies greatly depending upon the syntactic category of the element involved. That is, reduced accents appear to be realized more readily in auxiliary verbs than in particles, and even more so in hozvo doosi, the second member of the compound-like verbal sequences. And at the very end of this continuum lie the lexical items and phrases, which, as is known from the cases in (27) (cf. Table 17), manifest their accents most readily:
Table 20  Syntactic Category (SC) & Accent Realization

<table>
<thead>
<tr>
<th>Accent SC</th>
<th>Realized (25a/b)</th>
<th>Unrealized (25c)</th>
<th>(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(24) Particle</td>
<td>14</td>
<td>66</td>
<td>80</td>
</tr>
<tr>
<td>(26a) Auxiliary Verb</td>
<td>16</td>
<td>24</td>
<td>40</td>
</tr>
<tr>
<td>(26b) hozvo-doosi</td>
<td>24</td>
<td>6</td>
<td>30</td>
</tr>
<tr>
<td>(27) Phrase</td>
<td>20</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

Since the result in Table 20 may contain the effects of the two factors already mentioned, phrases of the same PALM and the same degree of morphological complexity need to be compared. Table 21 compares the effect of different syntactic categories by analyzing the phrases whose PALM is two (morae) and which are morphologically 'simplex,' i.e. followed by no more particles: e.g. (24) ro'oma vo'ri, (26a) ka' eru vo'oda; (26b) no'nde mi'ru. In the case of the sentences in (27) the second phrases are chosen for comparison although they cannot be said to be morphologically 'simplex.' Table 21 exhibits essentially the same tendency as Table 20, the only difference being that the difference between auxiliary verbs and hozvo-doosi is not distinct.
Table 21 Syntactic Category & Accent Realization
(PALM = 2 morae, MC = simplex)

<table>
<thead>
<tr>
<th>Accent SC</th>
<th>Realized (25a/b)</th>
<th>Unrealized (25c)</th>
<th>(total)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(24) Particle</td>
<td>3</td>
<td>37</td>
<td>40</td>
</tr>
<tr>
<td>(25a) Auxiliary Verb</td>
<td>16</td>
<td>14</td>
<td>30</td>
</tr>
<tr>
<td>(26b) hozvo-doosi</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>(27) Phrase</td>
<td>20</td>
<td>0</td>
<td>20</td>
</tr>
</tbody>
</table>

3.4. Summary and Theoretical Implications

The foregoing discussion of the experimental data can be summarized in the following three points:

(30)

a) Contradicting the generally adopted impressionistic view, what have been described as "reduced accents" are often realized at the phonetic level. This holds true not only in the concatenation of two (or more) accented phrases but also within what putatively constitutes the simplest form of phrase called "minimal minor phrase."

b) Whether "reduced accents" are phonetically realized or unrealized is not entirely predictable: utterances produced by a single speaker show a variation between the two phonetic patterns under apparently the same linguistic and paralinguistic conditions. This suggests that the variation between realized and unrealized accents involves phonetic variation to a considerable extent.

c) Despite (b), there is evidence to believe that the variation between realized and unrealized accents is conditioned by linguistic factors to a certain extent, such as the phonological (tonal) structure of phrases, the morphological complexity and the syntactic category of the element whose accent is reduced.

These findings have several implications for the
characterization of accent reduction and some related issues. Let us consider, first of all, the finding that accents of particles are often realized at the relatively low pitch level along with those of the words to which they are attached. This fact has two implications. First, it suggests that our 'ears' do not always provide as accurate a description as might be supposed, or at least, a phonetically accurate picture of what happens at the relatively low level of pitch register.

Second, and more important, the fact casts doubt on the very notion of "minimal minor phrase" and the hypothesis behind the notion. Recall that the realization of the "reduced accents" is often accompanied by the realization of the initial lowering of the accented particles, as shown in (25a) (cf. Table 15). What this means is that particles can form, quite contradicting the popular view, an intonational minor phrase separately from the lexical items to which they are attached. This leads us to suppose that the notion of "minimal minor phrase" is not simply unnecessary but makes a wrong generalization in the intonational theory of Japanese. Moreover, the fact that two minor phrases can result from what appears to be the simplest form of syntactic phrases suggests that it is basically wrong to assume a priori that sequences of such and such morphemes "must form a single minor phrase." In more general terms, it casts doubt upon the hypothesis that intonational categories (prosodic categories, to speak more generally) can be defined so rigidly by 'text,' i.e. by syntactic and/or morphological structures of sentences. This point will be further developed in Chapter Four, section 3.
The experimental results summed up in (30) also give an interesting insight into the theoretical interpretation of accent reduction. The very fact that what have been described as "reduced accents" are often realized at the phonetic output of speech suggests that these accents may be phonologically existent. It suggests, in other words, that the accent reduction due to accent clashes may not involve a phonological change, as has been believed (i.e. "accent deletion" or 'tonal masking of accents'), but may represent no more than a phonetic change to be defined at the phonetic level.

This idea is supported by at least two lines of evidence. One of them comes from the second finding mentioned above, that is, that reduced accents show an apparently phonetic variation in regard to their realization. If one should take the position that the accents which are unrealized at the surface are either deleted at the accentual level or masked at the tonal level, one would be unable to characterize this apparently phonetic variation in any reasonable manner.

One may, for instance, define the accent reduction as an optional phonological process and, accordingly, the accent deletion rule (ADR) as an optional accent assignment rule, as illustrated in (31). If one should adopt this analysis, however, one would be obliged to recognize the existence of a minor phrase with more than one realized accent as in (31a), alongside a phrase in which all but the leftmost accents are deleted, i.e. (31b). ('IP' stands for intonational phrasing):
This evidently violates the very basic assumption underlying the notions of "accent deletion" and "tonal masking", the assumption that only one accent may be realized within a minor phrase. Moreover, given that the minor phrase is the domain of tone assignment rule (cf. Poser, 1984), it is technically impossible to assign a correct tonal melody to the minor phrases as in (31a), since none of the tonal analyses of the past allows for the possibility of more than one accent being realized in the domain of tonal assignment.

It may be objected against this argument that one can save the phonological treatments by viewing the phrases in (31a) as consisting of two minor phrases rather than one. This account can apparently help the phonological analyses avoid the problems just pointed out, since now the principle of '(at most) one realized accent per minor phrase' is well preserved, as illustrated in (32):
This analysis, however, falls into several difficulties. That is, it would imply that the process of intonational phrasing (IP), which is supposed to take place in prior to the application of tone assignment rules (cf. Chapter Four), is subject to phonetic variability. In other words, it would follow that intonational phrasing patterns fluctuate owing to phonetic factors as well as phonological and other linguistic factors. Given that intonational phrasing is a phonological process and not a phonetic one, it is clear that this is not a favorable consequence at all.

In addition to the phonetic variation which "reduced accents" show, the phonetic interpretation of accent reduction is supported by the idea that accent reduction may be a subcase of 'downstep.' It was mentioned in passing above that the FO pattern called total downstep exists in Japanese: cf. (25b). As the data presented in section 3.2 suggest and the data to be given in Chapter Four confirm, total downstep appears to represent an intermediate stage between the two FO patterns given in (33a) and (33c) below. That is, the three patterns in (33) is to be seen as a continuum, with (33a) and (33c) representing its two ends and (33b) representing an intermediate stage.
If this characterization of the three F0 patterns is tenable, there appears to be no justification for drawing a line between (33a)/(33b) and (33c). Besides, the definition of (33c) as the continuation of (33a) and (33b) has a far-reaching implication for the characterization of accent reduction. As will be discussed in Chapters Four and Five, (33a) and (33b) represent two different manifestations of downstep, which is an intonational phenomenon whereby a minor phrase, accented and unaccented alike, is reduced by the accented minor phrase that precedes it. If (33c) is defined on the same continuum as (33a) and (33b), then it is not unrealistic to suppose that (33c) represents an extreme case of downstep, a case where the second accented element is totally reduced by the preceding accented element — so much so that neither the initial lowering nor the accent (i.e. accentual fall) of the second element is now realized at the phonetic output.

As we shall see in Chapter Five, downstep is a process whose effect is to be defined at the phonetic level, not at the phonological (accentual or tonal) levels. Given this, the characterization of accent reduction as a case of downstep entails that accent reduction in (33c) is also a phonetic process. Under this analysis, the phrase no'nde mi'ru is seen to
have one and only one accentual and tonal representations respectively, irrespective of its varying phonetic manifestations, as illustrated in (34). The surface variability is, then, seen to result at the stage where phonetic realization rules interpret the tonal representation of the phrase, partly as a phonetic variation and partly due to the various linguistic factors to which the phonetic realization rules are subject (i.e. PALM, syntactic category, etc.).

In sum, the accent reduction phenomenon should be viewed as a phonetic rather than a phonological (accentual or tonal) process for the following two reasons: (i) the phonetic interpretation can provide a reasonable account of the phonetic variation shown by 'reduced accents,' and (ii) accent reduction is best seen as a subcase of 'downstep,' an intonational phenomenon whose effect should be defined as a phonetic phenomenon, and not as a phonological one.

---

(34) Accentual no'nde mi'ru

IP % no'nde % mi'ru %

Tonal % HLL % HL %

Surface pattern

(33a) (33b) (33c)
NOTES TO CHAPTER THREE

1. This statement is not entirely correct since [Peak1] tends to rise slightly in proportion to the value of PALM. The implications of this fact will be discussed in Chapter Five, in connection with the factors influencing the process of downstep.

2. Essentially the same phenomenon is observed with the phrase in (6e) below.

3. Just as in the data in Table 1, [Peak1] apparently tends to rise slightly as the number of the post-accentual Low-toned morae increases (cf. Note 1). This will be discussed in Chapter Five (section 2).

4. Note that many of the phrases whose first component phrase is unaccented show a unification of the entire phrase into one minor intonational phrase with the second component phrase showing no independent initial lowering. In such cases, the highest point within the component was considered its peak even if it does not constitute a 'peak' in the true sense of the term.

5. Two accented phrases show no significant difference in the height of [Peak2] as long as they stand in the same environment: (9d) na'okono o'obaa vs. (9e)na'okono or1'maki — (P(T=1.211, 20df)>.20).

6. Similar observations can be made about the data from Dataset VII, which provides two types of three-element phrases, right-branching phrases and left-branching phrases. For both of these branching structures there are two sets of phrases which differ in the accentedness of the second elements. These sets yield the differences as summarized in the following table, where one finds that accented phrases have considerably higher peaks than unaccented phrases in both right-branching and left-branching structures: See Chapters Four and Five for an account of the F0 differences these two types of constituent (branching) structures show in Japanese.

Summary of Statistics: Dataset VII (Peak 2)

1. Right-branching constructions (df=17)

<table>
<thead>
<tr>
<th>Set</th>
<th>Accent</th>
<th>Mean (Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1a&gt;</td>
<td>[+A,+A,+A]</td>
<td>168.3</td>
<td>7.07</td>
<td>3.433</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>&lt;1c&gt;</td>
<td>[+A,-A,+A]</td>
<td>158.0</td>
<td>5.53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Left-branching constructions (df=37)

<table>
<thead>
<tr>
<th>Set</th>
<th>Accent</th>
<th>Mean (Hz)</th>
<th>SD</th>
<th>T</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2/3a&gt;</td>
<td>[+A,+A,+A]</td>
<td>162.7</td>
<td>4.84</td>
<td>6.723</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>&lt;2/3c&gt;</td>
<td>[+A,-A,+A]</td>
<td>150.8</td>
<td>6.20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
7. No data was available for (b), i.e. (10b): the unaccented member of the pair *amai oimo* apparently formed a single minor phrase without showing a phrase-internal valley: cf. Chapter Four. With the pair in (f), i.e. (10f), only the tokens which showed a clear phrase-internal F0 dip were taken into consideration.

8. The data from Dataset VII give additional evidence for the leftward spread of the accentual boost. As the following tables show, the onset of accented phrases has a significantly higher F0 value than that of unaccented phrases, irrespective of the syntactic configuration of the sentence in which they appear:

Dataset VII: Valley 1

1. Right-branching constructions

<table>
<thead>
<tr>
<th>Set</th>
<th>Accent</th>
<th>Mean (Hz)</th>
<th>SD</th>
<th>T</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1a&gt;</td>
<td>[+A,+A,+A]</td>
<td>165.0</td>
<td>6.89</td>
<td>2.230</td>
<td>14</td>
<td>&lt;.05</td>
</tr>
<tr>
<td>&lt;1b&gt;</td>
<td>[-A,+A,+A]</td>
<td>158.4</td>
<td>4.75</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1c&gt;</td>
<td>[+A,-A,+A]</td>
<td>166.4</td>
<td>5.64</td>
<td>3.419</td>
<td>19</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>&lt;1d&gt;</td>
<td>[-A,-A,+A]</td>
<td>158.4</td>
<td>5.04</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Left-branching constructions

<table>
<thead>
<tr>
<th>Set</th>
<th>Accent</th>
<th>Mean (Hz)</th>
<th>SD</th>
<th>T</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2/3a&gt;</td>
<td>[+A,+A,+A]</td>
<td>166.7</td>
<td>6.34</td>
<td>3.179</td>
<td>38</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>&lt;2/3b&gt;</td>
<td>[-A,+A,+A]</td>
<td>158.4</td>
<td>5.04</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;2/3c&gt;</td>
<td>[+A,-A,+A]</td>
<td>169.0</td>
<td>5.54</td>
<td>6.250</td>
<td>41</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>&lt;2/3d&gt;</td>
<td>[-A,-A,+A]</td>
<td>159.0</td>
<td>4.87</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Dataset VII: Valley 2

1. Right-branching constructions

<table>
<thead>
<tr>
<th>Set</th>
<th>Accent</th>
<th>Mean (Hz)</th>
<th>SD</th>
<th>T</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;1a&gt;</td>
<td>[+A,+A,+A]</td>
<td>144.4</td>
<td>5.78</td>
<td>3.386</td>
<td>17</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>&lt;1c&gt;</td>
<td>[+A,-A,+A]</td>
<td>135.8</td>
<td>5.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&lt;1b&gt;</td>
<td>[-A,+A,+A]</td>
<td>172.9</td>
<td>7.31</td>
<td>3.083</td>
<td>20</td>
<td>&lt;.01</td>
</tr>
<tr>
<td>&lt;1d&gt;</td>
<td>[-A,-A,+A]</td>
<td>164.3</td>
<td>5.41</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Left-branching constructions

<table>
<thead>
<tr>
<th>Set</th>
<th>Accent</th>
<th>Mean (Hz)</th>
<th>SD</th>
<th>T</th>
<th>df</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;2/3a&gt;</td>
<td>[+A,+A,+A]</td>
<td>147.8</td>
<td>8.93</td>
<td>5.022</td>
<td>37</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>&lt;2/3c&gt;</td>
<td>[+A,-A,+A]</td>
<td>136.2</td>
<td>4.39</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

256
9. As explained in Chapter One, the traditional tonal analyses of Japanese accent take the High tone as the unmarked tone while regarding the Low tone as a marked tone. Accordingly, they define the phrase-initial FO rise phonologically as a 'lowering' phenomenon, as opposed to the characterization as an FO rise which is generally supposed by phonetic studies. This phonological definition shows up clearly in the naming of the phonological rule accounting for the phenomenon, such as 'initial lowering' (Haraguchi, 1977) or 'initial Low insertion' (Poser, 1984).

10. Many of the test phrases whose first component is unaccented show a merger of the two components, with the second component having no independent initial lowering (cf. Chapter Four, section 6.) Test phrases consisting of an unaccented phrase followed by an accented one (e.g. (9a), (10b) amai me'ron), for example, often show only one peak within them — mostly on the accented mora. In such cases, I identified as [IL 1] (i.e. the initial lowering of the first component phrase) the FO difference between the valley at the onset of the first component and the peak of the entire phrase (see the figure below). Among the test phrases consisting of two unaccented components (e.g. amai oimo), those instances which involve only one peak (mostly within the first component) are excluded for the comparison of [IL2] (i.e. initial lowering in the second component phrase).

11. As Figures 3.39-3.42 may show, the difference in the accentedness of a given phrase affects not only the phrase itself but also its neighboring phrase(s) with which it constitutes a major phrase. These effects will be discussed in Chapter Four ("Pre-accentual Boost") and Chapter Five ("Downstep").

12. Different researchers employ different terms for this prosodic category — see Chapter Four.

13. Some philological phonologists hold a slightly flexible view of the accent of particles. Kawakami (1973:37), for example, assumes that the accents of particles can be phonetically realized when pragmatic emphasis is placed on the particles or special attention is somehow paid onto their accents. Despite this kind of flexible view, however, the fact remains that past work shares the view that the accents of particles are phonetically unrealized in normal speech.

14. Poser apparently follows McCawley (1968) in the treatment of reduced accents. It must be noted, however, that McCawley
takes an ambiguous position in this regard: he proposes to account for the accent reduction by an accent deletion rule (his "accent elimination rule") in the early part of his account (pp. 139–140), but he disposes of the accent assignment rule in the later part of the analysis (pp. 173–174) to propose a tonal account instead.

15. *hozyo doosi* literally means 'auxiliary verb' but it is quite distinct from the auxiliary verbs proper as given in (26a).

16. As we saw in section 3.1 above, there is a slight disagreement in the literature as to the treatment of auxiliary verbs. However, auxiliary verbs are treated by most people as dependent words, or words which do not constitute an independent intonational phrase on their own. Meanwhile, *hozyodoosi* has not been well characterized in this respect in the literature: Few people clearly say whether this category of words are to be regarded as dependent words like particles, or as independent words like nouns and verbs. One exception will be Poser (1984), who takes the former position by saying that they "generally form a single minor phrase" (p. 143) together with the verb that precedes them.

17. The sentences in (27) are comparable to the sentence McCawley and Poser actually cite: i.e.

   do'o i'ittara i'idesu ka "How would it be best to go?"

18. The phrasing patterns in (28) will be discussed in Chapter Four.

19. Given this intonational variation, one may naturally wonder how these two FO patterns match upon the frequency scale, that is, whether total downstep is caused by the raising of the intervening valley or by the lowering of the second peak. I will consider this question in Chapter Four (section 4) in discussing the phonetics and phonology of total downstep.

20. The value of "PALM" defined in this way corresponds to 'Inter-Accent Interval (IAI),' that is, the number of morae between the accented mora of the first element and that of the second element: cf. (24a) o'oman ma'de % HLLL % HL %.

21. Phrases of the type (26a) do not provide relevant data in this regard, since all the phrases of this type analyzed in the experiment happened to be what I describe as 'simplex' phrases.

22. As for the linguistic factors influencing the choice between (34a) and (34b), see the discussion in Chapter Four.
Figures 3.1-3.4 Typical F0 contours of phrases made up of two (minor) phrases: Datasets V and VI

Figure 3.1: [++] uma'i nomi'mono
Figure 3.2: [++] uma'i yamaimo
Figure 3.3: [-+] amai nomi'mono
Figure 3.4: [-+] amai yamaimo

Figures 3.5-3.12 Typical F0 contour illustrating the effect of accentual fall in the sequences of two accented phrases.

Figure 3.5: uma'i me'ron "tasty melon"
% LHL % HLL %

Figure 3.6: na'mano u'ni "raw sea-urchin"
% HLL % HL %

Figure 3.7: o'okina me'ron "big melon"
% HLLL % HLL %

Figure 3.8: vo'nmaino o'oba "four overcoats"
% HLLLL % HLL %

Figure 3.9: o'nosannoi rui "Mr. Ohno's clothes"
% HLLL % HLL %

Figure 3.10: uma'i nomi'mono "tasty drink"
% LHL % LHL %

Figure 3.11: nau'i iromo'voo "trendy design"
% LHL % LHll %

Figure 3.12: uma'i maamare'edo "tasty marmalade"
% LHL % LHHLZ

Figures 3.13-3.17 Typical F0 contours illustrating the effect of accentual fall in the sequences of an accented phrase plus an unaccented phrase.

Figure 3.13: uma'i oimo "tasty potato"
% LHL % LH %

Figure 3.14: na'mano oimo "raw (uncooked) potato"
% HLL % LH %

Figure 3.15: o'okina oimo "big potato"
% HLLL % LH %

Figure 3.16: vo'nmaino purie "big drawings"
% HLLLL % LH %

Figure 3.17: o'nosannoo name "Mr. Ohno's (given) name"
% HLLLLL % LH %
Figure 3.18 Typical FO contour of the phrase *na'mano u'ni* "raw sea-urchin" (Figure 3.6) superimposed on that of *vo'nmaino o'obaa* (Figure 3.8).

Figure 3.19. A time-normalized schema illustrating the effect of 'PALM' on the onset and terminal point of accentual fall in the sequences of two accented phrases.

Figure 3.20. A diagram illustrating the relation between the extent of accentual fall ([Peak1-Valley2]), plotted on the x-axis, and the terminal point of the pitch fall ([Valley2]), plotted on the y-axis, in the sequences of two accented phrases.

Figure 3.21 Typical FO contour of *o'onosanno j'ru'i* "Mr. Ohno's clothes" (Figure 3.9) superimposed on that of *vo'nmaino o'obaa* (Figure 3.8).

Figure 3.22 Typical FO contours of *umai me'ron* "tasty melon" (Figure 3.5) and *nau'j iromo'yoo* "trendy design" (Figure 3.11) superimposed on each other.

Figure 3.23 Typical FO contour of *na'mano oimo* "uncooked potato" (Figure 3.14) superimposed on that of *vo'nmaino nurie* (Figure 3.16).

Figure 3.24 Typical FO contour of *o'onosanno namae* "Mr. Ohno's (given) name" (Figure 3.17) superimposed on that of *vo'nmaino nurie* (Figure 3.16).

Figure 3.25. A time-normalized schema illustrating the effect of 'PALM' on the onset and terminal point of accentual fall in the sequences of an accented phrase plus an unaccented phrase.

Figure 3.26. A diagram illustrating the relation between the extent of accentual fall ([Peak1-Valley2]), plotted on the x-axis, and the terminal point of the pitch fall ([Valley2]), plotted on the y-axis, in the sequences of an accented phrase plus an unaccented phrase.

Figures 3.27-3.28 Accentual Boost: Effect of accent on the peak of the phrase (mean peak values): Datasets V & VI

Figure 3.27: [first minor phrase]
Figure 3.28: [second minor phrase]
Figures 3.29-3.30 Typical F0 contours of phrases consisting of four component phrases: Dataset X.

Figure 3.29: [...+] na'okono a'nino ao'i eri'maki
"Naoko's brother's blue muffler"

Figure 3.30: [...] na'okono aneno ao'i eri'maki
"Naoko's sister's blue muffler"

Figure 3.31. Schematized F0 contours of Figure 3.29 (solid line) and Figure 3.30 (dotted line) superimposed on each other.

Figures 3.32-3.33 Accentual Boost: Effect of accent on the onset of the phrase (mean onset values): Datasets V & VI.

Figure 3.32: [first component phrase]
Figure 3.33: [second component phrase]

Figures 3.34-3.35 Accentual Boost: Effect of accent on the initial lowering of the phrase: Datasets V & VI.

Figure 3.34: [first component phrase]
Figure 3.35: [second component phrase]

Figures 3.36-3.38 Typical F0 contours of initially accented phrases in comparison with those of unaccented phrases: Datasets V & VI.

Figure 3.36: (a) na'okono o'oba "Naoko's overcoat"
(b) naomino o'oba "Naomi's overcoat"

Figure 3.37: (a) uma'i me'ron "tasty melon"
(b) uma'i oimo "tasty potato"

Figure 3.38: (a) na'okono o'oba "Naoko's overcoat"
(b) na'okono omamori "Naoko's amulet"

Figures 3.39-3.42 Accentual Boost (summary): Effects of accent on various parameters of the phrase (mean F0 values): Datasets V & VI.

Figure 3.39: First Component
(a) [...] uma'i nomi'mono "tasty drink"
(b) [...] uma'i nomi'mono "sweet drink"

Figure 3.40: First Component
(a) [...] uma'i yamaimo "tasty yam"
(b) [...] uma'i yamaimo "tasty yam"

Figure 3.41: Second Component
(a) [...] uma'i nomi'mono "tasty drink"
(b) [...] uma'i yamaimo "tasty yam"
Figures 3.42: Second Component
(a) \([-\rightarrow]\) amai nomi'mono "sweet drink"
(b) \([-\rightarrow]\) amai yanaimo "sweet yam"

Figure 3.43. A diagram illustrating the effect of accentual boost on initial lowering.

Figures 3.44-46. Three typical F0 contours of the sequences of an accented noun plus an accented particle(s): Datasets I & II.

Figure 3.44: the accented particle manifests itself as an independent minor phrase in (kono) ra'nnaa-vo'ri-mo (ano ra'nnaa-no ho'o-ga) ("this") "runner" "than" Null = (that runner) than (this) runner.

Figure 3.45: An accented particle shows total downstep in
(a) the same sentence as Figure 3.44,
(b) ro'o'ma vo'ri (mi'rano e mukatta) "from Rome (to Milan went)"

Figure 3.46: An accented particle is intonationally merged with its preceding noun in the same sentence as Figure 3.45 (b)

Figures 3.47-3.49 Three typical F0 contours of the phrase (naomiwa avama'ru daro'o "(Naomi) will apologize," i.e. [accented verb + accented auxiliary verb]: Datasets I & II.

Figure 3.47: The accented auxiliary verb manifests itself as an independent minor phrase.

Figure 3.48: The accented auxiliary verb shows total downstep.

Figure 3.49: The auxiliary verb is intonationally merged with its preceding verb.

Figures 3.50-3.52 Three typical F0 contours of the phrase no'nde mi'ru "try to drink", i.e. [accented verb + accented hozvo doosi]: Datasets I & II.

Figure 3.50: The accented hozvo doosi manifests itself as an independent minor phrase in (naomiga) no'nde mi'ru ma'de "until Naomi tries to drink (it)"

Figure 3.51: The accented hozvo doosi shows downstep in (ramunego) no'nde mi'ru "try to drink (lemonade)"

Figure 3.52: The accented hozvo doosi is intonationally merged with its preceding verb in the same sentence as Figure 3.51

Figures 3.53-3.54 Two typical F0 contours of the phrase na'nio
no'ndara い'idesu か "What would it be best to drink?": Dataset I.

Figure 3.53: The second component phrase no'ndara manifests itself as an independent minor phrase.

Figure 3.54: The second component phrase shows total downstep.
(sorewa) uma'i nomimono (desu)

Figure 3.1

(sorewa) uma'i yamaimo (desu)

Figure 3.2
Figure 3.3

(sorewa) amai nomi'mono (desu)

Figure 3.4

(sorewa) amai yamaimo (desu)
Figure 3.5

Figure 3.6
Figure 3.7

Figure 3.8
Figure 3.9

Figure 3.10
Figure 3.11

Figure 3.12
Figure 3.13

Figure 3.14
Figure 3.17

Figure 3.18
Figure 3.19

Figure 3.20
Figure 3.21

Figure 3.22
Figure 3.23

Figure 3.24
Figure 3.25

Figure 3.26
Figure 3.27

Figure 3.28

277
Figure 3.31
Figure 3.32

Figure 3.33
Figure 3.34

Figure 3.35
Figure 3.36 (a)

Figure 3.36 (b)
Figura 3.37 (a)

Figura 3.37 (b)
Figure 3.38 (a)

Figure 3.38 (b)
Figure 3.39

Figure 3.40
Figure 3.41

Figure 3.42
Figure 3.43
Figure 3.47

Figure 3.48
Figure 3.49

Figure 3.50
Figure 3.51

Figure 3.52