Theoretical Issues of the Lexicon and Phonological Structure

A Case Study of Winnebago

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Contents

Preface

This is a coherent and comprehensive study of the phonological system of Winnebago within a unified theoretical framework which draws together recent remarkable developments in the theory of phonology: the Level-Ordered Theory of Lexical Phonology, the Theory of Constraints and Repair Strategies, Underspecification Theory, and Metrical Stress Theory. Its scope is limited mainly to the phonology of a single language, Winnebago, but I will present an overall phonological system of this language and a detailed analysis of segmental and morphological processes, syllable structure, metrical structure, pitch-accent phenomena, and their interaction in the Lexicon. A certain diachronic change of the system will also be elucidated. I hope that it will be of particular interest for readers to see how individual processes interact and converge in a single unified system and, conversely, how it works well to account for a large body of phenomena in Winnebago phonology which would otherwise appear to be complex, unpatterned, and even arbitrary.

A number of people have contributed to my general linguistic research and substantial analyses within the present dissertation, and I am deeply grateful to them all for the guidance and support they have given to me.

I have learned a lot from Prof. Shosuke Haraguchi, my thesis advisor, who guided me to the world of phonology and phonological theory when I was an undergraduate student. He not only has taught me a typological method to give a deep insight into language, not just a language, but also has given me lots of opportunities for publishing my works. On the other hand, Prof. Minoru Nakau has taught me about the other side of a coin in general linguistic methodology: the deep affection for a particular language and especially, the importance of a coherent attitude to investigate into an adequate model for capturing the correspondence between meaning and (sound) form in a language.

Although this study is concerned with the phonological system of a particular language, it also discusses the relation between Winnebago grammar and Universal Grammar within the principles-and-parameters framework. Thus, there is no doubt that the spirits I have learned from these two professors underlie the whole part of this study. They have also taught me how to present valid, compelling, and convincing arguments in scientific research.

I also owe much to the other committee members. I have learned the method of historical linguistics from Prof. Yasuaki Fujiwara and have realized a great interest in the diachronic development of a language. In fact, the methodology I have learned from him has much to do with my treatment of the historical change of Winnebago phonology. Prof. Yukio Hirose has taught me about logical linguistic thinking and has exercised a great influence on my argumentation and style in English. His lecture on English grammar was always exciting and insightful. I am also grateful to Prof. Chikafumi Hayashi for his valuable review of the present study.

Moreover, I am also deeply indebted to Haruo Kubozono and Koichi Tateishi for having given me an opportunity to write a review article on Hayes (1995) for *English Linguistics* 14, the Journal of the English Linguistic Society of Japan, when the basic idea of this dissertation substantially occurred to me. They were excellent editors, giving me valuable comments and suggestions on my paper, which was written in October, 1996 and then published as Tanaka (1997b). This basic idea was largely extended and elaborated by my talk entitled "Syllable and Foot Structures in Winnebago," which was delivered at the workshop on the 14th National Conference of the English Linguistic Society of Japan held on November 16, 1996, at Kwansei Gakuin University. In that sense, I express my heartfelt gratitude to Takeru Honma, the organizer of the workshop, for having let me participate in it as a lecturer. What I wrote in the review article or talked at the workshop was somewhat revised and incorporated into the substantial part of chapter 3.

Special thanks go to Ayako Uchida, my colleague of the Faculty of Language and Culture at Nagoya University, who spared no effort to photocopy Susman (1943) at Columbia University during her stay in New York. Her help greatly enhanced the reliability of my central claims which, no doubt, build on the abundant original data sources of Susman (1943).

Last but not least, I wish to express my deepest indebtedness to Noriko Yamane, my wife and joint researcher, for her constant encouragement and assistance. Had it not been for her support, I would not have completed this work which took me so much delicacy and patience but had always been exciting during the process of writing for the last two years.

Data Sources and Abbreviations

This work deals with theoretical and philological issues of the phonology of a particular language. In general, with respect to data sources and analyses, Bruce Hayes remarks in his recent sizable book that "it was precisely by moving beyond theory-centered writings to the original sources that the data could be found to support a sharply different analysis" (Hayes (1995: 4)). This may be because theorists may naturally have a tendency to focus on the data most relevant to their own analyses and not on others. I believe that the theory I will develop here can be said to be free from such a danger in that the data I will use are based on a wide array of facts taken mainly from original sources of reliable descriptive works (as well as those of theoretical writings).

Although the Winnebago tribe forms a relatively larger group as native Americans (having the population of about 12,000), its language itself is one of those that have been endangered to a great extent and whose native speakers have mostly been assimilated to speaking English. It is said that at present, there are many English-speaking monolinguals, only a few bilingual speakers, and still fewer genuine monolingual Winnebago speakers. For this reason, there are very limited sources that are available in the research history of the Winnebago language. As for the present research, our discussion relies on the following two types of data sources: original sources taken from Susman (1943), Lipkind (1945), Hale (1980), Hale and White Eagle (1980), White Eagle

(1982), and a series of Miner's (1979, 1981, 1989, 1993) works or those constructed by some trivial grammatical rules of Winnebago; and other subsidiary sources which in turn are based on any of the original ones given above and are utilized to develop theoretical analyses, such as Halle and Vergnaud (1987), Steriade (1990), Halle and Idsardi (1995), Hayes (1995), Alderete (1995), Heiberg (1995), and so on. I especially owe a large debt to Miner's original sources full of live data, which I believe are totally reliable and insightful. My theoretical study would not be possible without a series of his works, for which I would like to show my deepest respect.

As for dialectal variation, I will refer to Wisconsin Winnebago simply as Winnebago throughout this dissertation, since almost all of the above works with original sources are based on this dialect but Lipkind (1945). Hence, I will only mention Lipkind (1945), which describes the grammar of Nebraskan Winnebago, or invoke the data therein when the difference between the two dialects does not matter (or the Nebraskan dialect is relevant). As for historical variation, on the other hand, Susman (1943) might appear to be somewhat old as data sources, though she is concerned with the description of the Wisconsin dialect. However, careful comparison of Susman's and Miner's works certainly allows us to conclude that the difference between the times does not matter at all in constructing a synchronic grammar of Present-Day Winnebago. Hence, I will treat the data from their studies as reflecting the same grammar of Winnebago.

Finally, for clarity and credit, I will consistently make clear any data sources for each of the examples: in what follows, I will use some abbreviated notations for oft-cited works in the way represented below, in order to indicate data sources in a simple and explicit fashion or for other purposes. But note that 1) I will not abbreviate but spell out the relevant works when they are taken up as discussion sources in the text (I will use abbreviated notations only for data sources of the examples given); 2) when an example (datum) is found in more than one work (source), I will mainly mark the original work(s) in abbreviated form; and 3) there are some examples not marked by any abbreviation, which are either constructed by some trivial grammatical rules or mentioned and abbreviated elsewhere before. The following is the list of abbreviations I will use throughout the present research:

[List of Abbreviations]

Alderete (1995): A95
Hale (1985): H85
*Hale and White Eagle (1980): HWE80
Halle (1990): H90
Halle and Idsardi (1995): HI95
Halle and Vergnaud (1987): HV87
Hayes (1995): H95
Heiberg (1995): Hg95
Lipkind (1945): L45
*Miner (1979): M79
*Miner (1981): M81
*Miner (1989): M89
*Miner (1993): M93
Steriade (1990): S90
*Susman (1943): S43
*White Eagle (1982): WE82

The sources with an asterisk appear most frequently, because they describe the Wisconsin dialect by using a vast variety of original data. Conversely, those without an asterisk are theoretical studies (except for Lipkind's), which are cited less frequently.

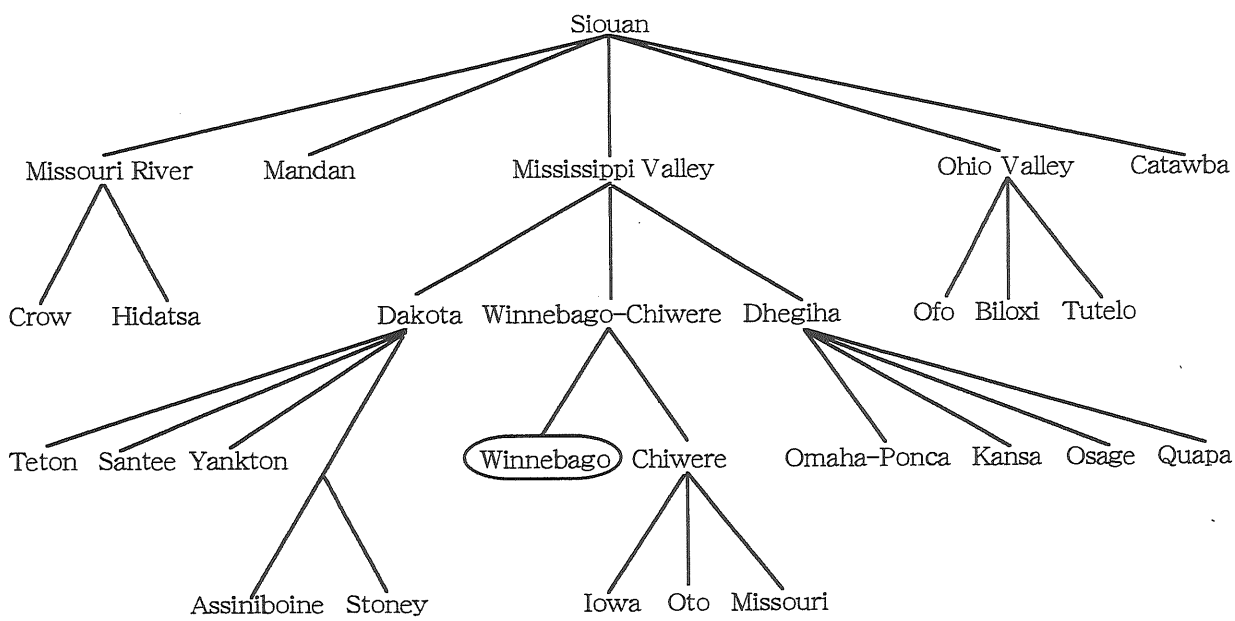
Chapter 1
Introduction: Why Winnebago?

1.1. The Status and History in Genealogy and Generative Phonology

Throughout the history of accentual phonology, there have been a huge number of descriptive and theoretical studies on the location of stress accent and/or pitch accent, most of which ended up dealing with the issue as language-particular phenomena until a turning point came up in the late 1970s: the advent of Metrical Stress Theory.[1] The development of Metrical Stress Theory in the 1980s, which was in tandem with the orientation of Universal Grammar in the principles-and-parameters approach to syntax, has made it possible to work out the typological enterprise of accounting for (stress or pitch) accent cross-linguistically and also of deducing its location of a single language from Universal Grammar. The underlying hypothesis is that such a theory can both account for the stress systems of the world's languages and for the ease with which children acquire complex stress systems simply by setting parameters one by one. Naturally, the scope of the theory has then gone beyond major Euro-American languages to those Asian, African, and Amerindian languages whose accentual facts remain to be characterized in a uniform and explicit way.

Winnebago was not the exception to such an analysis in the typological and parametric enterprise, and has often been taken up as evidence for metrical structure since Hale and White Eagle's (1980) initiative work in an earlier metrical framework, although there were eminent descriptive or pre-generative studies before, such as Susman (1943), Lipkind (1945), Wolff (1950a-c, 1951), Matthews (1958), and Miner (1979). It is known as a polysynthetic or incorporating language, now spoken in central Wisconsin and eastern Nebraska, whose syntax is characteristic of some Amerindian languages. Together with Chiwere, which is represented by three dialects of Iowa, Oto, and Missouri, it forms the Winnebago-Chiwere branch of Mississippi Valley Siouan, which also includes Dakota and Dhegiha. In order to make explicit the genealogical status of Winnebago, it will be helpful to refer to the genetic classification in (1), taken from Shaw (1976), which is based on the findings mainly by Voegelin (1941) and by other Siouanists such as Wolff (1950a-c, 1951), Haas (1968), Matthews (1970), and so on, and shows the acknowledged composition of the Siouan family of the Macro-Siouan phylum:

(1) Siouan Family



In spite of these genealogical results in comparative linguistics, the overall phonological component of a synchronic grammar of Winnebago is still obscure, partly because pre-generative work was mostly devoted to describing its phonological processes diachronically by comparing them with those of other closer relatives, and partly because the primary focus in Metrical Stress Theory has naturally been laid on the verification of its metrical structure and not of its syllable structure and/or segmental processes.

In particular, even earlier metrical or optimality-theoretic treatments that appeared to be convincing proved to be rather controversial, because there are essential issues in Winnebago grammar which still remain unresolved and unexplored, such as the ones given in (2a–c):[2]

(2) a. How is the entire phonological system of this language to be characterized with respect to the Lexicon?

b. Why is it that Dorsey's Law is required to apply at all? What syllable structure does Winnebago have?

c. How is the ordering paradox between accent assignment and Dorsey's Law to be accounted for? What metrical structure does Winnebago have?

First, Halle and Vergnaud (1987), following the restructuring analysis by Hale and White Eagle (1980), proposed the Domino Condition to resolve the problem in (2c) and at the same time adduced supporting evidence for metrical structure (according to the Domino Condition, the applicability of restructuring depends solely on the relative position of vowels copied by Dorsey's Law to metrical constituents). However, this seemingly-valid solution to (2c) proves to be ineffective as Miner (1981) and Miner (1989) showed that there were many types of examples whose accent could not be accounted for by Hale and White Eagle's (1980) and Halle and Vergnaud's (1987) analyses.[3] Furthermore, the other two questions in (2) were ignored and thus remained unanswered in the two restructuring analyses (but we must make allowance for these difficulties now, taking their pioneering contribution in the metrical framework into consideration).

Second, turning to the tone-shift analysis in Hayes's (1995) biplanar approach, which was an updated and elaborated version of Miner's (1979, 1989) accent-shift analysis, we must say that these two analyses were virtually encompassing in empirical respects, based on the historical change of Winnebago accent, and also provided a seemingly-elegant answer to question (2c). Unfortunately, however, they both could not give any principled account of questions (2a, b).[4] Miner's (1979, 1989) contribution was indeed remarkable in that he first presented several arguments for Dorsey's Law as a synchronic rule by showing its interaction with other synchronic processes, but his resolution of problem (2a) was still incomplete for two reasons: he did not show an overall picture of the phonological component in Winnebago, and his approach itself was nothing but diachronic and rejected restructuring.[5] However, we claim that in any synchronic analysis that attempts to predict modern accent directly, accent assignment and accent shift should be replaced by a single, quite different accent rule (cf. Hayes (1995: 356)). Miner's (1993) more recent work indeed made some point about syllable structure, but his arguments were only partial and thus did not answer question (2b). On the other hand, Hayes (1995) was not concerned with the issues in (2a, b), and even his tone-shift account of (2c) proves to be untenable on conceptual grounds (section 3.2.3.3 and also Tanaka (1997b)).

Third, based on the recent development in Optimality Theory, Alderete (1995) proposed a constraint-ranking analysis and attempted to give ingenious accounts of problems (2b, c) by utilizing established constraints and newly-devised ones. However, there occurred a wide array of empirical problems with his assumption concerning both syllable structure and metrical structure, because actual syllables and accent positions observed in this language turned out to be not characterized by his analysis. In addition, as conceptual problems, his proposed ranking of constraints in Winnebago grammar was not adoptable as it stands, because there occurred several cases of ranking paradox and the ranking proposed for this language would vary according to the words concerned (section 3.2.3.2). Thus, we must say that his answers to (2b, c) were not valid. Moreover, he was not concerned with the issue in (2a) for the apparent reason that if he took into account all other segmental processes than Dorsey's Law in the Lexicon, the ranking would naturally be much more complex. Of course, we must admit that it was Alderete himself who first noted the importance of questions (2b, c), and took large steps toward offering an optimality-theoretic account for them in a systematic and uniform way. Heiberg (1995) also presented a constraint-ranking analysis within the framework of Optimality Theory, and tried to solve the problem in (2c). But his account was not adoptable for much the same reasons as Alderete's analysis.

In short, there has been no systematic and comprehensive study in the literature on the whole phonological system of Winnebago that offers plausible answers to the problems in (2a–c). As will be known in later chapters, the mysteries of the Lexicon organization, the application of Dorsey's Law, and the ordering paradox are the most essential to Winnebago grammar, because we can never solve them without shedding much light on segmental and morphological processes, syllable structure, metrical structure, and their complex interaction. Needless to say, this task is equivalent substantially to the elucidation of the phonological system of Winnebago as a whole.

1.2. Aim and Scope

Given the points at issue in the previous section (i.e. the mysteries posed in (2a–c) and the need for explicit and coherent solutions to the difficulties), the chief goal of the present dissertation can be stated simply as elucidating the overall phonological system of Winnebago and presenting a systematic and comprehensive analysis of a variety of phonological processes within the grammar. Its scope will be basically limited to Winnebago as an object language, but Chiwere, one of its close relatives in (1), will also be referred to in the course of discussion, since we will aim at shedding some light on the historical origin of the Present-Day Winnebago grammar on the basis of the diachronic changes of its phonological processes. Japanese will also be invoked in section 3.2.5 to focus on its surprising similarity in metrical structure to Winnebago, though they hardly have any typological kinship.

To achieve these goals, I will adduce full evidence in favor of the following specific claims in the phonology of Winnebago, spacing the remaining three chapters:

(3) a. Winnebago has a level-ordered organization of lexical and postlexical phonology, as in figures 1 and 2 on the next pages; in other words, the entire system illustrated below shows the phonological component of a synchronic grammar of Winnebago, where another component in the grammar, morpho-syntax, is also given in figure 1. The interaction between constraints and repair strategies are also relevant to the grammar, as a consequence of Universal Grammar, which is shown in figure 2. It will be known that this simple model is in fact necessary to account for such surprisingly complex and interactive phenomena as observed in Winnebago phonology: —— sections 2.1–2.6

Figure 1: The Level-Ordered Organization of the Lexical and Postlexical Phonology of Winnebago with Special Reference to Morphology

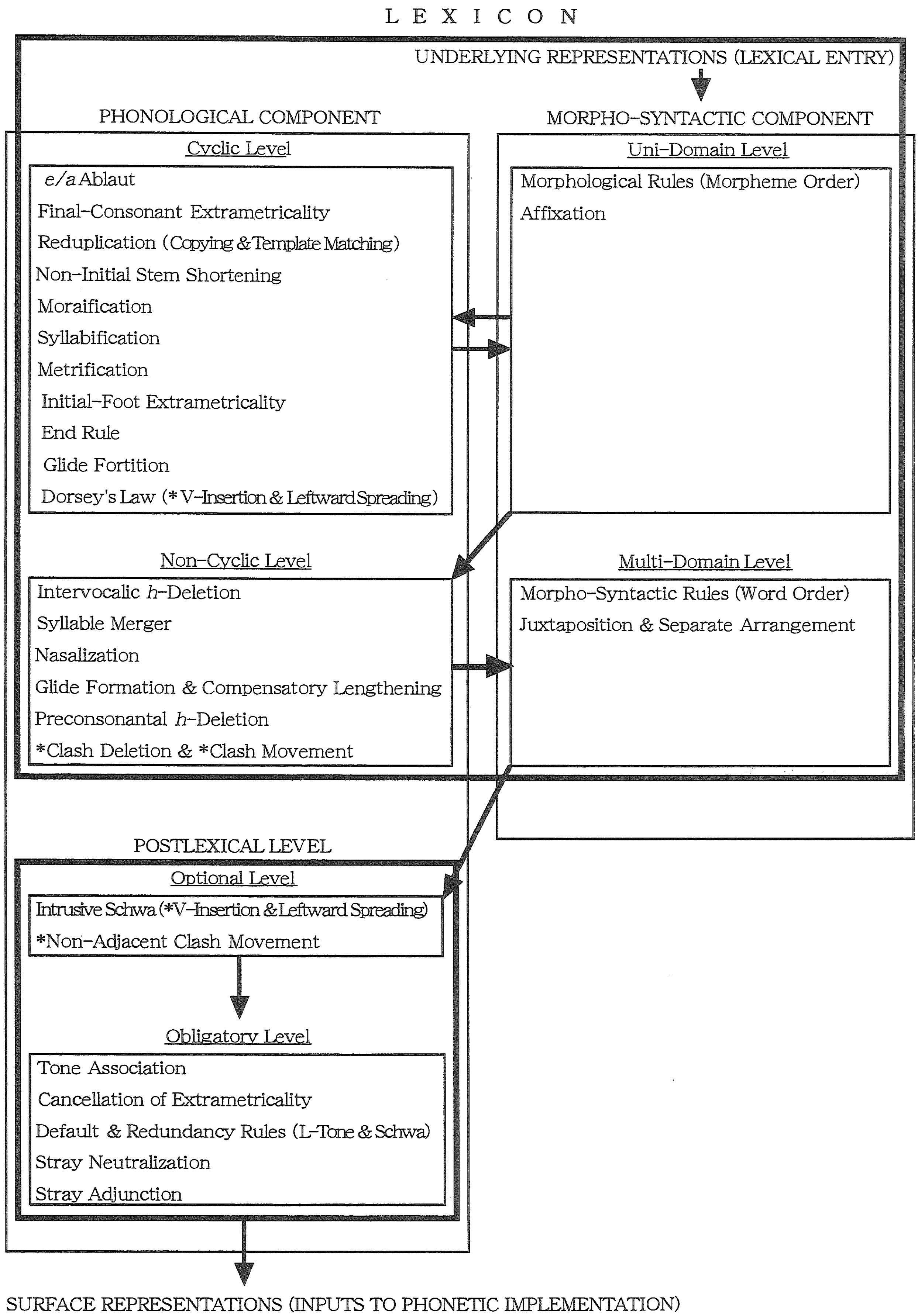
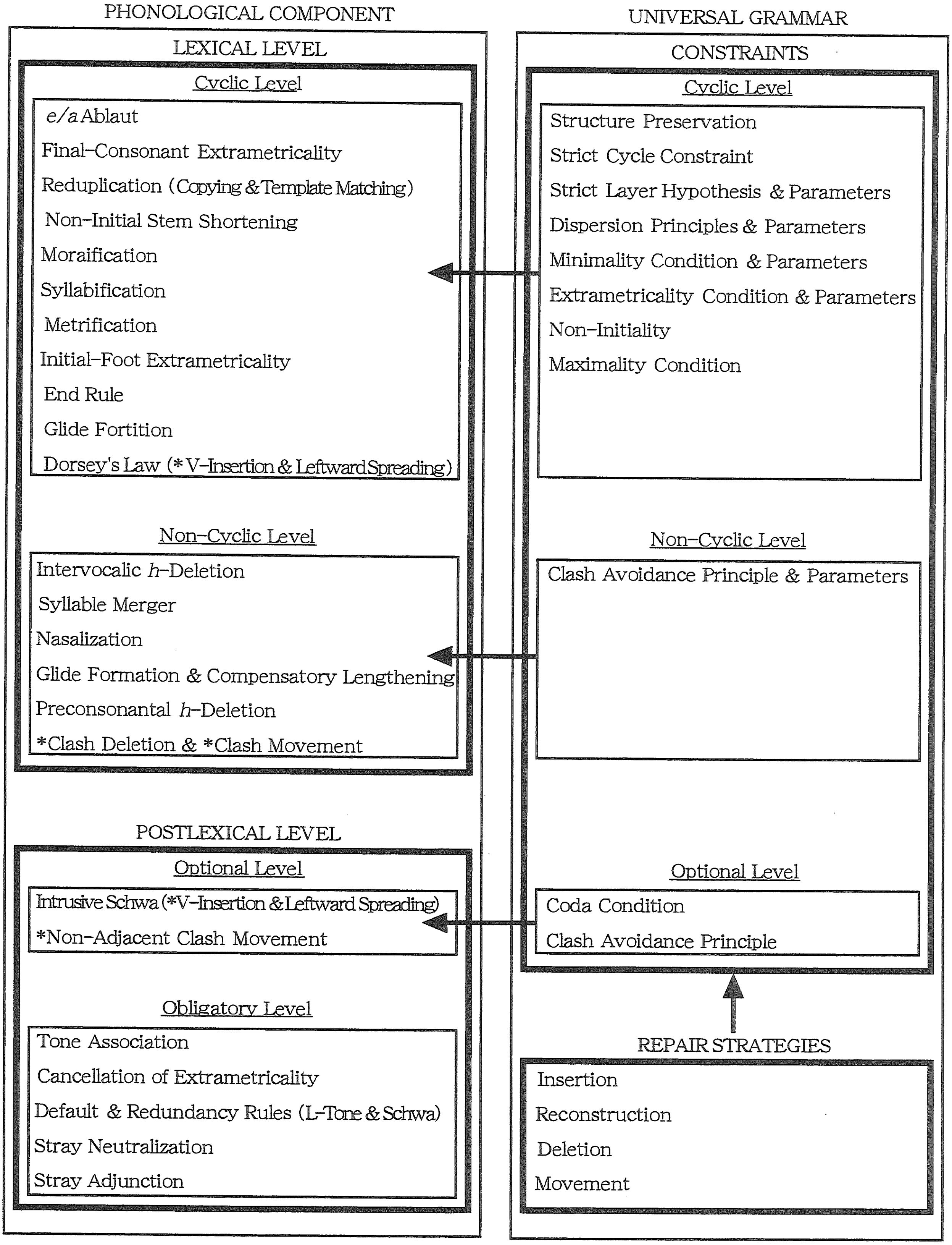


Figure 2: The Level-Ordered Organization of the Lexical and Postlexical Phonology of Winnebago with Special Reference to Universal Grammar (Asterisked rules are repair strategies)



b. With respect to the lexical level in Winnebago, cyclic rules are either structure-building (feature-filling) or structure-changing (feature-changing), all of which are subject to Structure Preservation and the Strict Cycle Constraint, whereas all non-cyclic rules are structure-changing (feature-changing) and immune from the effects of the two constraints. As for the postlexical level, on the other hand, it is composed of two levels: a block of optional rules and a block of obligatory ones. —— sections 2.3, 2.6.5, 2.6.6, etc.

c. Dorsey's Law is characterized as a repair strategy (insertion) with vowel harmony, which is induced by a violation of the syllable structure licensed in Winnebago. I will especially propose the General Sonority Hierarchy and adopt Clements's (1990, 1992) Dispersion Principle, which together make it possible to account for Winnebago phonotactics and for the application of Dorsey's Law. —— section 3.1

d. The apparent paradox of accent assignment and Dorsey's Law is given a principled account by the judicious use of extrametricality and the application of a repair strategy (reconstruction) triggered by a violation of the Strict Layer Hypothesis or Structure Preservation.

—— section 3.2.4

e. The opacity at both edges of a word is a surface manifestation of the effect of extrametricality and neutralization. I will claim that the former rule applies to the initial foot and the final consonant on the cyclic lexical level, and the latter to word-final stray (i.e. unsyllabified) consonants on the postlexical level.

—— sections 2.6.1, 2.6.2, 3.2.4, etc.

f. Winnebago is a mora-counting, syllable-accenting language like

Standard Japanese. The difference is that it is also a quantity-sensitive language whose accent is divided into primary and subsidiary ones, like English. More surprisingly, it is shown that the accent distributions of Winnebago and Japanese form a mirror image.

—— sections 3.2.3.1 and 3.2.5

g. The notion of foot weight is crucial for accounting for the overall accent positions. I will also demonstrate that foot weight consists of foot quantity and foot prominence, just as syllable weight of syllable quantity and syllable prominence. This notion determines the applicability of movement and deletion as repair strategies in violation of the Clash Avoidance Principle. —— section 3.2.4.1

h. Diachronic changes are characterized as a transition of synchronic grammars from Proto-Winnebago (Winnebago-Chiwere in (1)) through Early Winnebago to Present-Day Winnebago. In addition, I will demonstrate that in light of Lexical Phonology, the present form of Dorsey's Law has developed diachronically from intrusive schwa as a 'residual upward change' in the Lexicon: as a directionality of diachronic change, the status of Dorsey's Law is seen as proceeding upward from the postlexical to the lexical levels in the history of Winnebago. The reason that this rule had applied only in word-initial position before is also given a principled account in terms of the syllable structure of Early Winnebago. —— sections 3.1.3.2.5 and 3.1.4

Neither of these claims in (3a-h) are found in the earlier literature. They will not only be major results of the present study but also leave several consequences in the grammar of Winnebago or in phonological theory. Particularly, note in figure 1 that there are four phonological levels, two lexical and two postlexical, in the phonological component of this language. The details of the Winnebago Lexicon has remained unexplored so far, as stated above. Moreover, Dorsey's Law, which has not been found in any other languages and thus whose application has been considered to be a long-standing mystery, is excluded from the list of idiosyncratic lexical rules and given a status of repair strategies. The dispute over the ordering paradox of accent assignment and Dorsey's Law also comes to an end within the framework of constraints and repair strategies. These three contributions above are directly related to the questions posed in (2).

The discussion of the remaining chapters is organized in the following order. First, chapter 2 is concerned with macroscopical aspects of the grammar: based on various kinds of data, I will argue for the organization of the Lexicon and investigate mainly into the essential issues in (3a, b). More specifically, I will introduce fundamental concepts in Lexical Phonology by invoking various relevant forms, and make clear the exact reasons why the theory is crucial for Winnebago phonology (i.e. the entire picture of the Lexicon given above) and for phonology in general. This task will be a large step toward answering the question in (2a).

Second, more microscopical aspects of the language will be examined in chapter 3; namely, I will adduce several pieces of evidence for syllable and foot structures in Winnebago, or for the claims in (3c–h) above. I will then show that the claims themselves are plausible answers to the questions in (2b, c).

Third, the final chapter will recapitulate several theoretical implications that my specific claims and proposals give to the current trends of phonological theory when I enter into the fundamental problems in (2a–c). I will conclude that the most essential in characterizing Winnebago grammar are the following three phases: the Lexicon, Dorsey's Law, and the ordering paradox. These three will prove to be significant issues in both theoretical and empirical respects.

Notes to Chapter 1

[1] The term of Metrical Stress Theory, which characterizes the field and also serves as the main title of Hayes (1995), is alternatively and more frequently used as simply Metrical Theory. The latter term might encompass the objects of the field in a more rigorous way (or otherwise would be called Metrical Accent Theory), because the field in general and the analysis by Hayes (1995) cover pitch accent as well as stress accent. The same holds true for Halle and Vergnaud's (1987) *An Essay on Stress*, another dominant work in the field. The tendency not to use "accent" but "stress" can be ascribed to the fact that the theory was initiated and developed principally on the basis of the analysis of stress-accent languages with a special emphasis on English. And yet the convention of referring to both types of accents as "stress" constitutes a dramatic contrast with Haraguchi's (1991) *A Theory of Stress and Accent*, which still might just as well be called *A Theory of Stress (Accent) and Pitch Accent*, if we follow McCawley's (1968) definition.

Throughout this dissertation, I will basically follow the general convention in referring to both stress accent and pitch accent as simply stress, unless a strict definition is needed to characterize Winnebago or any particular language. For the definition of stress in general, see section 3.2.2.1.

[2] For specific examples and other details concerning (2a-c), see sections 2.1-2.6, 3.1, and 3.2 in the given order. Here I only mention what has been at issue and what has been ignored throughout the history of Metrical Stress Theory.

[3] See also Tanaka (1991:153-154) and Hayes (1995: 354-355) for other empirical and conceptual problems with Halle and Vergnaud's account.

[4] We should not miss Hayes's point here, of course: his theory did not aim

at probing deeply into the phonology of a particular language, but elucidating the cross-linguistic metrical structure insightfully on the basis of his research of over 150 languages.

[5] Needless to say, diachronic approaches per se are valuable and indispensable in general linguistic theory. I am just claiming here that if we follow the basic tenet of a principles-and-parameters approach in the generative paradigm, which is roughly sketched at the beginning of this chapter, the phonology of a particular grammar should naturally be characterized synchronically. This idea is one of the basic assumptions of the present dissertation. In fact, I will investigate the diachronic change of syllable structure in section 3.1.3.2.5 and propose a diachronic account of the development from intrusive schwa and Dorsey's Law in section 3.1.4, assuming that these historical changes can be attributed to a transition of synchronic grammars from Proto-Winnebago through Early Winnebago to Present-Day Winnebago.

Chapter 2
The Organization of Lexical and Postlexical Phonology

2.1. The Definition of 'Word' and the Lexicon Model

At first sight, the phonology of languages per se appears to be an intricate and even chaotic set of phenomena; however, phonological theory allows us to discover a certain order underlying the phenomena as a whole, changing the chaos into a system. With the remarkable development of generative phonology, such an order (i.e. phonological system) has proved to have two aspects: one in universal grammar and the other in a particular grammar. The latter aspect has been of particular interest to what is called 'Lexical Phonologists,' and the phonology of a particular language has started to be given a systematic organization, when seen through the looking glasses of Lexical Phonology, which was initiated in the late 1970s and developed by Kiparsky (1982a, b), Mohanan (1982), and a series of subsequent works. In short, Lexical Phonology is a powerful device to elucidate the interaction between the phonological and morphological components in the Lexicon and to gain a deep insight into the phonological system of a particular language.

On the other hand, there has been a long-standing controversy and no agreement on the valid Lexicon model through the history of Lexical Phonology, as is evident from the four sizable collections of papers which are edited as special issues on Lexical Phonology: Ewen and Anderson eds.

(1985), *Phonology Yearbook 2* (the first half of the volume as *Phonology and the Lexicon*), Inkelas and Zec eds. (1990), *The Phonology-Syntax Connection*, Hargus and Kaisse eds. (1993), *Phonetics and Phonology 4: Studies in Lexical Phonology*, and Wiese ed. (1994), *Recent Developments in Lexical Phonology*. In the third issue of the four, Kaisse and Hargus (1993: 1) evaluate these situations as "there is no common core of beliefs that all lexical phonologists adhere to." [1] Specifically, this diversity is reflected on such conceptual assumptions as the manner of interaction between phonology and morphology, the number of levels and their relation to cyclicity, the presence/absence of the effects of structure preservation and strict cyclicity on each level, and so on. In a sense, it is quite natural that there has been no coherent theoretical viewpoint in this way, since languages may have different phonological structures and processes and Lexical Phonology is concerned with the detailed systems of individual languages. In other words, the disagreement on the Lexicon model may well stem from the diversity of languages themselves. Winnebago is no exception to the rule, and has various kinds of idiosyncrasies in the Lexicon as well as certain characteristics common to other languages. As Miner (1993: 128) notes, a comprehensive study on the Lexical Phonology of Winnebago still remains to be worked out. The following sections are devoted to discussing the topic concerning the valid Lexicon model of this language within the framework of Lexical Phonology and examining how this particular model is related to, and follows from, the phonological system of Universal Grammar.

First of all, Winnebago is a polysynthetic or incorporating language like other Amerindian languages, where grammatical relations or functions are primarily expressed not by word order but by adding various sorts of affixes to a stem, although such a string of morphemes exhibits a certain order specified by the morphological rules of this language. More specifically, affixation alone serves as a variety of morphological processes such as inflection, derivation, compound formation, and even sentence formation like the ones found in other types of languages, so that the notion of 'word' in Winnebago is somewhat different from the one in an inflecting language like English and in an agglutinating language like Japanese. These processes with affixation are exemplified in (1):[2]

(1) a. Inflection (Declension & Conjugation)

hoočą́k 'Winnebago M79: 27' / hoočą́gra 'the Winnebago M79: 27'

nį́įp 'to swim WE82: 309' / nįįpšą́ną 'swim (declarative) or swam WE82: 309' /

hanįpšą́ną 'I swim (declarative) or I swam WE82: 309' /

ranįpšą́ną 'you swim (declarative) or you swam WE82: 309' /

nįįpšą́ną 'he swims (declarative) or he swam WE82: 309'

hikorohó 'to prepare, dress S43: 35, 48, M79: 39, HWE80: 128, M89: 155' /

yaakóroho 'I prepare HWE80: 128' / hirakóroho 'you prepare HWE80: 128' /

hikorohó 'he prepares HWE80: 128'

b. Derivation (Reduplication)

gihú 'to swing M89: 149' / gihuhú 'to wag its tail M89: 149'

račgą́ 'to drink M89: 149, 151' / račgąčgą́ 'to drink repeatedly M89: 149'

parás 'flat S43: 71, M79: 27, 29, 30' / parapáras 'wide M79: 29'

šará 'bald S43: 33, M79: 29, M89: 149' / šarašára 'bald in spots S43: 33, M79: 29, M89: 149'

c. Compound Formation

wáa 'snow M89: 152' / poropóro 'spherical M79: 26' / waapóroporo 'snowball M79: 30'

wakirí 'insect, small animal S43: 59' / parás 'flat S43: 71, M79: 27, 29, 30' /

wakiripáras 'flat bug, cockroach M79: 30, HWE80: 131, M89: 155' wakirí 'insect, small animal S43: 59' / poropóro 'spherical M79: 26' /

wakiripóroporo 'spherical bug HWE80: 131, M89: 155'

hinų́k 'woman S43: 42, 123' / wačék 'young S43: 35, 42' / hinųgwáček 'young woman, virgin S43: 42, 57'

húu 'leg S43: 120' / géeš 'bow, arch S43: 120' / huugéš 'bow-legged S43: 120'

šų́ųk 'dog S43: 42, 68, 123' / xeté 'big S43: 22, 35, 42, 59, 68' / šųųkéte 'horse S43: 42, 68'

hajá 'to see S43: 47, M79: 31, 32, HWE80: 123' / pį́į 'good, to be able S43: 113' /

hajapį́ 'good-looking S43: 122, 123'

pąną́ 'to smell S43: 123' / pį́į 'good, to be able S43: 113' / pąnąpí 'sweat-smelling S43: 14, 123'

d. Sentence Formation

wažók 'to mash HWE80: 124' / šawažók 'you mash HWE80: 124, M89: 153' /

šawažókjį 'you mash hard M89: 154'

hikorohó 'to prepare, dress S43: 35, 48, M79: 39, HWE80: 128, M89: 155' /

hirakóroho 'you prepare HWE80: 128' /

hirakórohonį 'you don't prepare HV87: 31' /

hirakórohonįra 'the fact that you don't prepare H90: 149'

hakirújik 'to pull taut HWE80: 126' / harakíšurujik 'you pull taut HWE80 126' /

harakíšurujikšąną 'you pull taut (declarative) or you pulled taut HWE80: 126'

Let us explain here the basic morphology and morpho-phonemics of nominal and verbal forms given above. First, the suffix of *-ra* indicates the definiteness of a noun like *hoočą́gra* in (1a) or of a proposition like *hirakórohonįra* in (1d). When a voiceless obstruent consonant is followed by certain sonorant-initial suffixes like this, it becomes voiced as in the former example (Miner (1979: 27, 1981: 342, 1989: 150, 1993: 112)).[3] Second, *-šąną* is a declarative or past-forming ending after consonant-final verbal stems like *nįįpšą́ną* in (1a), which has an allomorphic counterpart *-Vną* after vowel-final ones. The initial vowel of the *-Vną* suffix surfaces as the same as the final vowel of the stems, as in *hit'et'é* 'to speak S43: 9, 10, 47, M89: 149, WE82: 316' / *hit'et'éeną* 'speak (declarative) or spoke WE82: 316.' Third, *ha*, *ra*, and *ϕ* indicate first-, second-, and third-person singular forms of verbs respectively, which function as either infixes or prefixes as in the examples in (1a). Notice that the first-person singular form *yaakóroho* is derived from /hi-ha-koroho/ in the underlying representation, which undergoes intervocalic *h*-deletion and other processes (Hale and White Eagle (1980: 121)), and that the verbal stem *nį́įp* shortens when preceded by certain prefixes (White Eagle (1982: 312)).[4] On the other hand, there is another class of verbs whose persons are marked by consonantal prefixes such as *h*, *š*, and *ϕ*, as in *šawažók* in (1d).[5] In either case, these three pairs of affixes are interpreted as forming the person-marking inflection of verbs, and there are no distinctive pronominal words in Winnebago.[6] Fourth, word formation by derivation is usually done by reduplication as in (1b), copying the final light syllable of the base and suffixing it as a reduplicant to the base.[7] Fifth, in this language there are compounds like many other languages, which appear to be like phrases in meaning, but notice in (1c) that they are left-headed unlike English and Japanese. Left-headed phrases seem to be more likely to become compounds than right-headed ones, although they may occasionally remain to be phrases as in *hinųk* 'woman S43: 42, 123'/ *čáap* 'related S43: 57'/ *hinųkčáap* 'one's own sister S43: 57' and *wakirí* 'insect, small animal S43: 59'/ *čóop* 'four, four-legged S43: 59' / *wakiríǰóop* 'lizard S43: 59.' Finally, *-ǰį* and *-nį* are intensifying and negative suffixes respectively, as seen in (1d).

Although each of the four processes in (1a-d) might strictly be not equivalent to that of other languages by definition, readers can see what I mean here. Morphologically, a word behaves the same as that of other types of languages because it consists of stems and affixes (including the zero affix) in a somewhat fixed order specified by morphological rules, whereas semantically, it plays a role not only as an ordinary word but also as a phrase or a sentence. In other words, a word is just a word in form but can be a word, a phrase, or a sentence in meaning. Bearing such a complex nature of a word in mind, we can say then that it is defined as in the following way:

(2) The Definition of 'Word'

> The 'word' in Winnebago is a phonological domain with lexical, phrasal, or sentential meaning.

The morphological processes in (1a-d) can apply on a level which constitutes a uniform phonological domain as a word. Let us call this level 'the uni-domain level,' where certain phonological rules apply uniformly on this level as well as morphological rules. Such an assumption is motivated by the fact that for example, each of the words in (1) has one and only one primary accent in its domain (and of course, accent assignment is a phonological rule). It is also to be noted that on this level, morphological rules such as order-specifying rules and affixation apply <u>before</u>, and thus give the environments of, phonological rules such as accent assignment, voicing, shortening, and so on.

There are, however, other morpho-syntactic processes than those in (1), which should be considered carefully with respect to their status in morphology and phonology:[8]

(3) a. Phrase Formation (Nouns)

péeč 'fire S43: 25, M89: 150'/ nį́į 'water, liquid S43: 123, M89: 150'/ péeǰnį́ 'whiskey M89: 150'

péeč 'fire S43: 25, M89: 150' / wáač 'boat M89: 150' / péeǰwáac 'locomotive M89: 150'

ną́ą 'wood S43: 120' / pą́ą 'sack S43: 120' / nąąpą́ą 'basket S43: 120'

čí́i 'lodge, house, to live S43: 33, 36, HWE80: 130' / nąągú 'road S43: 59, 61' /

čiiną́ągu 'home roads S43: 57, 123'

b. Phrase Formation (Verbs)

'áa 'to say S43: 48' / ǰiré 'to start S43: 48, 74' / 'áaǰiré 'to start saying S43: 48' cf. * 'aaǰíre

háač 'I eat M93: 123' / tée 'I go S43: 79, M89: 150, M93: 123' /

háačtée 'I go to eat cf. M93: 123' cf. * haactée

waší 'to dance S43: 46, M89: 151' / kirigí 'to come back' /

wašíkirigí 'to come back dancing S43: 58' cf. * wa šikírigi

haǰá 'to see S43: 47, M79: 31, 32, HWE80: 123' / pį́į 'to be able, good S43: 113' /

haǰápį́į 'able to see S43: 122' cf. * haǰapį́į but haǰapí 'good-looking S43: 122, 123'

pąną́ 'to smell S43: 123' / pį́į 'to be able, good S43: 113' / pąną́pį́į 'able to have an odor S43: 14, 123'

cf. * pąnąpį́į but pąnąpį́ 'sweat-smelling S43: 14, 123'

c. Utterance Formation[9]

hačį́įǰa 'where S43: 36, WE82: 309' / kųnųgá 'Kųnųga (person name) WE82: 308, 309' /

heeną́ga 'Heenąga (person name) 308, 309' / nį́įp 'to swim WE82: 309' /

nįeǰá 'river WE82: 309' / hačį́įǰa kųnųgá nį́įp 'where did Kųnųga swim? WE82: 309'

heeną́ga hačį́įǰa nį́įp 'where did Heenąga swim? WE82: 309' /

nieja niipsana 'he swam in the river WE82: 309'

The nominal phrases in (3a), the verbal phrases in (3b), and the utterances in (3c) have a noticeable common property, as compared to the words in (1) (particularly to the compounds in (1c) and the sentences in (1d)): phonologically, each of the words constitutes a distinct phonological domain and is assigned more than one primary accent in the entire string, while morpho-syntactically, words are either juxtaposed as in (3a, b) or separately arranged as in (3c) by certain morpho-syntactic rules. What is important here is that phonological rules including accent assignment first apply to each word (i.e. each domain) on the uni-domain level and then all words are juxtaposed or arranged in accordance with a somewhat specified order (although the examples in (3c) imply that the syntactic order is not so strict, as is often the case with polysynthetic languages in general); that is, phonology precedes morphology on this level. Calling this level 'the multi-domain level,' to which the three processes given in (3a-c) belong, we can recapitulate what we have observed about the level distinction, as in (4):

(4) a. Uni-domain Level

i) Morphological Rules: Morpheme-Order Specification

Affixation: Inflection, Derivation, Compound Formation, Sentence Formation

ii) Phonological Rules: Accent Assignment, Voicing, Shortening

b. Multi-domain Level

iii) Morph-Syntactic Rules: Word-Order Specification

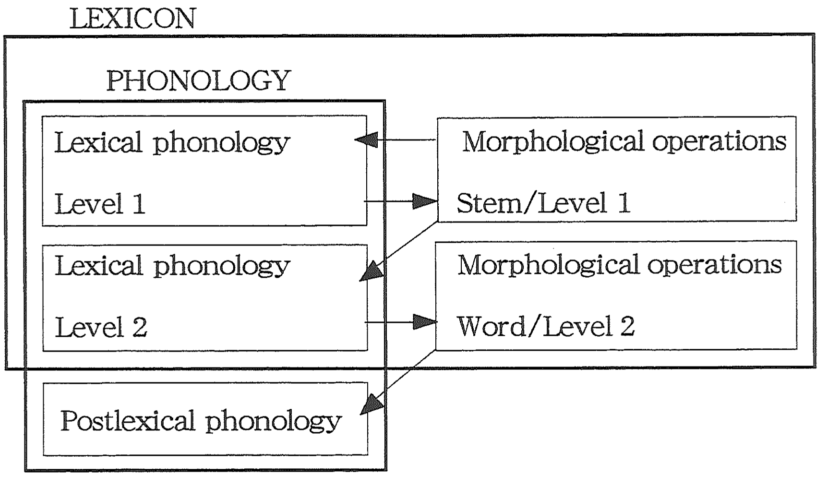
Juxtaposition: Nominal & Verbal Phrase Formation

Separate Arrangement: Utterance Formation [10]

This basic ordering of levels and rules involves some crucial assumptions based on phonological and morphological facts. As for the ordering itself, morphological rules on the uni-domain level precede phonology while those on the multi-domain level follow phonology. Furthermore, it should be noted that although there are other phonological rules on the postlexical level as will be discussed in section 2.2, all lexical rules precede morphological operations on the multi-domain level.

Based on all the observations and assumptions that have been made, we can conclude that the Lexicon model that is the most appropriate to the phonology and morphology of this language is the one put forward by Borowsky (1993: 200), a kind of interactionist hypothesis adopted in favor of the English Lexicon:

(5) Boworsky's (1993) Lexicon Model



What has come to be known as interactionism, which is defended by Hargus (1993) and Booij and Lieber (1993), advocates the claim that phonological rules may precede morphological ones in some cases, adopting the basic tenets of the classical theory of Lexical Phonology, although when and how the interaction occurs varies across its proponents.[11] Here, a crucial point is the precedence of phonology over morphology on level 2 in (5) and on the second level of the Lexicon in figure 1 of section 1.2.

Finally, as for the data in (3a), I claim that some of the phrases in (3a) be formed on not the multi-domain but the uni-domain level, or can be taken to be lexicalized, as is the case with the compounds in (1c); namely, we may just as well reinterpret the accent position of the first phrase in (3a) as *peeǰnį́*, contrary to Miner's (1989: 150) description, on the grounds that both the voicing rule (i.e. *peeǰ* < /peeč/) and non-initial stem shortening (i.e. *nį* < /nįį/) only apply in the derived environments on a single domain (e.g. *hoočą́gra* < /hoočąk-ra/ in (1a) and *hanįpšą́ną* < /ha-nįįp-šąną/ in (1a)). As for the latter rule, it is also related to the fact that Winnebago has the minimal word requirement to the effect that a word (i.e. a phonological domain, according to (2)) must have at least two moras, as there are no monomoraic words in this language (see section 2.6.3); thus, shortening the final domain of /peeč-nį̨į̨/ to *nį̨* would lead to a violation of this requirement, if *nį̨* formed a distinct word domain at all. Instead, the phrase should form a single phonological domain as a whole and have one and only one primary accent on the right member, or their morphological head. This also seems to be true for the second phrase in (3a), which should be reinterpreted as *peeǰwáč* with one and only one accent and the short vowel on its morphological head. To sum up, compounds are likely to be formed on the uni-domain level in (4a), whereas nominal or verbal phrases belong to the multi-domain level in (4b). Note also that in Winnebago, compounds like the ones in (1c) tend to be left-headed while phrases like the ones in (3a) and (3b) are right-headed.[12] The same point can also be made in the case of verbal phrases and compounds as in *haǰápį́į̨* 'able to see S43: 122' vs. *haǰapį́* 'good-looking S43: 122, 123' (< *haǰá* 'to see S43: 47, M79: 31, 32, HWE80: 123' + *pį́į̨* 'to be able, good S43: 113') and *pąnąpį́į̨* 'able to have an odor S43: 14, 123' vs. *pąnąpį́* 'sweat-smelling S43: 14, 123' (< *pąną́* 'to smell S43: 123' + *pį́į̨* 'to be able, good S43: 113').

The following section will deal with the existence of postlexical phonology in Winnebago, which follows the operations on the multi-domain level.

2.2. Lexical vs. Postlexical Levels

In spite of many diversities of a conceptual viewpoint or many competing hypotheses in phonological description, there is a pervasive point on which almost all Lexical Phonologists agree: languages commonly have rules with different clusters of characteristics which are usually associated with the labels lexical and postlexical. Concerning the difference in character between lexical and postlexical rules, it is convenient to refer to Kaisse and Hargus's (1993: 16-

17) table shown below, which in turn is based on the findings of Kiparsky (1983, 1985, 1988) and Rubach (1984):

(6) Rule Typology in Lexical Phonology

	Lexical	Postlexical
a.	word-bounded	not word-bounded
b.	access to word-internal structure assigned at the same level only	access to phrase structure only
c.	precede all postlexical rules	follow all lexical rules
d.	cyclic	apply once (postcyclic)
e.	disjunctively ordered with respect to other lexical rules	conjunctively ordered with respect to lexical rules
f.	apply in derived environments (subject to the strict cyclicity effect)	apply across the board
g.	structure-preserving	not structure-preserving
h.	apply to lexical categories only	apply to all categories
i.	may have exceptions	automatic
j.	not transferred to a second language	transferable to L2
k.	outputs subject to lexical diffusion	subject to Neogrammarian sound change
l.	apply categorically	may have gradient outputs

Although Kaisse and Hargus admit that these characterizations have been so controversial as to be challenged by many other researchers, it is nevertheless unanimously believed that the distinction does exist. Thus, I will assume that (6a-l) are just a guide and not a rigid diagnostics, since they can often vary across languages.

As for Winnebago, this guide allows us to see easily that the distinction between lexical and postlexical rules does come into effect and that at least the characteristics in (6c, e, i, l) hold true for its phonology: lexical rules, which are disjunctively ordered with respect to each other, first apply categorically or obligatorily though they may have exceptions, and then postlexical rules ordered conjunctively with respect to lexical rules apply automatically and sometimes optionally, having gradient outputs.[13]

For example, accent assignment may well be a lexical rule as is evident from the fact that its application is obligatory and followed by other lexical rules. In fact, the rule is morphologically-conditioned, and applies cyclically to such examples as in (1) and non-cyclically to those in (3b-c);[14] thus, it is uncontroversial that the accent assignment rule of this language is a lexical rule. In contrast, accent shift can be thought of as a postlexical rule (when the clashing accents are non-adjacent) in that its application is either subject to the phonetic length of an intermediate vowel surrounded by two clashing accents or sometimes optional. Consider the behavior of subsidiary accent in the following examples (hereafter, each underlined vowel is not present in the underlying representations but inserted by Dorsey's Law):

(7) a. *raagáką̲ną̀šge → raagáką̲nąšgè 'ant M81: 342'

*harakíšu̲rùǰikšą̲̀ną → harakíšu̲ruǰìkšą̲ną̀ 'you pull taut (declarative) or you pulled taut HWE80: 126'

b. waapó̲ropò̲ro → *waapó̲ropo̲rò 'snowball M79: 30

hirakó̲rohòn į̲ra → *hirakó̲rohonį̲̀ra 'the fact that you don't prepare H90: 149'

The left-hand stages before accent shift are derived by the accent assignment rule discussed in section 3.2.4.1. The problem is that the examples in (7a) undergo accent shift while the ones in (7b) do not in spite of the fact that they have almost the same accent configuration in common except for the position of copied vowels. The sole difference between these shifted and non-shifted forms is that in the former cases the inserted or underlined vowel is surrounded by the two clashing accents and that according to Miner (1979: 26), "the [Dorsey's Law] sequences are spoken (and, apparently, sung) faster than other CVCV sequences". Susman (1943: 9–10) also remarks that the Dorsey's Law sequence of "CVCV is intermediate between one long and two short syllables." As a consequence, the distance of the clashing accents becomes somewhat nearer in (7a) and accent shift is likely to apply. That is, accent shift is sensitive to phonetic length (or speech rate), which certainly is a postlexical feature. Furthermore, there is another case, though very rare, where this non-adjacent accent shift applies optionally regardless of the presence or absence of Dorsey's Law vowels: in the example of *wiiraguˇšgera* 'the stars M79: 28, HWE80: 117,' both shifted and non-shifted forms are acceptable according to Hayes (1995: 347, 350) (i.e. *wiirágųšgèra* / *wiirágųšgerà*), which appears to be virtually equivalent to the optional application of the English Rhythm Rule as in *cosmètic súrgery* / *còsmetic súrgery* and *Salvàtion Ármy* / *Sàlvation Ármy* (though the directionality is opposite).[15] It can safely be said then that accent shift in the non-adjacent clashing environment is a postlexical rule either for its phonetic (or speech rate) sensitivity or for its optionality in application.[16]

There is another case where apparently-similar rules are divided into lexical and postlexical ones: Dorsey's Law and intrusive schwa. First, Dorsey's Law is a lexical rule in the sense that its application is morphologically-conditioned as in *waší* 'to dance S43: 46, M89: 151' / *š<u>a</u>waší* 'you dance M89: 151' and *rušíp* 'to pull down S43: 45, M89: 151' / *k<u>u</u>rušíp* 'to pull down one's own S43: 45, M89: 151' (although it can apply to a monomorphemic environment as will be discussed in detail in section 2.3.4) and that these copied vowels, like ordinary ones, can be accented as in *mąąráč* 'to promise S43: 106, HWE80: 127' / *mąąš<u>ą́</u>rač* 'you promise S43: 106, HWE80: 127, M89: 154' and *hik<u>o</u>rohó* 'to prepare, dress S43: 35, 48, M79: 39, HWE80: 128, M89: 155' / *hirak<u>ó</u>roho* 'you prepare HWE80: 128'. On the other hand, there is another vowel insertion rule, fully independent of Dorsey's Law, which is called 'schwa epenthesis' by Miner (1979) and is so common in Mississippi Valley Siouan languages like Dakota as Shaw (1976) discusses. Miner (1979: 27) remarks the epenthesis as "when in suffixing or compounding an obstruent comes to stand before a sonorant, the obstruent is voiced and a slight schwa (or more precisely, a barely audible intrusive vowel having more or less the quality of a short version of the following full vowel) intervenes between the obstruent and the sonorant." [17] The description of this rule is found elsewhere in Miner (1989: 150, 1993: 112), and the inserted schwa and the Dorsey's Law vowel are in complementary distribution because final voicing, which feeds schwa epenthesis, bleeds Dorsey's Law:

(8) a. wą́ąk 'man' / –nąk– 'sitting (positional)' / –ga 'that (demonstrative)'

		voicing		schwa epenthesis	
	/wąąk–nąka/	→	wąągnąka	→	wąąg^{ə}nąkạ or wąąg^{a}nąka̤

'that man sitting M79: 27, M81: 342, M93: 111'

		voicing		Dorsey's Law	
b.	/hiruknąną/	→	n/a	→	hirukąnąną

'boss M81: 342, M93: 111–112'

As is known from the example, inserted schwas as the one in (8a) consistently never bear accent unlike copied vowels as the <u>ą</u> in (8b), although this position (i.e. the third mora counting from the word-initial position) is the most promising candidate for assigning primary accent in polymoraic words. In observed in Miner's (1979: 72) citation given above (in particular, his remark in parentheses), it can be said that schwa epenthesis is somewhat optional or automatic because the schwa is "barely audible" and that its outputs are gradient in character because it is obscure whether the vowel in question is a schwa or a vowel with "more or less the quality of a short version of the following full vowel". It follows then that schwa epenthesis is nothing but a postlexical rule, and I will call it 'intrusive schwa' hereafter because of its phonetic character.[18]

2.3. Cyclic vs. Non-Cyclic Levels

2.3.1. Accent Assignment, Dorsey's Law, and Reduplication

In addition to the lexical and postlexical levels on which phonological rules apply in a somewhat different manner, there is another distinction in rule application within the lexical level: the cyclic and non-cyclic levels. Postlexical rules such as accent shift and intrusive schwa are non-cyclic (or postcyclic) in a sense; however, I will not examine the (non-)cyclicity of postlexical rules here but are concerned only with the difference in cyclicity between the two lexical levels. In this respect, I will follow the basic tenet of Booij and Rubach's (1987) or Borowsky's (1986, 1989, 1993) Lexical Phonology, who propose that the last set of rules on the lexical level applies non-cyclically, making the cyclic vs. postcyclic or the level 1 vs. level 2 distinction in the lexical component.

Morphologically, I can adduce evidence showing that there is in fact a distinction between the cyclic and non-cyclic levels in Winnebago, since some morphemes are non-stress-neutral while others are stress-neutral, as in the case of Class I and Class II suffixes in English (e.g. *sénsitive* + *-ity* →

sensitívity vs. *sénsitive* + *–ness* → *sénsitiveness*):

(9) a. Non–Stress–Neutral

giginą́gaǰą 'he should have done it to him' + –nį 'not (negative)'

→ giginį́ngaǰą 'he should not have done it to him S43: 53, 136'

t'ée 'he dies' + –kǰąne 'would (future)'

→ t'eekǰą́ne 'he would die S43: 48, 137'

b. Stress–Neutral

'áa 'to say' + ǰiré 'to start'

→ 'áaǰiré 'to start saying S43: 48' cf. * 'aaǰíre

wašį́ 'to dance' + kirigį́ 'to come back'

→ wašį́kirigį́ 'to come back dancing S43: 58' cf. * wašikį́rigi

The examples in (9) clearly show that negation and future formation in (9a) are present on the cyclic level and hence *–nį* and *–kǰąne* are cyclic morphemes whereas verbal compounding in (9b), which was also exemplified above in (3b), occurs on the non–cyclic level. Note also that the cyclic and non–cyclic levels correspond directly to the uni–domain and multi–domain levels, respectively, which are discussed in section 2.1. That is, affixation processes in (1) and nominal compounding in (3a) are all in cyclic morphology while juxtaposition in (3b) and separate arrangement in (3c) are in non–cyclic morphology; and the crucial difference can be seen on the basis of stress–neutralness in tandem with the morphological processes.

The above reasoning of the distinction in cyclicity based on morphological processes, of course, presupposes that accent assignment is a cyclic phonological rule, and there are several independent motivations or arguments in favor of this assumption. First, theoretically, accent assignment is subject to Structure Preservation and the Strict Cycle Constraint, both of which are considered to hold for the cyclic level only (cf. (6d, f, g)).[19] Second, cyclic rules reapply after every word-formation operation, as Booij and Rubach (1987) observe, which implies that they reapply whenever a stem or a word suffers a certain change in form: this change may be either morphological (e.g. word-formation operation) or phonological (e.g. epenthesis), and one of the phonological changes that trigger the reapplication of accent assignment is Dorsey's Law. Relevant examples are given below:

(10) a. wažokǰį́ 'to mash hard' / ša̲wažókǰį 'you mash hard M89: 154'

b. ruxurúk 'to earn' / šu̲ruxú̲ruk 'you earn, you are able M79: 30, 33, M89: 154'

c. mąąráč 'to promise' / mąąšá̲rač 'you promise S43: 106, HWE80: 127, M89: 154'

Note here that affixation with *(–)š–* alone does not affect any accent location or trigger accent reassignment because it does not change syllable structure (i.e. the number of syllables) at all in (10a–c). Rather, it is Dorsey's Law that changes syllable structure and triggers accent reassignment. Finally, the examples in (10) not only show that Dorsey's Law as well as accent assignment is a cyclic rule, but also imply that there may be other cases where two or more cyclic rules naturally interact with each other in this way. The phenomena in (11) can be seen as one such case, where accent assignment and Dorsey's Law interact not only with each other but also with reduplication:

(11) a. čį̲wį́ 'sound' / čį̲wįčį̲́wį 'sound causing vibration M79: 26, M89: 149'

b. ša̲rá 'bald' / ša̲rašá̲ra 'bald in spots S43: 33, M79: 29, M89: 149'

On the second cycle in each example (i.e. each reduplicative form), both accent assignment and Dorsey's Law reapply in tandem with reduplicative processes, if at all reduplication is considered as a phonological operation which causes a phonological change just like Dorsey's Law. Or even if it is seen as a morphological operation which changes both meaning and form, it is in cyclic morphology because of its non-stress-neutralness. I assume here that as was shown in (1b), reduplication is morphologically an affixation (derivation) process on one hand but that as will be discussed in section 2.6.2, it phonologically comprises the two rules of copying and template matching on the other. In either case, it must be a cyclic rule and hence interacts with accent assignment and Dorsey's Law in this way. For the ordering relations among the three, see section 2.6.2. See also section 3.1.5, where rule interactions are discussed between Dorsey's Law and other lexical rules.

2.3.2. Structure-Building (Feature-Filling) vs. Structure-Changing (Feature-Changing) Rules

In the previous section, I was concerned with the level distinction in cyclicity within the lexical component, particularly focusing on the existence of cyclic morphological and phonological processes. A question which might naturally arise then is whether there is an explicit diagnosis to distinguish between cyclic and non-cyclic phonological rules, aside from the stress-neutralness of morphological operations; unfortunately, however, there has been no unanimous criterion of their difference in the literature, since the present situation in phonological theory is that even the distinction between lexical and postlexical rules is somewhat controversial as stated with respect to (6) in section 2.2. One of the diagnoses is the relation of the phonological rules in question to morphology, namely, whether they reapply after every word-formation operation or apply once after all word-formation operations (cf. (6d)); however, this alone does not allow us to see the whole picture because non-cyclic rules are still rather difficult to identify. That is why I could not lay a particular emphasis on them in the previous section.

Hence, I tentatively suggest the following criterion of distinguishing between cyclic and non-cyclic rules in Winnebago:

(12) The Criterion of Cyclicity and Non-Cyclicity

In the lexical component, a rule is cyclic if it reapplies after every affixation process principally in a structure-building (feature-filling) way and is subject to Structure Preservation and the Strict Cycle Constraint, but non-cyclic if it applies once after all affixation processes in a structure-changing (feature-changing) way and does not obey the two constraints.

Logically, (12) does not imply, and thus it is not always the case, that all structure-building (feature-filling) rules are cyclic and all structure-changing (feature-changing) rules are non-cyclic; this is because whether certain rules are structure-building (feature-filling) or structure-changing (feature-changing) is merely a necessary but not sufficient condition for distinguishing between the two levels. In fact, there are structure-changing (feature-changing) rules on the cyclic level and structure-building (feature-filling) ones on the postlexical level, as will be discussed in later sections.

Surprisingly enough, the criterion in (12) holds well not only for ordinary lexical rules in Winnebago grammar but also for repair strategies in Universal Grammar when they apply in violation of the constraints on the lexical level. I assume that repair strategies are classified into the following four types: insertion, reconstruction, deletion, and movement. In sections 3.1.3.1 and 3.2.4.1, I will demonstrate that when there occur violations of certain lexical constraints, the former two apply on the cyclic level while the latter two on the non-cyclic level.

In (12), there are three factors in the level distinction between the cyclic and non-cyclic characteristics: 1) morphologically-conditioned application vs. across-the-board application, 2) structure-building (feature-filling) vs. structure-changing (feature-changing), and 3) the presence vs. absence of the effects of structure preservation and strict cyclicity. Concerning the level distinction, Borowsky (1993: 201) argues by invoking the table in (5) that "[o]n the first domain, the Stem level [i.e. Level 1], ... the rules are structure-preserving, are cyclic, and obey the strict cycle condition ... After all Level 1 operations are completed, the resulting forms complete another circuit ... This, the word cycle, is the last phonological domain in the lexicon and constitutes what I will call the Word Level [i.e. Level 2]. Rules of this level may be non-structure-preserving ... is not cyclic ... does not show evidence of strict cyclic effects." Therefore, the most crucial of the three factors in (12) is surely the third factor, to which I will turn in the following two sections. The first and the second factors, of course, will also be mentioned in discussing the matter there.

2.3.3. Structure Preservation

First, as for the concept of 'structure preservation', a general idea is that the prototypical lexical rule preserves the basic underlying segment and total inventory of the language and the basic arrangement of strings of segments as well. As for prosodic operations, Kiparsky (1984) observes that syllabification and stress rules are not subject to the effect. However, I will adopt here Borowsky's (1986: 28-29) version of this concept, which has a wider domain or coverage of its effect, incorporating the templates of syllables and feet as well as the inventory and arrangement of segments:

(13) Structure Preservation (Cyclic Level)

Lexical rules may not mark features which are non-distinctive, nor create structures which do not conform to the basic prosodic templates of the language (i.e. syllable and foot templates).

The first half of (13) has a certain implication on underspecification; that is, it is true that a rule may not mark non-distinctive features (i.e. can only insert or change distinctive (or contrastive) features during the lexical phonology), but at the same time it may not change any features, either, that are distinctive but unspecified in the framework of underspecification theory.[20] It is quite natural that unspecified features or values can be inserted, but not be changed by rule on the lexical level even if they are distinctive. This is simply because unspecified features do not exist on that level. Moreover, as for the second half of (13), it implies that although syllabification and metrification can construct or insert structures conforming to the basic prosodic templates, they cannot change such well-formed prosodic structures on the level where Structure Preservation is in effect.

An immediate consequence of these facts is that structure-building (feature-filling) rules such as construction, insertion, and reconstruction are likely to keep up with the level where Structure Preservation holds well, while structure-changing (feature-changing) rules such as deletion and movement are likely to keep away from it exactly because they cannot change any features or prosodic structures under the control of the constraint. That is why, under the assumption of (12), Structure Preservation must hold on the cyclic level only, and structure-building (feature-filling) rules and structure-changing (feature-changing) rules have a strong tendency of applying on the cyclic and non-cyclic levels, respectively. In short, there must be a lexical level on which Structure Preservation turns off and structure-changing (feature-changing) rules are likely to apply. This, of course, is the genesis of the non-cyclic level.

The above speculation is supported by the fact that some Lexical Phonologists argue that Structure Preservation holds on the innermost cyclic level but turns off on the next non-cyclic level, such as Kiparsky (1985) and Borowsky (1986, 1989, 1993) among others, although the definition of this constraint somewhat varies among them. Moreover, I can find evidence in Winnebago accent in favor of the three-way distinction (i.e. cyclic, non-cyclic, and postlexical) and of Structure Preservation holding only on the first level. This is illustrated in the following example:

(14) a. hokiwárokè 'swing M79: 28' b. waipéresgà 'linen M79: 28'

```
            (*        )                    (*        )
     <(*  .)> (*   . ) (*)            <(*)> (*   . ) (*)

      σμ  σμ  σμ  σμ  σμ               σμμ  σμ σμ  σμ
      ho  ki  wa  ro  ke               wai  pe re  sga
```

c. hižąkíičąšguniąną̀gà 'nine and M79: 25'

```
            (*                  )              (*                    )
     <(*  .)> (*)  (*   . ) (*)  (*   . )   <(*  .)> (*)  (.    .)  (*)  (.   *)

      σμ σμ  σμμ  σμ  σμ  σμμ  σμ σμ        σμ σμ  σμμ  σμ  σμ  σμμ  σμ σμ
      hi žą  kii  čą  šgu nįą  ną ga   →    hi žą  kii  čą  šgu nįą  ną ga
```

d. wiirágųšgèra or wiirágųšgerà 'the stars M79: 28, HWE80: 117'

```
         (*           )             (*          )
     <(*)> (*   . )  (*   . )     <(*)> (*   . ) ( .  *)

      σμμσμ σμ  σμ  σμ            σμμσμ σμ  σμ  σμ
      wii  ra gų  šge ra    →     wii  ra gų  šge ra
```

The metrical structures in (14) are constructed by the parameters discussed in section 3.2.4.1. It is sufficient here to state that Winnebago has the feet of Moraic Trochees assigned from left to right, the initial-foot extrametricality indicated here as <>, and the upper constituent assigned by the End Rule Left. In examples (14a, b), accent assignment (or metrical structure construction) produces each output straightforwardly, but note in (14c, d) that there occur clashing environments: two adjacent clashes in the former example and a non-adjacent clash in the latter. In either case, they are exactly violations of the Clash Avoidance Principle, a general constraint in Universal Grammar (Haraguchi (1991)). For the reasons I will argue in section 3.2.4.1, an adjacent clash is resolved by clash deletion and clash movement as in (14c), both of which apply obligatorily, whereas a non-adjacent clash is remedied by optional movement as in (14d).

The most crucial here is that the application of deletion and movement results in the violations of Structure Preservation, a cyclic condition, producing the anomalous foot structures not conforming to the basic template. That is why only metrical structure construction (i.e. accent assignment) belongs to the level on which Structure Preservation holds, namely the cyclic level. Furthermore, there must be a striking difference in application level between deletion and movement in (14c) on the one hand, and movement in (14d) on the other; this is because the adjacency/non-adjacency of clashing environments corresponds directly to the obligatory/optional applications of the repair strategies. It naturally follows then that clash deletion and clash movement in the adjacent environments apply on the non-cyclic and yet lexical level, but non-adjacent clash movement operates on the postlexical level for the reason stated in section 2.2.[21] It is also clear that Structure Preservation are effective on the cyclic level, while the Clash Avoidance Principle holds on both the non-cyclic and postlexical levels.

2.3.4. The Strict Cycle Constraint

The second constraint I now examine is the Strict Cycle Constraint, which prevents certain rules from applying within a morpheme or from applying in environments which were already available on a previous cycle. This line of practice has been followed by Lexical Phonologists since the pioneering ideas of Mascaro (1976), Kiparsky (1982a, 1983), and so on. In other words, this constraint allows certain rules to apply only to 'derived environments,' and by 'derived environments,' it is meant either that the concatenation of two morphemes or more creates the environment for those rules or that the application of another previous rule on the same cycle feeds those rules.

Indeed, Lexical Phonologists generally agree that there is a robust set of phenomena which motivate something roughly like what this constraint states, i.e. the effect of strict cyclicity. Again, however, since the proposal of this constraint in the early 1980s, it has been under attack from all directions because there are often cases where lexical rules may exhibit or fail to exhibit such effects: it has been rather controversial as to 1) what types of rules are subject to this constraint and 2) on which level this constraint holds. First, as a starting point, we must abolish the assumption in (6f) that all rules on the lexical level are subject to this constraint, because it is now widely known that both cyclic and non-cyclic rules may or may not exhibit the effect.[22] Second, Kiparsky (1982a: 154) argues that cyclic rules (i.e. lexical rules on the cyclic level) can apply only to derived environments, and there are other proponents holding that the effect is observed on the cyclic level only, such as Kiparsky (1985), Booij and Rubach (1987), and Borowsky (1986, 1993); this alone, however, does not capture the fact, either, since there is full evidence now that structure-building (feature-filling) rules fail to exhibit the effect even if they are cyclic. In fact, as noted in Kiparsky (1985: 87, 92), Borowsky (1986: 26) and Clark (1990: 89, 293), this constraint allows structure-building (feature-filling) rules to apply in non-derived environments as well as derived environments, but restricts the application of structure-changing (feature-changing) rules to derived environments. Taking these considerations into account, we can conclude that only structure-changing rules obey this constraint on the cyclic level. (15) is a somewhat revised version of Clark's (1990: 89) formulation, restricting its effect to the lexical cyclic level only:

(15) Strict Cycle Constraint (Cyclic Level)

Structure-changing (feature-changing) rules apply only to derived environments.

As I have been assuming, structure-changing (feature-changing) rules are ones that (re)move or alter existing information of any kind within a segment, a syllable, a foot, and so on. The addition of some information to these segmental and prosodic constituents is not regarded as a change of their structure.

Direct evidence for the above formulation can be adduced by invoking the cyclic and non-cyclic phonology of Winnebago. For example, accent assignment and Dorsey's Law, which are obviously cyclic and structure-building, apply to both monomorphemic and polymorphemic words, whereas non-initial stem shortening, which is also cyclic but structure-changing, applies only to derived words. This difference is shown in (16), (17) vs. (18):

(16) Accent Assignment (Structure-Building)

a. underived	b. derived
/gihu/ → gihú 'to swing M89: 149'	/gihu-hu/ → gihuhú 'to wag its tail M89: 149'
/račgą/ → račgą́ 'to drink M89: 149, 151'	/račgą-čgą/ → račgąčgą́ 'to drink repeatedly M89: 149'

/wanįk/ → wanį́k 'bird M89: 150'   /wanįk-nįk/ → wanįgnį́k 'little bird M89: 150'

(17) Dorsey's Law (Structure-Building)

a. underived   b. derived

/šra/ → ša̲rá 'bald S43: 33, M79: 29, M89: 149'   /š-waši/ → ša̲waší 'you dance M89: 151'

/kre/ → ke̲ré 'to leave returning M79: 26, 27'   /k-rušip/ → ku̲rušíp 'to pull down one's own S43: 45, M89: 151'

/pras/ → pa̲rás 'flat S43: 71, M79: 27, 29, 30'   /waa-pro-hi/ → waapó̲rohi 'snowball making M79: 30'

(18) Non-Initial Stem Shortening (Structure-Changing)

a. underived   b. derived

/nįįp/ → *nįp → nį́įp 'to swim WE82: 309. 310'   /ra-nįįp/ → ranį́p 'you swim WE82: 309, 310'

/gųųs/ → *gųs → gų́ųs 'to teach WE82: 310'   /ha-gųųs/ → hagų́s 'I teach WE82: 309'

/nįį/ → *nį → nį́į 'water, liquid M89: 150'   /peeč-nįį/ → peeǰnį́ 'whiskey M89: 150'

It is clear from (18) that the Strict Cycle Constraint is effective only in the case of non-initial stem shortening, a structure-changing rule. This rule, no doubt, is cyclic in that morphological processes involved in (18b) operate on the uni-domain level, which is seen as the cyclic level as concluded in section 2.3.1. Incidentally, the blocking of shortening in (18a) involves the minimal word requirement as well as the Strict Cycle Constraint. For more details, see section 2.6.3.

On the other hand, however, even structure-changing rules are not subject to the strict cyclicity if they are present on the non-cyclic level. Nasalization, for instance, applies to monomorphemic or underived words as well as polymorphemic or derived ones, although it is structure-changing. This rule nasalizes all vowels in the nasal-initial syllable, as in /maa/ → *mą́ą* 'earth M79: 28, M89: 149' and /nii/ → *nį́į* 'water M89: 149, 150' (for simplifying the discussion, I have so far transcribed the same type of examples as if their vowels in question were nasalized in the underlying representations). It might appear at first glance that the rule is structure-building (feature-filling) in that it inserts the [+nas] value to the vowels concerned; but I claim that nasalization is a structure-changing (feature-changing) rule, 1) because there is an underlying contrast of [±nas] in Winnebago vowels, aside from the application of nasalization, as in *síi* 'foot M89: 149' vs. *sį́į* 'liver M89: 149' and *gisú* 'to husk M89: 149' vs. *gisų́* 'upset M89: 149' and 2) because I follow Steriade (1987, 1995) in assuming the Theory of Contrastive Underspecification (section 2.5), where contrastive values (i.e. both positive and negative values) must be specified in the underlying representations:

(19) Nasalization (Structure-Changing)

a. underived

/hižąkiičąšguni/ → hižąkíičąšgunį 'nine M79: 25'

b. derived

/hižąkiičąšguni-anaga/ → hižąkíičąšgunįąnąga 'nine and M79: 25'

Note here that the first vowel of /anaga/ in (19b) undergoes nasalization in the derived environment because it forms a diphthong with the preceding root-final syllable /ni/. Furthermore, because of its application to the underived environment in (19a) as well, this rule must belong to the level on which the Strict Cycle Constraint does not work, namely the non-cyclic level. The same is also true of clash deletion, a structure-changing rule, which applies to both derived and underived words and thus can be thought of as applying on the non-cyclic lexical level, as shown below:

(20) Clash Deletion (Structure-Changing)

a. underived: hižąkíičąšgunį

```
                          (*              )            (*                )
                      <(*   .)> (*)   (*    . )  (*)  <(*   .)> (*)   (.     .)  (*)
                        σμ σμ  σμμ   σμ  σμ   σμ      σμ σμ  σμμ   σμ   σμ   σμ
/hižąkiičąšguni/ →  hi  žą   kii   čą  šgu   nį  →  hi  žą   kii   čą  šgu   nį
```

b. derived: hižąkíičąšgunįą̀nągà

```
                                      (*                             )
                                  <(*   .)> (*)   (*    . )  (*)  (*    . )
                                    σμ σμ  σμμ   σμ  σμ   σμμ  σμ  σμ
/hižąkiičąšguni-anaga/  →  hi  žą   kii   čą  šgu  nįą   ną  ga

                                     (*                             )
                                 <(*   .)> (*)   (.     .)  (*)   (.    *)
                                   σμ σμ  σμμ   σμ  σμ   σμμ  σμ  σμ
                              →  hi  žą   kii   čą  šgu  nįą   ną  ga
```

It should also be noted that clash deletion creates headless feet in both of the above examples, which are violations of Structure Preservation. Therefore, clash deletion is a non-cyclic rule, and the Strict Cycle Constraint works on the cyclic level only, just like Structure Preservation.

To sum up, (21) illustrates the level-ordered organization of lexical and postlexical rules which have been discussed so far (SB and SC indicate structure-building (feature-filling) and structure-changing (feature-changing) rules, respectively):

(21) a. Cyclic Level (subject to Structure Preservation & the Strict Cycle Constraint)

Reduplication (SB): (11)

Non-Initial Stem Shortening: (SC) (18)

Accent Assignment (SB): (9), (10), (11), (14a, b), (16)

Dorsey's Law (SB): (8b), (10), (11), (17)

b. Non-Cyclic Level (immune from Structure Preservation & the Strict Cycle Constraint)

Nasalization (SC): (19)

Clash Deletion & Clash Movement (SC): (14c), (20)

c. Postlexical Level

Non-Adjacent Clash Movement: (7), (14d)

Intrusive Schwa: (8a)

In section 2.6, I will consider many other phonological rules in Winnebago on the basis of this level-ordered composition of the Lexicon.

2.4. The Parallelism between the Affixation of Cyclic Morphemes and the Application of Dorsey's Law

In section 2.3.1, I pointed out that cyclic rules reapply whenever a stem or a word suffers a certain change in form and that this change may be either morphological or phonological.[23] Specifically, we have seen that the reapplication of accent assignment, a cyclic rule, is triggered by the affixation of certain morphemes as in (9a) or by the insertion of certain vowels as in (10). This fact leads to the following two consequences. First, the suffixes in (9a) are cyclic morphemes, and the suffixation itself must be a cyclic morphological process (on the uni-domain level). Second, the epenthetic vowels in (10) are present on the lexical level, and the insertion process, or Dorsey's Law, must apply on the same cyclic level as accent assignment, unlike intrusive schwa in (8a). This consequence is also sustained by the fact that vowels inserted by intrusive schwa never bear accent but Dorsey's Law vowels can (section 3.1.4).

Comparing these two consequences, some careful readers might observe that Dorsey's Law vowels behave just like cyclic morphemes in the sense that they trigger accent reassignment in just the same way, in spite of the apparent difference in theoretical status between them (i.e. morphological vs. phonological operations). This point can be made clear in (9a) and (10), and also in the following examples where cyclic morphemes and Dorsey's Law vowels have double and single underlines, respectively:

(22) a. The Affixation of Cyclic Morphemes

wiǰúk 'cat' → wiǰugnį́k 'small cat WE82: 313'

nąą'ą́ 'to weigh' → nąąną́'ą 'you weigh HWE80: 121'

hokit'é 'to talk to' → horakít'e 'you talk to HWE80: 121'

b. The Application of Dorsey's Law

/kreǰųsep/ → kereǰų́sep 'Black Hawk M79: 30, M89: 154'

/boopres/ → boopéres 'to sober up M89: 154'

/hikroho/ → hikorohó 'to prepare, dress S43: 35, 48, M79: 39, HWE80: 128, M89: 155'

c. Both (22a) and (22b)

wažokǰį́ 'to mash hard' → šawažókǰį 'you mash hard M89: 154'

mąąráč 'to promise' → mąąšárač 'you promise S43: 106, HWE80: 127, M89: 154'

howažá 'to be ill' → hošawažá 'you are ill HWE80: 125, M89: 155'

Although the position of affixation or insertion varies across the examples, there is no doubt that the two processes uniformly trigger accent (re)assignment. Note in particular that the location of accent in (22b) is just the same as the one in (22c), which is a natural consequence of the parallelism between the position of affixation and that of insertion. Thus, it can be assumed that a certain change in syllable structure triggers the reapplication of accent assignment. The crucial examples supporting this assumption are given below, in which there is no change in the number of syllables and to which accent assignment does not reapply (or reapply only vacuously) even though *-h-* is a cyclic morpheme marking first-person singular forms just like the second-person singular marker -š̌- in (22c):

(23) wažók 'to mash HWE80: 124' → pažók 'I mash' (< /h-wažok/) cf. note 41

mąąráč 'to promise S43: 106, HWE80: 127' → mąątáč 'I promise' (< /mąą-h-rač/)

howažá 'to be ill HWE80: 125' → hopažá 'I am ill' (< /ho-h-waža/)

Here, morpho-phonemic changes occur such as /hw/ → [p] and /hr/ → [t], but the affixation of the first-person marker is not followed by Dorsey's Law or accent reassignment, since there is no change of the number of syllables unlike the affixation of the second-person marker.[24] It follows then that it is precisely the addition of syllable structure to the form at the preceding stage that triggers the reapplication of cyclic rules, regardless of whether the addition is due to a morphological or a phonological process.

It is true, of course, that there is a radical difference between cyclic morphemes and Dorsey's Law vowels: cyclic morphemes constitute a distinct cycle of rule application in phonology but Dorsey's Law vowels do not. Thus, as shown in (24), the second-person singular marker *-ra-* provides accent assignment (strictly, left-foot extrametricality and metrification processes discussed in section 3.2.4.1) with a second cycle, while Dorsey's Law must apply at the end of the first cycle and the inserted vowel *o* of the second syllable does not constitute a second cycle.

(24) a. The Affixation of Cyclic Morphemes: horakít'e 'you speak HWE80: 121'

1st Cycle: /hokit'e/ →(accent assignment) <hoki>t'é (→(affixation) *<horaki>t'é)

2nd Cycle: /horakit'e/ →(accent assignment) <hora>kít'e

b. The Application of Dorsey's Law: hikorohó 'to prepare S43: 35, 48, etc.'

accent assignment → Dorsey's Law →

1st Cycle: /hikroho/ → <hikro>hó → <hikoro>hó

accent assignment →

(2nd Cycle: /hikoroho/ → *<hiko>róho)

However, in spite of the difference in (24), the parallelism observed in (22) is still existent as an independent issue, which we cannot overlook whatsoever. This is because it is not at all clear at present why cyclic morphemes trigger the reapplication of phonological rules in the first place; that is, there seems to be no exact reason why these types of morphemes resort to such a costful means as to erase the structures that have been built already and to reconstruct new structures.

A clue to answer this question no doubt lies in the parallel relation of cyclic morphemes to Dorsey's Law vowels, namely the addition of a syllable to the preceding form available. This significant parallelism is captured by the Strict Layer Hypothesis, a general constraint discussed in section 2.6.4, which requires every form to have well-formed prosodic structure on the cyclic level and whose violation is amended by one of the repair strategies, reconstruction. Since the addition of newly-built syllable structure, either morphological or phonological, brings about partially-incomplete prosodic structure, it violates the Strict Layer Hypothesis and is repaired by reconstruction. Thus, the parallelism concerned is given a principled account, and there is a good reason why both cyclic morphemes and Dorsey's Law vowels trigger the reassignment of accent in just the same way, as in (22), as long as they increase the number of syllables unlike (23). In some cases where Dorsey's Law applies within an extrametrical foot, even the newly-created syllable is made invisible to the requirement of the constraint and hence not remedied by reconstruction, as seen in (24b). See section 3.2.4.1 for the exact derivation of these particular cases and section 3.1.3.2.6 for other interactions of extrametricality with the Strict Layer Hypothesis.

2.5. Phonemic Inventory, Underspecification Theory, and the Obligatory Contour Principle

2.5.1. The Inventory of Consonants

Before discussing many other rules than the ones in (21), let us consider the phonemic inventory of Winnebago, which, together with Underspecification Theory, will give rise to some implications for the characterization of phonological rules mentioned hereafter. In the course of introducing the inventory of consonants and vowels in this language, we will occasionally turn our attention to such related issues as the distinctive feature system, its relation to underspecification, co-occurrence restrictions, and so on.

First, the consonantal inventory is given in (25), which is classified on a phonetic basis in terms of places and manners of articulation:

(25) Consonantal Inventory (Phonetic Classification)

	Labial	Alveolar	Palato-Alveolar	Palatal	Velar	Glottal
Stop	p / b	t			k / g	'
Affricate			č / ǰ			
Fricative		s / z	š / ž		x / ǧ	h
Nasal	m	n				
Trill		r				
Glide	w			y		

Phonologically, however, this classification can be more simplified as in (26), which is partly based on Miner's (1993: 114) proposed inventory but radically extended and revised by incorporating feature matrices:

(26) Consonantal Inventory & Feature Bundles (Phonological Classification)

Manner Features \ Place Features				[−gutt] [−cor] [+ant]	[−gutt] [+cor] [+ant]	[−gutt] [+cor] [−ant]	[−gutt] [−cor] [−ant]	[+gutt] [−cor] [−ant]
				Labial	Alveolar	Palato-Alveolar	Velar	Glottal
[−son]	[−cont]	[−nas]	Stop	p / b	t	č / ǰ	k / g	ʼ
[−son]	[+cont]	[−nas]	Fricative		s / z	š / ž	x / ğ	h
[+son]	[−cont]	[+nas]	Nasal	m	n			
[+son]	[+cont]	[−nas]	Glide	w	r	y		

(gutt = guttural, cor = coronal, ant = anterior, son = sonorant, cont = continuant, nas = nasal; and each slash mark / indicates the voicing contrast, i.e. [±voi])

(26) not only shows the feature bundles of each consonant by utilizing the SPE-like feature matrices but also involves several classificatory simplifications, as compared to (25): Glide and Trill, Stop and Affricate, and Palato-Alveolar and Palatal are unified as the same manner or place of articulation, namely, as Glide, Stop, and Palato-Alveolar, respectively.

As for the feature matrices, the aim of incorporating feature values in the classification is to explicitly show contrastive values for each consonant of the inventory in Winnebago. This is because I follow Steriade's (1987, 1995) Theory of Contrastive Underspecification in assuming that both values of a feature are specified underlyingly if they are contrastive across the inventory; thus, pairs of phonemes with a slash mark are specified for either of [±voi], but the alveolar stop *t* and sonorants remain unspecified for voicing, unlike other obstruents, since they lack their voiceless counterpart in the consonantal system of this language.

Moreover, the radical simplifications of columns and rows in (26) are based on a natural class of consonants whose behavior is made clear when seen through the lens of the following rule. In particular, the reason for the simplifications involves a certain morpho-phonemic change observed in the verbal paradigm with the first-person marker *-h(a)-* (with double underlines in (27)), which functions as a prefix or an infix in a fixed order and may sometimes be doubly affixed. I will call this morpho-phonemic rule 'glide fortition,' which changes the [+son, +cont] values of glides into [-son, -cont], resulting in the corresponding stops with the same place of articulation:

(27) Glide Fortition (Structure-Changing)

a. w → p / h __

wažók 'to mash HWE80: 124' / pažók 'I mash' (< /h-wažok/) cf. note 41

waší 'to dance S43: 46, M89: 151' / paší 'I dance' (</h-waši/)

wašiną́k 'to dance sitting S43: 50' / pašiną́k 'I dance sitting' (</h-waši-nąk/)

howažá 'to be ill HWE80: 125' / hopažá 'I am ill' (< /ho-h-waža/)

b. r → t / h __

rée 'to go M89: 151, M93: 113' / tée 'I go' (< /h-ree/)

rušíp 'to pull down S43: 45, M89: 151' / tušíp 'I pull down' (< /h-rusip/)

mąąráč 'to promise S43: 106, HWE80: 127' / mąątáč 'I promise' (< /mąą-h-rač/)

hakirúǰik 'to pull taut HWE80: 126' / haakítuǰik 'I pull taut' (< /ha-ha-ki-h-ru-ǰik/)

c. y → č / h __

haǰá 'to see S43: 47, M79: 31, 32, HWE80: 123' / hačá 'I see' (< /ha-h-ya/)[25]

Each first-person singular form undergoes glide fortition and then preconsonantal *h*-deletion, so that the cluster of [*h* + a glide] surfaces as the corresponding stop with the same place of articulation. Glide fortition must be a cyclic structure-changing rule subject to Structure Preservation and the Strict Cycle Constraint, changing only the distinctive values and applying only to derived environments. For example, such underived forms as *ho̲wé* (< /hwe/) 'swollen S43: 22,' *he̲ré* (< /hre/) 'to be, he is S43: 10, 22,' and *ho̲rók* (< /hrok/) 'to join S43: 106' do not undergo glide fortition but Dorsey's Law. Its cyclicity is also supported by the fact that it should apply before Dorsey's Law, a cyclic rule, since otherwise Dorsey's Law would apply erroneously to the forms in (27) (e.g. **ha̲wažók*). On the other hand, preconsonantal *h*–deletion must be a non–cyclic rule for the reasons stated in section 2.6.5. Interestingly, in the case of *haakítuǰik*, another rule called intervocalic *h*–deletion applies as well as preconsonantal *h*–deletion. For further details of intervocalic *h*–deletion, see section 2.6.5.

Now the most significant point to emphasize here is the three natural classes with respect to the phonological rule in (27). That is, 1) the glides *w, y* and the trill *r* together participate in the structural description of the rule; 2) stops and the affricate *c* must also be folded as a single class, as seen in its structural change (in fact, affricates behave just the same way as stops, with respect to the co–occurrence restriction on consonant clusters and the sonority scale in Winnebago (sections 2.5.2 and 3.1.3.1));[26] and 3) the fact that in (27c), the palatal *y* corresponds to the palato–alveolars *č* shows that they behave just the same way in place of articulation. These considerations are precisely the motivations for simplifying the mere phonetic classification in (25) into the phonological one in (26). Moreover, contrary to Miner's (1993: 114) or Alderete's (1995: 33) assumption, the glottal *h* is classified not as a glide but a fricative here, since *h* never undergoes glide fortition (i.e. there is no rule like h → ' / h __) unlike other glides. Words like *wiağéphuu* 'sunrise S43: 17, 67' and *mąįtáwushira* 'May Miner 81: 342' also show that *h* is a fricative, or otherwise it would undergo Dorsey's Law because of the sequence of a voiceless obstruent and a glide (* *wiağép<u>u</u>huu* and * *mą̨į táwus<u>i</u>hira*). Instead, a voiceless obstruent followed by a voiceless fricative is a usual consonant cluster, as we will discuss in the following section.

2.5.2. Against the OCP Effect on Consonant Clusters

In the preceding section, I introduced the rule of glide fortition (27) and suggested phonological arguments for simplifying the consonant classification, but did not make clear the problem of why such a rule is required to apply to the consonant cluster in question. Concerning the problem, it might appear that the application of glide fortition reflects a certain co-occurrence restriction on the sets of consonant clusters in Winnebago: the sequence of [*h* + a glide] is banned by the adjacency of continuant segments, so that glides are changed into the corresponding stops. In fact, according to Miner (1993: 116), there is an effect of the Obligatory Contour Principle (hereafter, OCP) on the manner of articulation of a cluster, which prohibits the adjacency of (non-)continuant consonants (i.e. *[α cont]-[α cont]).

Before examining the existence and validity of this constraint in this language, let us consider Alderete's (1995: 33) generalization of Winnebago consonant clusters, which in turn is based on Miner's (1993: 114-119) insightful observations listing possible consonant clusters of this language:

(28) Winnebago Consonant Clusters: C_1C_2

a. Word-initial or Word-medial Position

C_1 voiceless obstruent + C_2 voiced stop

e.g. sgáa 'white M89: 152, M93: 117, 120,' sgáač 'to play M93: 117,' xgąąsák 'energetic M93: 117,' xgį́įk 'to draw out fluid S43: 70,' šǰáak 'warm M93: 117,' xǰaanáne 'yesterday M89: 152,' bagáaxge 'chicken S43: 35' etc.

C_1 voiceless obstruent + C_2 voiceless fricative

e.g. psįįpsį́č 'awkward M79: 29, small change M93: 117,' ksáač 'stiff M93: 117,'

kšíi 'S43: weak,' pšoopšóč 'fine M93: 117,' kšée 'apple M93: 117,'

boiksáp 'I come to M93: 119,' wiağéphuu 'sunrise S43: 17, 67,' etc.

b. Word-medial Position only

C_1 voiced obstruent + C_2 sonorant

e.g. haračábra 'the taste M79: 28,' hoočą́gra 'the Winnebago M79: 27,' warujrá 'the food S43: 59,'

hirawáhazra 'the license M79: 28,' wanįgnį́k 'little bird M89: 150,'

wąągwášoše 'brave man S43: 57,' nųųğrá 'the ear S43: 64,' etc.

As for the manner of articulation, it is true that there are no clusters made up of two stops, two fricatives, two sonorants, and so on. Instead, (28a) shows clearly that possible combinations are [(voiceless) fricatives + (voiced) stops], [(voiceless) fricatives + (voiced) affricates], and [(voiceless) stops + (voiceless) fricatives]. Thus, they indeed appear to suggest the OCP effect on continuancy, licensing the clusters of either [+cont]-[-cont] or [-cont]-[+cont], provided that affricates are substantially stops having the [-cont] value.

Unfortunately, however, the prohibition on adjacent (non-)continuants (i.e. *[αcont]-[αcont]) can easily be falsified by the following three facts. First, in the case of a voiced obstruent plus a sonorant given in (28b), we can find the clusters of [+cont]-[+cont] (e.g. *zr*) and [-cont]-[-cont] (e.g. *gn*) as well as the cluster of [-cont]-[+cont] (e.g. *br, gr*). Since the [$\pm$cont] feature appears to be contrastive between glides (*r, w, y*) and nasals (*n, m*) in light of the feature system in (26), either value should be specified underlyingly. But this reasoning would not hold if the underlying distinction between sonorants were made by another available manner feature, [$\pm$nas], and the latter specification is supported by nasalization (19) mentioned in section 2.3.4 (see also section 2.5.3), which spreads the [+nas] value of onset nasals to tautosyllabic vowels. If so, we must admit that sonorants may be not specified for [±cont] and hence that the argument here is rather weak. However, as Miner (1993: 115) himself gives, other combinations than those in (28) exist, which consist of a voiceless obstruent followed by the glottal stop:

(29) C_1 voiceless obstruent + C_2 glottal stop

a. p'ąąp'ą́č 'to give to the touch' b. t'ų́ųp 'to put something long'

c. k'ée 'to dig' d. s'íi 'for a long time'

e. š'ée 'drip' f. x'ée 'drip (thin liquids)' M93: 115

Note that the glottal stop ' must be specified for [−cont] underlyingly in order to distinguish it from the glottal fricative *h*. Thus, this type of cluster is a compelling example of the [−cont]−[−cont] sequence.

Second, affricates can co-occur not only with fricatives as in (28a) but also with stops as in (30). They are thought of as another case for the [−cont]−[−cont] cluster, and should be categorized into the former type of (28a):

(30) a. C_1 voiceless stop + C_2 voiced affricate

e.g. kǰée 'revenge M93: 117,' t'eekǰą́ne 'he would die S43: 48, 65, 137,'

t'ąąpǰą́ąre 'this one that jumped down S43: 42,' gišgáipǰąne 'he will strike M93: 124,' etc.

b. C_1 voiceless affricate + C_2 voiced stop

e.g. xočgé 'gray S43: 58,' nąįwáčgis 'saw (n) M93: 119,' račgá 'to drink M89: 149, 151' etc.

One might imagine that the occurrence of the cluster in (30b) can be accounted for by assuming that affricates are contour segments with the sequence of [−cont][+cont] and that the cluster in (30b) suffers from no violation of the OCP, having the values of [−cont][+cont]−[−cont] as a whole. But such an 'edge effect' analysis is falsified by the existence of (30a), whose cluster consists of the sequence of [−cont]−[−cont][+cont]. Moreover, (31) (i.e. examples to be classified into (28b)) shows that this analysis with the edge effect becomes more complicated because either [−cont] or [+cont] can follow the right edge of the voiced affricate (if we assume that in accordance with (26), nasals and glides are specified for [−cont] and [+cont], respectively):

(31) a. C_1 voiced affricate + C_2 sonorant

e.g. peeǰnį́ 'whiskey M89: 150,' peeǰwáč 'locomotive cf. M89: 150, M93: 123,' etc.

b. ǰn: [−cont][+cont]−[−cont] ǰw: [−cont][+cont]−[+cont]

Therefore, it is natural that affricates are treated as stops with only the [−cont] value specified, and there is no co-occurrence restriction on the cluster including an affricate.

Third, the following examples also seem to constitute evidence against the OCP effect in question, provided that affricates are treated as stops:

(32) C_1 voiceless stop + C_2 voiceless stop

e.g. hąąpčék 'Monday M93: 123,' háačtée 'I go to eat cf. M93: 123,'

čuugiásąnąpke 'kingbird M81: 342,' teeǰą́nağopke 'pelican M81: 342,' etc.

Since these clusters contain the featural sequence of [−cont]−[−cont], the OCP effect turns out to be falsified again. Incidentally, the consonant combinations observed in (32) are rather controversial in the sense that their second elements are <u>voiceless</u> unlike (28a) and hence that they have no place to fit in the co-occurrence generalization in (28). The first word in (32) is a compound (< *hą́ąp* 'day S43: 66, M93: 123' + *čéek* 'new S43: 25, 33, 35, M93: 123') on the uni-domain (i.e. lexical) level, which undergoes non-initial stem shortening and is very likely to undergo final voicing (cf. note 3 and section 2.6.1). But I will ignore this exceptional case in the following discussion, because I cannot find any other examples with the consonant cluster *pč* (and forbidden clusters usually becomes the input to consonant reduction or elision on the lexical level, as in *šųųkéte* 'horse S43: 42, 68,' derived from *šų́ųk* 'dog S43: 42, 68, 123' and *xeté* 'big S43: 22, 35, 42, 59, 68'). A promising interpretation is that the form is *haabcek*, which undergoes final voicing. The second word in (32) is a postlexical compound whose members have distinct phonological domains (< *háač* 'I eat M93: 123' + *tée* 'I go S43: 79, M89: 150, M93: 123'), as discussed in (3) in section 2.1. If this were a lexical compound within a single phonological domain, the cluster would be elided as in *haną́ąte'e* 'all this S43: 66' (< *haną́ąč* 'all S43: 67' + *te'é* 'this S43: 47, 66'), as Susman (1943: 66) remarks "[f]inal *č* elides before *t* as well as *č* and *ǰ*." So I can also exclude this example from our discussion.[27] Turning to the latter two words in (32), I cannot find any other examples of the sequence of *pk*, or for that matter, any other examples of the sequences of two voiceless stops (**kp, *pt, *tp, *tk, *kt*, etc.). Rather, the sequence of *pg* is often found as in the following way:

(33) C_1 voiceless stop + C_2 voiced stop

e.g. hąąpgú 'dawn S43: 56,' t'ąąpgúu 'to jump down S43: 56,122,'

boošípge 'because he shot it down S43: 64,' xaapgénįk 'rapidly S43: 67,' etc.

Thus, it is quite natural that the second element of *pk* be interpreted as a voiced stop like (33) (i.e. *čuugiásąnąpge* and *teeǰą́nağopge*), so that (33) is categorized into (28a).

All of the arguments presented so far allow us to conclude that there is no OCP effect like *[α cont]−[α cont] and that affricates have the same behavior as stops and can occur wherever stops are licensed. To sum up, our considerations forces (28) to be revised as in the following way:

(34) Consonant Clusters: C_1C_2 (Revised)

a. Tautosyllabic Clusters: Word-initial or Word-medial Position

C_1 voiceless obstruent + C_2 voiced stop: sg, šg, xg, sǰ, xǰ, kǰ, pǰ, čg, pg, etc.

+ C_2 voiceless fricative: ps, pš, ks, kš, ph, etc.

+ C_2 glottal stop: p', t', k', s', š', x', etc.

b. Heterosyllabic Clusters: Word-medial Position only

C_1 voiced obstruent + C_2 sonorant: br, gr, ǧr, zr, gn, ǰn, ǰw, etc.

In other words, (34) is a complete and exhaustive list of clusters licensed on the lexical level. One of the important points here is that the clusters in (34a) appear in either word-initial or word-medial position while the ones in (34b) only word-initially: the clusters which appear word-initially can also occur word-medially, but not vice versa. In section 3.1.3.1, I will attribute this asymmetry to the syllabification principle I propose therein, which captures (34a) as tautosyllabic onset clusters and (34b) as heterosyllabic clusters with the voiced obstruents syllabified into the preceding coda position (see also section 2.6.1, as a first approximation). It might also appear that the former clusters occur either in derived environments or underlyingly while the latter clusters usually emerge in suffixation and compounding. But the cluster in (34b) is also found underlyingly, as in the demonstrative marker *-n̦agre* 'S43: 52'.

Recall that the question posed at the beginning of this section is whether glide fortition is a mere morpho-phonemic rule or a repair strategy to resolve a violation of the OCP effect on continuancy. All of the above arguments naturally lead us to conclude that glide fortition is the former type of idiosyncratic rule.

As for other co-occurrence restrictions than the one on continuancy, it can be said that there is no OCP effect of *[αplace]–[αplace], because the adjacent location of consonants with the same place of articulation is licensed as in *xg* (*xgąąsák* 'energetic M93: 117'), *šǰ* (*šǰáak* 'warm M93: 117'), *zr* (*hirawáhazra* 'the license M79: 28'), and so on. This is also true for the restriction on voicing: there seems to be no constraint of *[αvoi]–[αvoi] because of the presence of [a voiceless obstruent + a voiceless fricative] such as *ps, pš, ks, kš*, etc. As is clear from (26), obstruents (except for *t, h, '*) are contrastive with respect to voicing and hence specified for either [+voi] or [–voi]; thus, all these clusters contain the sequence of [–voi]–[–voi], a violation of the above constraint, although clusters with the glottal stop (*p', t', k', s', š', x'*) or with sonorants (*br, gr, zr, gn, ǰn, ǰw*) would not count as violations of the OCP since neither the glottal stop nor sonorants are contrastive with respect to voicing (hence, they have no [±voi] values on the relevant level).

Finally, aside from the topic of the OCP effect on voicing, place, and continuancy, there is a rather anomalous cluster I have not mentioned thus far but cannot be dismissed, since its behavior cannot be accounted for by the generalization in (34); namely, the cluster of *st* in *stoohí* 'gather M93: 117' and *haastį́* (syllabified as *haa . stį́*) 'strawberry S43: 65,' as compared to **sp* and **sk*. Its anomaly lies in the fact that as seen in (34a), a voiceless obstruent can be followed only by a voiced stop (or a voiceless fricative). Furthermore, this cluster cannot be reinterpreted in a way like (33) whatsoever, because of the absence of *d* as a phoneme. Concerning this problem, I think at present that there may be several distributional conditions on consonant clusters and that two of these are something like the ones in (35), which predict the occurrence of the clusters in (34a): [28, 29]

(35) Cluster Filters (Cyclic)

a. * σ[C   C
       | |
[−voi, −son] [−voi, −son, −con]

b. * σ[C   C
       | |
[−voi, −son] [+voi, −son, +con]

(35a) prohibits the clusters of a voiceless obstruent followed by a stop with the underlying [−voi] value, while (35b) bans the clusters of a voiceless obstruent followed by a fricative with the underlying [+voi] value. If so, the apparent anomaly of the *st* cluster can be attributed to the fact that the alveolar stop *t* is the only oral stop without contrastive voicing (i.e. with no underlying specification for [−voi]) and thus is licensed in this position. Note also that **sp* and **sk* are excluded by (35a) because of the underlying specification of *p* and *k* for [−voi], whereas *p', t', k', s', š'*, and x' are not filtered out by (35a) because of no specification of the glottal stop for either [−voi] or [+voi]. Particularly, it is a noticeable fact that the consonant *t* can also appear as a cluster with the glottal stop, as in (36). This cluster is also not excluded by the conditions in (35):

(36) a. t'ée 'to die M79: 28, M89: 151'

b. t'ų́ųp 'to put something long M93: 115'

This fact means that the first member of a cluster in (34a) is licensed as long as it has no [+voi] specification.

The distributional facts I have discussed so far can be seen as other pieces of evidence favoring Contrastive Underspecification over Radical Underspecification. For more anomaly of the behavior of *t* and another condition on syllable structure, see section 2.6.1.

2.5.3. The Inventory of Vowels and Two Related Rules

Now let us discuss the inventory of vowels in Winnebago, which can be characterized more simply than that of consonants. The following is a feature-based phonological classification, which relies on, but somewhat different from, Miner's (1993: 119) assumption:

(37) Vocalic Inventory & Feature Bundles (Phonological Classification)

Depth Features / Height Features	[-back]	[+back]
[+high] [-low]	i / į	u / ų
[-high] [-low]	e	o
[-high] [+low]	a / ą	

(Each slash mark / indicates the nasal contrast, i.e. [±nas])

Here, [±back] and [±high] are contrastive in the case of high and mid vowels; so is [±low] in the case of mid and low front vowels; and so is [±nas] in the case of high and low vowels. As for the final point, the contrastiveness of [±nas] is illustrated in the examples in (38):

(38) a. síi 'foot M89: 149' vs. sį́į 'liver M89: 149'

b. gisú 'to husk M89: 149' vs. gisų́ 'upset M89: 149'

c. háak 'rear part M89: 149' vs. hą́ąk 'woodchuck M89: 149'

d. psíč 'to spray S43: 70' vs. psį́č 'to sway S43: 70'

e. híi 'to do S43: 56' vs. hį́į 'to suck S43: 34'

Thus, as pointed out in section 2.3.4, nasalization which nasalizes vowels with nasal consonants in onset position (as in /maa/ → *mąą* 'earth M79: 28, M89: 149' and /nii/ → *nįį* 'water M89: 149, 150') is a feature-changing rule within the framework of Contrastive Underspecification, because it replaces the underlying [−nas] with [+nas].

Interestingly, this rule sometimes interacts with Dorsey's Law, as in (39), where the inserted vowels become nasal though the initial consonants are non-nasal:

(39) a. /knak/ → ka̧ná̧k 'to marry M89: 149, M93: 124'

b. /sni/ → si̧ní̧ 'cold M79: 29, M89: 149'

c. /boopnus/ → boopú̧nu̧s 'to hit at random M89: 149'

Miner (1989: 149) assumes that the nasalized vowels themselves are copied by Dorsey's Law (hence, nasalization is ordered before Dorsey's Law); I claim, however, that because Dorsey's Law belongs to the cyclic level and nasalization to the non-cyclic level (see sections 2.3.4 and 2.6.5), nasalization naturally applies after Dorsey's Law. For more details about the mechanism of this ordering and several arguments for it, see sections 2.6.5 and 3.1.5.

Note in (37) that contrary to Miner's (1993: 119) or the standard assumption on vowels, the low vowels *a/a̧* are classified phonologically as having the [−back] value. This is because the redundant rule of [+back] → [+round] is sufficient for characterizing the roundedness of Winnebago vowels (and hence the values of [±round] are non-contrastive and remain unspecified lexically). The second reason is related to a rule called *e/a* ablaut by Miner (1989: 150), which changes the root-final *e* into *a* before certain suffixes, as in the following way:[30]

(40) *e/a* Ablaut (Structure-Changing)

a. waré 'to work' / wara-ré 'work ! M89: 150'

b. ma̧a̧čé 'to cut a piece off' / ma̧a̧čá-ire 'they cut a piece off M79: 29, M89: 150'

c. tée 'I go' / taa-ná̧ 'I could go M89: 150'

d. hit'et'é 'to speak, talk' / hit'at'á-ak 'he (lying) talked S43: 10, 11, 47'

This rule can be simply formulated by changing the underlyingly-specified [–low] value of *e* into [+low], provided that *a* is a front vowel just like *e*, which seems to be a phonologically natural assumption. This analysis, moreover, implies that *e/a* ablaut is a structure (feature)-changing rule replacing the underlying [–low] value with [+low]; and its application to derived environments only allows us to assume that it applies on the cyclic level because of the obedience to Structure Preservation and, especially, the Strict Cycle Constraint. The cyclic nature of this rule is supported by the existence of lexical exceptions to this rule (cf. (6i)), like *hit'et'é* 'to speak, he speaks S43: 9, 10, 47, M89: 149' / *hit'et'é–ire* (* *hit'at'á–ire*) 'they speak M79: 29' / *hit'et'é–eną* (* *hit'at'a–ena*)' he spoke WE82: 316,' where *–ire* is an ablaut-triggering suffix as seen in (40b) and *–Vną* is a declarative or past-forming suffix as discussed in section 2.1. In some cases, a variation is also observed as in *hit'at'á–ǰire* / *hit'et'é–ǰire* 'he started to talk S43: 74.'

Forms like *hit'at'á–ak* and *hit'at'á–ǰire* show that *e/a* ablaut applies before reduplication (i.e. *hit'é* 'to speak M79: 28' > *hit'et'é* 'to talk'), namely that the final syllable is copied after it undergoes the ablaut rule (section 2.6.2). That is why the penultimate syllable of the root turns into *a* as well as the ultimate syllable. Similar cases with consecutive *a* vowels are also observed when it interacts with Dorsey's Law, just like nasalization in (39). Consider the examples below:

(41) a. keré 'to leave returning' / kará–ire 'they leave returning M79: 29, M89: 150'

b. mąąpére 'to slice thin' / mąąpára–ną 'he could slice thin M89: 150'

c. gisewé 'to calm down' / gisawá–nąk 'to calm down sitting M89: 150'

d. šerée 'you go' / šara–ną́ 'you could go cf. M89: 151'

Unlike nasalization, I follow Miner (1989: 150) in assuming that the ablaut vowels themselves are copied by Dorsey's Law (hence, *e/a* ablaut is ordered before Dorsey's Law). In section 2.6.2, I will elucidate the exact ordering of *e/a* ablaut on the cyclic level by invoking its interaction with reduplication, as suggested above.

2.5.4. Long Vowels, Diphthongs, and the General Sonority Hierarchy

In addition to a single oral or nasal vowel, i.e. the monophthongs in (37), Winnebago has several types of vowel combinations: what we call 'falling' and 'rising' diphthongs as well as long vowels.[31] The naming of 'falling' and 'rising' comes from the sonority contour of diphthongs, and the sonority has much to do with the pitch contour of vowel sequences in this language. In particular, according to Susman (1943: 27), Miner (1979: 28), and Hayes (1995: 348), when a syllable with any of the following vowel combinations bear accent, the accented mora is uniquely determined by their relation in sonority strength (each empty intersection denotes a systematic gap of such a vowel sequence):

(42) Vowel Sequence V_1V_2 and Syllable Nucleus

V_1 \ V_2	i	e	u	o	a
a	ái		(falling)		áa
o	ói	óe		óo	oá
u	úi	úe	úu	uó	uá
e	éi	ée		eó	eá
i	íi	ié	(rising)	ió	iá

Nasal vowels can also be combined and accented in exactly the same way as oral ones: į, ų, and ą can in principle occur where their oral counterparts are found in the chart. When consecutive vowels are among the three, both are usually nasalized (ąį, oį, ųį, eį, įį, but *ąi, *ųi, *įi). Some rising diphthongs may involve nasally-splitting cases like *wąągią́* 'a man S43: 67, 79,' but I will ignore the distinction in nasality here and below, because it is irrelevant to accent position. Examples are given in (43), although they do not illustrate all the vowel combinations in (42):

(43) a. Long Vowels:

ną́ąp 'hand S43: 71'	šóo 'to spit S43: 71'
rúus 'to take S43: 71'	x'ée 'to drip S43: 33, 71, M93: 115'
gį́įx 'around S43: 71'	

b. Falling Diphthong

húič	'butt end, foot of tree S43: 36, 71'	'úič	'lower end S43: 36, 71'
hiǰáira	'more, bigger S43: 63'	čaaháižą	'a deerskin S43: 29, 78'
hagoréižą	'sometimes S43: 63, 67'	čaahéižą	'a deer horn S43: 78'
mąąčóiǧop	'to have grizzly bear power S43: 79'		

c. Rising Diphthong

kiás	'to flee in fear S43: 36'	wašiák	'he was dancing S43: 47, 76'
wąągią́	'a man S43: 67, 79'	raabią́	'a beaver S43: 67'
wa'ų́ąkše	'he (moving) did it S43: 72'	hiruákų	'I used it S43: 74'
hąąhiókahi	'every night S43: 62'	hit'eókirač	'to speak different languages S43: 67'

Two points can be made with respect to the generalization in (42). First, considering syllable structure into account, we can safely assume that the accented mora constitutes the nucleus of each syllable, because it is the sonority peak as well. Second, within each vowel sequence, the accented mora can be regarded as having more sonority than the accentless mora; if so, accent location is determined according to the following sonority hierarchy (Hayes (1995: 348)):

(44) The Sonority Hierarchy of Vowels

a > o > u > e > i

As is known from the columns and rows of *a* and *i*, the two are constantly strong and weak, respectively, with respect to other vowels; and the relation of *o* > *u* > *e* is clear from *uó, úe,* and *óe*. I will basically adopt Hayes's hypothesis on the sonority hierarchy in (44), and propose to extend it into the General Sonority Hierarchy in (45), which incorporates consonants as well as vowels:

(45) The General Sonority Hierarchy in Winnebago

vowel (a > o > u > e > i >) > sonorant > voiced fricative > voiced stop > voiceless obstruent Tanaka (1997a: 17, 1998: 336)

As will be known in later sections, the internal hierarchy of vowels is very crucial for characterizing the status of Winnebago in accentual typology (section 3.2.3.1) and the hierarchy among consonant types for elucidating the syllable structure of Winnebago (section 3.1.3.1).

2.6. Other Rules and Constraints

2.6.1. Final-Consonant Extrametricality, Cancellation of Extrametricality, Stray Neutralization, and Stray Adjunction

In Winnebago, we can observe those consonant clusters whose first element is a voiced obstruent, such as the ones in (34b). Because words with these clusters are constantly derived ones (compounds or suffixal forms), Miner (1979: 27, 1981: 342, 1989: 150, 1993: 112) assumes a voicing rule which voices the root-final obstruents when followed by other roots or suffixes with initial sonorants. Susman (1943: 40) also remarks that "a final surd becomes sonant before initial *r* of a suffix or another word," but other sonorants than *r* may cause final voicing as in (46):

(46) a. hoočą́k 'Winnebago' / hoočą́g-ra 'the Winnebago M79: 27'

b. haračáp 'taste' / haračáb-ra 'the taste M79: 28'

c. hirawáhas 'license' / hirawáhaz-ra 'the license M79: 28'

d. warúč 'food' / waruǰ-rá 'the food S43: 59'

e. wiǰúk 'cat' / wiǰug-nį́k 'little cat' / wiǰug-wą́ąk 'male cat S43: 57'

f. wą́ąk 'man' / wąąg-ną́ka 'that man (sitting) M79: 27, M81: 342'

g. péeč 'fire' / peeǰ-wác' 'locomotive' / peeǰ-nį́ 'whiskey M89: 150'

The application of final voicing prevents the forms in (46) from undergoing Dorsey's Law correctly, since the latter rule applies only to the sequence of a voiceless obstruent followed by a sonorant. Instead, they will be the inputs to the postlexical application of intrusive schwa, as discussed in (8). If this analysis held true, final voicing would be a cyclic structure (feature)-changing rule ordered before Dorsey's Law, and its cyclic application might appear to be evidenced by the following examples (Susman (1943: 68) and (Miner (1989: 152) give *wanįgį́k* for 'little bird' as well as *wanįgnį́k*, but I adopt the non-elided form here):

(47) a. wanį́k 'bird' / wanįg-nį́k 'little bird' / wanįg-nį́g-ra 'the little bird M89: 150'

b. 1st Cycle: wanįk → n/a

2nd Cycle: wanįk-nįk → wanįg-nįk

3rd Cycle: wanįg-nįk-ra → wanįg-nįg-ra

Its cyclicity might also be supported by the obedience to the Strict Cycle Constraint, since this structure (feature)-changing rule would generally apply to derived environments.

This analysis crucially presupposes that the root-final obstruents in (46) and (47) are voiceless in the underlying representations. I claim, however, that there is no such rule as final voicing for the following reasons. First, there are often cases where foot-final obstruents are voiced even when they are followed by *h*, a voiceless fricative, although the following *h* is lost by elision, as seen in (48a):

(48) a. 'aabú 'blossom S43: 67, 125' (< 'áap 'leaf S43: 67, 125' + hú́u 'to come S43: 67, 125')

čeebí́ 'to consume S43: 56, 67' (< čée̞p 'finished S43: 56' + hí́i 'to do S43: 56')

waazí̜ 'to suckle S43: 34' (< wáas 'breast S43: 34' + hí̜i̜ 'to suck S43: 34')

wa̜a̜gáni̜ 'to be a man S43: 57' (< wá̜a̜k 'man S43: 56, M79: 27, HWE80: 130, M81: 342' + haní̜ 'to have S43: 57, 67')

wa̜a̜giá̜ 'a man S43: 67, 79' (< wá̜a̜k 'man S43: 56, M79: 27, HWE80: 130, M81: 342' + hi(ž)á̜ 'one S43: 29, 50, 67, 76, 78, 79, M79: 28')

raabiá̜ 'a beaver S43: 67' (< ráap 'beaver S43: 67, HWE80: 130' + hi(ž)á̜ 'one S43: 29, 50, 67, 76, 78, 79, M79: 28')

šu̜u̜gínu̜k 'female dog S43: 123' (< sú̜u̜k 'dog S43: 42, 68, 123' + hinú̜k 'woman S43: 42, 123')

ha̜a̜bókahi 'every day S43: 125' (< ha̜a̜p 'day S43: 66, M93: 123' + hokahí́ 'every S43: 125')

b. wiağéphuu 'sunrise S43: 17, 67' ma̜i̜táwushira 'May Miner 81: 342'

It is true that Miner (1993: 114) and Alderete (1995: 33) classify *h* as a glide (i.e. a sonorant), but this assumption cannot be adopted on the grounds that unlike other glides, it neither participates in glide fortition (27) (i.e. *hh* → **h'* cf. *hw* → *hp* and *hr* → *ht*) nor in Dorsey's Law (i.e. OhV → *OV̲hV), as discussed in section 2.5.1. Rather, it is crucial that it causes Dorsey's Law when followed by a sonorant, as seen in *howé* 'swollen S43: 22,' *heré* 'to be, he is S43: 10, 22,' *horók* 'to join S43: 106,' *hinįk* 'I am small S43: 64, 121,' and *harapé* 'you waited for him S43: 10': *h* is nothing but a voiceless fricative. If it is not a glide, there is no reason that it causes voicing. The second argument against final voicing is that contrary to (48a), there are other words like (48b), which undergo neither final voicing nor elision. Again, if *h* were a glide, the non-application of final voicing would not be accounted for, and as a consequence, its non-application would erroneously cause Dorsey's Law, as in **wiağépuhuu* and **mąįtáwusįhira*. Instead, *ph* (i.e. a voiceless obstruent followed by a voiceless fricative) is a usual onset cluster and licensed without any problem, as discussed in section 2.5.2.

In short, an approach with final voicing falls into a serious dilemma. But I am claiming that root-final clusters as in the former examples above, (46), and (47) are all underlyingly <u>voiced</u> and that only voiced obstruents are licensed in coda position on the lexical level. For example, the compound of /'aab/ + /huu/ simply undergoes non-initial stem shortening and elision (clusters other than (34) are elided by convention).

A question then may well occur to us as to why the forms in (46) and (47) have voiceless obstruents on the first cycle (i.e. at the unsuffixed stage). This question as well as all the other derivations in (46) and (47) involve the following four rules, one on the cyclic level and the other three on the postlexical level:

(49) a. Final-Consonant Extrametricality (Cyclic, Structure-Building)
b. Cancellation of Extrametricality (Postlexical, Structure-Changing)
c. Stray Neutralization (Postlexical, Structure-Changing)
d. Stray Adjunction (Postlexical, Structure-Building)

Rules (49a–d) have independent motivations: (49a) is indispensable for reduplication (section 2.6.2), (49b) for default L–tone insertion (section 2.6.6), and (49c) for certain types of devoicing phenomena (see below). (49d) can also be motivated on the grounds that any language with extrametricality seems to have something like the one in (49d) to account for syllabification after the cancellation of extrametricality (Hayes (1981, 1982), Halle and Vergnaud (1987)). The derivation of the words in (47) then proceeds as in the following way:

(50) a. 1st Cycle:

/wanįg/ $\xrightarrow{\text{(49a)}}$ wanį<g> $\xrightarrow{\text{(49b)}}$ wanį g $\xrightarrow{\text{(49c)}}$ wanį k $\xrightarrow{\text{(49d)}}$ wanįk

b. 2nd Cycle:

/wanįg–nįg/ $\xrightarrow{\text{(49a)}}$ wanįgnį<g> $\xrightarrow{\text{(49b)}}$ wanįgnį g $\xrightarrow{\text{(49c)}}$ wanįgnį k $\xrightarrow{\text{(49d)}}$ wanįgnįk

c. 3rd Cycle:

/wanįg–nįg–ra/ $\xrightarrow{\text{(49a–d)}}$ n/a → wanįgnįgra

(49a) makes the word–final consonant invisible to, and thus immune from, the syllabification rule; when extrametricality is canceled by (49b) on the postlexical level, the final consonant is still unsyllabified, or stray; (49c) neutralizes the values of [+voi] and [–voi] of such a stray segment, in effect changing them into [–voi] uniformly (note also that in Winnebago, there are no voiced codas in word–final position); and finally, stray segments are resyllabified into the preceding coda position by (49d). Although on the lexical level only voiced obstruents are licensed in coda position, this is not the case on the postlexical level.

Some comments are necessary on derivations like the one in (50). First, (49a) can apply to the word-final consonant and not to the morpheme-final consonant in a manner like (51):

(51) a. 2nd Cycle: /wanįg/ + /nįg/ → *wanį<g>–nį<g>

b. 3rd Cycle: /wanįg/ + /nįg/ + /ra/ → *wanį<g>–nį<g>–ra

That is, the extrametricality on the previous cycle(s) is not carried over on the present cycle even though (49a) is a cyclic rule. This is due to one of the well-known conditions on extrametricality, which has been advocated consistently in the metrical framework (cf. Hayes (1981, 1982, 1995), Tanaka (1990, 1991)):[32]

(52) Extrametricality Condition (Cyclic)

An element may be extrametrical only if it it a peripheral constituent of the phonological string.

Peripherality is a key word here. Second, recall that intrusive schwa can apply to the sequence of a voiced obstruent plus a sonorant, as seen in (8). This rule is postlexical like (49b–d), but belongs to the different block of optional rules from the block of obligatory ones in (49b–d). The block of optional rules is ordered before the block of obligatory ones, as in (53):

(53) a. Cyclic Level

Final-Consonant Extrametricality ⬅ Extrametricality Condition

b. Postlexical Level (Optional)

Intrusive Schwa ⬅ Coda Condition

c. Postlexical Level (Obligatory)

Cancellation of Extrametricality

Stray Neutralization

Stray Adjunction

As shown in (53b), I assume the Coda Condition on the optional postlexical level, which bans any consonant in coda position (although on the lexical level voiced obstruents are licensed in that position). That is why intrusive schwa applies optionally on that level before the application of (49b–d), as in (54):

(54) /wanįg/ + /nįg/ + /ra/ → wanįg^{ə}nį́g^{ə}ra (or wanįg^{i}nį́g^{a}ra)

Thus, intrusive schwa is a repair strategy to resolve a violation of the Coda Condition, when there is any sequence of a voiced obstruent followed by a sonorant.[33]

Contrary to a series of Miner's works, my analysis discussed so far relies solely on the assumption that the coda positions of such words as in (46) and (47) are occupied by underlyingly-voiced obstruents. I can present several arguments in favor of this assumption, and at the same time, they are thought of as advantages of my analysis over Miner's. First, although word-final codas are usually written as voiceless and hence I assume stray neutralization on the postlexical level (e.g. *rušíp* 'to pull down S43: 45, M89: 151, M93: 113' *péeč* 'fire S43: 25, M79: 31, M89: 150,' *čéek* 'new S43: 25, 33, 35, M93: 123,' *parás* 'flat S43: 71, M79: 27, 29, 30,' *šorόš* 'deep M89: 153, M93: 112,' *hiwą́x* 'to ask M89: 152,' and so on), they are the position where the voicing contrast of obstruents consistently disappears, as compared to word-initial onsets with contrastive voicing (e.g. *čáa* 'deer S43: 29, M93: 117' vs. *ǰáa* 'frozen M93: 117' and *síi* 'leg M89: 149, M93: 117, 119' vs. *zíi* 'yellow, brown M89: 152, M93: 117, 119, 120'). Therefore, not only word-medial but also word-final codas might be written as voiced, just as the non-contrastive *t* is sometimes written as *d*. This is also sustained by the phonetic fact that both obstruents in coda position and *t* in any position lack aspiration unlike other ordinary voiceless obstruents. In fact, this situation may have bothered Hale and White Eagle (1980: 118) to give a stipulative provision in their study that "[w]e write final stops as /p, ch, k/, rather than /b, j, g/." All of these opaque properties of coda positions are accounted for by the assumption that codas are voiced obstruents lexically but are devoiced (neutralized) postlexically. Second, my analysis can give a principled account of the asymmetry in (34): the clusters with an initial voiceless obstruent in (34a) appear in either word-initial or word-medial position while the ones with an initial voiced obstruent in (34b) appear in word-medial position only. This is because the former clusters as a whole constitute the syllable onset while the latter clusters consist of the syllable coda and the syllable onset. It is quite natural that the syllable coda never appears word-initially (see also section 3.1.3.2.1 for a detailed account of the asymmetry). Third, the hypothesis on voiced obstruents in coda position suggests that in word-medial position there may well be a triconsonantal cluster with a voiced obstruent in the syllable coda and a biconsonantal cluster in (34a) in the following syllable onset. Such triconsonantal clusters can in fact be found in the following words with suffixation:

(55) a. gúuč 'to shoot' / s'a 'repeatedly' / guuǰs'á 'to shoot repeatedly'

b. gišíp 'to fall' / šgu̯ni̯ 'must (dubitative)' / gišibšgú̯ni̯ 'he must have fallen'

c. ka̯nák 'to marry' / sge 'may (uncertain)' / ka̯na̯gsgé 'he may have married'

cf. M93: 124

Just like (54), each word-medial coda of the suffixed forms violates the Coda Condition and becomes stray on the optional postlexical level, undergoing stray neutralization (49c) and stray adjunction (49d) on the obligatory postlexical level and surfacing as *guučs'á*, *gišipšgú̯ni̯*, and *ka̯na̯ksgé*. Note here that the violations of the Coda Condition are not repaired by intrusive schwa because each coda position is not followed by a sonorant like (54). In sum, the licensing of such triconsonantal clusters as in (55) can only be given a natural account if the present hypothesis is adopted (see also section 3.1.3.2.2). Finally, my analysis also accounts for the distributional fact about coda consonants: unlike voiced obstruents, sonorants as well as *t*, ', and *h* never occur in coda position (i.e. *CVn, *CVm, *CVw, *CVr, *CVy, *CVt, *CV', *CVh). In other words, coda consonants are licensed only if they have contrastive voicing. Formally, this can be expressed by the syllable structure condition saying that syllable-final consonants must have the underlying [+voi] value.

Together with the two cluster conditions given in (35) (section 2.5.2), the conditions on syllable structure which have been discussed so far are summarized as in the following way (the mark □ indicates a positive requirement saying that such and such a form must be as in the representational format):

(56) Coda Requirement (Cyclic)

```
□  C]σ
   |
 [+voi]
```

(57) Cluster Filters (Cyclic)

```
a. *  σ[C                C                 b. *  σ[C                C
        |                |                         |                |
   [-voi, -son] [-voi, -son, -con]            [-voi, -son] [+voi, -son, +con]
```

These three conditions appear to be operative on the lexical cyclic level when the syllabification rule applies. They not only capture the descriptive generalization on Winnebago syllable structure in (34) but also account for the anomalous behavior of the alveolar stop *t* in the Theory of Contrastive Underspecification. Specifically, as a member of the C_1C_2 cluster, it can appear 1) in the C_2 position after a voiceless obstruent (e.g. *stoohí́* 'gather

M93: 117' and *haastį́* 'strawberry S43: 65') like the glottal stop and unlike other voiceless obstruents and 2) in the C_1 position before the glottal stop (e.g. *t'ée* 'to die M79: 28, M89: 151') like other voiceless obstruents; but it is prohibited 3) in post-vocalic coda position like sonorants and the glottal stop and the glottal fricative and unlike other obstruents. All of these are given a principled explanation by a set of conditions in (56) and (57).

In section 3.1.3, we will give more evidence for the present assumption on codas, in the context of syllable structure in general, and demonstrate that the effects of (56) and (75) are derivable from more general principles: the General Sonority Hierarchy in (45) and Clements's (1990, 1992) Dispersion Principle, both of which have independent motivations.

2.6.2. More on Reduplication

In the earlier sections, I gave reduplication phenomena as an example of a derivation process in word formation ((1b) in section 2.1) and of a cyclic rule interacting with accent assignment and Dorsey's Law ((11) in section 2.3.1). This section is devoted to scrutinizing reduplication in more detail on the basis of some other data, defining it as copying and template matching, and considering its ordering relation to other rules.

In simple cases, this process reduplicates the final light syllable of the base as in (58a), and when the final syllable is long, the suffixal reduplicant shortens as in (58b):

(58) a. gihú 'to swing M89: 149' / gihuhú 'to wag its tail M89: 149'
rač̌gą́ 'to drink M89: 149, 151' / račgąčgą́ 'to drink repeatedly M89: 149'
hit'é 'to speak M79: 28' / hit'et'é 'to speak repeatedly S43: 9, 10, 47, M89: 149'
mąąnį́ 'to walk S43: 33' / mąąnį́nį 'to walk a little S43: 33'

waazį́ 'to suckle S43: 34' / waazį́zį 'to suckle a little at a time S43: 34'

b. š'ée 'to leak S43: 71, M93: 115' / š'eeš'é 'to drip M79: 29'

x'ée 'to drip (thin liquids) S43: 33, 71, M93: 115' / x'eex'é 'to drop earnings S43: 33, 71'

If reduplication is composed of the two phonological rules of copying and template matching in the sense of the derivational framework of McCarthy and Prince (1986), then the reduplicative forms in (58) are correctly derived as in (59). In general, template matching involves the specification of its prosodic target (i.e. prosodic category as a type of template) and its association (i.e. from left to right or from right to left as a directionality of matching). I claim that in the case of Winnebago, the prosodic target is a syllable (either light or heavy) depicted as σ and the association is from right to left. Note also that template matching is subject to the Maximality Condition, since its association must be maximal (or otherwise **gihuú* and **racgagá* would be produced):

(59) a.

	copying		matching	σ (/ |)	floating erasure	σ (/ |)
/gihu/	→	gihu gihu	→	gihu gihu	→	gihu hu

b.

	copying		matching	σ (// |)	floating erasure	σ (// |)
/račgą/	→	račgą račgą	→	račgą račgą	→	račgą čgą

c.

	copying		matching	σ (// |)	shortening	σ (/ |)
/š'ee/	→	š'ee š'ee	→	š'ee š'ee	→	š'ee š'e

After copying and template matching, floating or unassociated segments in the reduplicants are erased later by convention (floating erasure). If the reduplicants have a long vowel, they undergo non-initial stem shortening, a usual cyclic process (see (18) in section 2.3.4 or section 2.6.3). Thus, non-initial stem shortening is ordered after copying and template matching.

The reduplicants in (58) are seen as suffixes, but in more complex cases, some reduplicants appear to function as infixes when the base forms end in a consonant, as shown below:[34]

(60) ǰúuk / ǰuuǰúk 'tender'   žóok / žoožók 'slippery'   pą́c / pąpą́č 'soft'

sgáap / sgaasgáp 'sticky'   psį́č / psįpsį́č 'awkward'   M79: 29

These apparent problematic forms might show that the present analysis falls into a dilemma: if the above rules applied to them, erroneous forms would be produced such as **ǰuukǰúk*, **žookžók*, **sgaapsgáp*, and so on; or if the processes in (60) were regarded as infixing, (58) and (60) would be treated separately and not be given a uniform account, which is a rather unfortunate and counter-intuitive result. However, final-consonant extrametricality (48a) gives us a breakthrough out of this situation, if it is ordered <u>before</u> reduplication (note that underlying codas are voiced here, following our previous assumption):[35]

(61) a.

/ǰuug/ →(extrametricality) ǰuu<g> →(copying) ǰuu ǰuu <g> →(matching) ǰuu ǰuu <g> (σ //|)

→(shortening) ǰuu ǰu <g> →(other rules) ǰuuǰuk

b.

/sgaab/ →(extrametricality) sgaa<b> →(copying) sgaa sgaa <b> →(matching) sgaa sgaa <b> (σ ///|)

→(shortening) sgaa sga <b> →(other rules) sgaasgap

What is crucial here is that extrametricality makes the final consonant of the base invisible to copying, so that the copied material lacks the final consonant, as in *ǰuu ǰuu <g>* and *sgaa sgaa <b>*. Note also that the copying process must leave the extrametrical element at the right edge, or otherwise the resulting representations would be **ǰuu<g> ǰuu* and **sgaa<b> sgaa*, which are violations of the Extrametricality Condition in (51) (hence, copying in such a way is blocked by this condition).

The most intricate but intriguing cases are the examples given below, where the reduplicants consist of two syllables and not of a single syllable (**čį̲wį́* and **pararás*). They might appear to make a remarkable contrast with the cases we have been discussing above and to be treated as an entirely separate type of reduplication, because each copied material comprises two syllables:

(62) a. čį̲wį́ 'sound M89: 149'/ čį̲wįčį̲́wį 'sound causing vibration M79, 26, M89: 149'

šaa̲rá 'bald S43: 33, M79: 29, M89: 149'/ ša̲rašá̲ra 'bald in spots S43: 33, M79: 29, M89: 149'

b. pa̲rás 'flat S43: 71, M79: 27, 29, 30' / pa̲rapá̲ras 'wide M79: 29'

ki̲rís / ki̲rikí̲ris 'striped, spotted S43: 33, 67'

ke̲réš / ke̲reké̲reš 'colorful M79: 26'

However, these words contain Dorsey's Law sequences and lack the underlined vowels in their underlying representations. If Dorsey's Law applies <u>after</u> copying and template matching, it is evident that my analysis is sufficient to derive such words as in (63):

(63) a.

/čwį/ →(extrametricality) n/a →(copying) čwį čwį →(matching) čwį čwį (σ //|) →(Dorsey's Law) čį̲wį čį̲wį

b.

/praz/ →(extrametricality) pra<z> →(copying) pra pra <z> →(matching) pra pra <z> (σ //|)

→(Dorsey's Law) pa̲ra pa̲ra <z> →(other rules) pa̲ra pa̲ras

Thus, copying and template matching as well as other rules I have been assuming can give a uniform account of the apparently-separate types of cases ranging from the simpler examples in (58) to the more difficult examples with infixation in (60) and with Dorsey's Law in (62).

As for the ordering relation between reduplication and *e/a* ablaut (section 2.5.3), there are suggestive examples as in *hit'é* 'to speak M79: 28' / *hit'at'áak* 'he (moving) talked S43: 10, 11, 47' / *hirat'át'ašąnąkšąną* 'you are talking HWE80: 130, H85: 428,' where ablaut-triggering morphemes are *–ak* and *–nąk*, respectively (*–ra* and *–š(a)* are second-person makers, and *–š(ą)ną* is a declarative suffix). Interestingly, these forms have ablaut vowels in their base and reduplicant and thus can be derived correctly if *e/a* ablaut applies first before reduplication:

(64)

/hit'e–ag/ →(ablaut) hit'a–ag →(extrametricality) hit'a–a<g> →(copying) hit'a hit'a–a<g>

σ
/|
→(matching) hit'a hit'a–a<g>

σ
/|
→(floating erasure) hit'a t'a–a<g> →(other rules) hit'at'aak

Note here that template matching proceeds from right to left in the base-reduplicant unit (ignoring the suffix) and that non-initial stem shortening does not apply to (64) because the stem vowel is not long underlyingly.

All the interactive processes discussed so far apply in the given order on the cyclic level: *e/a* ablaut, final-consonant extrametricality, reduplication (copying and template matching), non-initial stem shortening, Dorsey's Law, and so on. Naturally, reduplication is a cyclic structure-building process, whose cyclicity is evidenced by the non-stress-neutralness of (58), (60), and (62). It seems to be an advantage of our rule-based system that these processes with a complex interaction (especially, the three apparently-distinct types of reduplications in (58), (60), and (62)) can be treated uniformly in the framework of prosodic morphology.

2.6.3. More on Non-Initial Stem Shortening

Another lexical cyclic rule is non-initial stem shortening, which has occasionally appeared in the preceding discussion. This rule shortens the non-initial stem vowel of such compounded, reduplicated, and inflected forms as in (65):

(65) a. Compounded Forms

čée 'deer' / hée 'horn' / čeehé 'deer horn, buffalo horn S43: 41, 56'

péeč 'fire' / nį́į 'water, liquid' / peeǰnį́ 'whiskey M89: 150'

hą́ąp 'day' / čéek 'new' / hąąpčék 'Monday M93: 123'

hąąhé 'night' / wíi 'sun' / hąąhéwi 'moon S43: 58, 123'

b. Reduplicated Forms

š'ée 'to drip' / š'eeš'é 'to drip repeatedly M79: 29'

x'ée 'to drip (thin liquids)' / x'eex'é 'to drop earnings S43: 33, 71'

ǰúuk / ǰuuǰúk 'tender M79: 29' ž́ook / žoož́ok 'slippery M79: 29'

pą́ąč / pąąpą́č 'soft M79: 29' sgáap / sgaasgáp 'sticky M79: 29'

c. Inflected Forms

nį́įp 'to swim'/ranį́p 'you swim'/ranįpšą́ną 'you swim (declarative) or swam'/

nįįpšą́ną 'he swims (declarative) or swam WE82: 309, 310'

gų́ųs 'to teach' / hagų́s 'I teach' / hagųsšą́ną 'I teach (declarative) or taught' /

gųųsšą́ną 'he teaches (declarative) or taught WE82: 309, 310'

Shortening is not restricted to a word-final stem vowel; it can also apply to a word-medial vowel if it belongs to a stem as in *ranįpšą́ną* and *hagųsšą́ną*; and conversely, it does not apply to a word-initial vowel even if it comprises a stem as in *nįįpšą́ną* and *gųųsšą́ną*. In short, this rule may be formulated as applying only to non-initial stem vowels.

It is important to note that its application to *nį́įp* and *gų́ųs* as infinitives is blocked correctly by the Strict Cycle Constraint, because of their underived nature; thus, it surely is a cyclic structure-changing rule applying only to derived forms. Its non-application is also true for such bare forms as in (66a):

(66) Bimoraic Monosyllabic Word

a. Bare Forms

gúu 'to leave returning here'	t'ée 'to die'
į́į 'to live'	ų́ų 'to make'

b. Prefixed Forms

šgúu 'you leave returning here'	šǰée 'you die'	
š'į́į 'you live'	k'ų́ų 'to make one's own'	M89: 151

Interestingly, however, even the prefixed (i.e. derived) words in (66b), whose stems are certainly non-initial, do not undergo non-initial stem shortening and preserve their mora structure; and the blocking of shortening in (66b) is not predicted by the Strict Cycle Constraint. I thus assume another general principle in (67a) with the parameter value in (67b), which are at work extensively in various languages:

(67) Minimality Condition (Cyclic)

a. For a certain category C_i, $i \neq 1$, C_i contains at least *n* constituent(s) of the category below.

b. A word contains at least two moras in Winnebago.

In the prosodic hierarchy, C_i universally contains at least one constituent of the category C_{i-1} (a syllable contains at least one more, a foot one syllable, a word one foot, and so on), while some languages have particular requirements on the size of a foot or on the size of a word.[36] For example, (67b) also holds true for English, where all rime phonemes count as moras and the minimal size of a word is CVC and CVV (e.g. *luck, pen, spa, pea*) except for footless function words (e.g. *the, a*). In the same way, in Winnebago, where all vowels count as moras as stated in section 2.6.4, there is no word with the size of CV and CVC, except for bound morphemes such as *-ra* (definite marker), *-nį* (negative marker), *-ha* (first-person marker), and *-ra* (second-person marker); namely, the minimal size of a word is (C)(C)VV(C) like (66). Thus, applying non-initial stem shortening to the words in (66b) gives rise to a violation of the Minimality Condition even if they offer a derived environment.

Clearly, what I have been discussing so far presupposes that the <u>entire</u> phonological string constitutes a 'word' in the sense of (2) in section 2.1; in other words, the final stem alone cannot be a word (or a distinct phonological domain) like *[čee][hee], *[š'ee][š'ee], *[ha][nįįp], and so on, because the Minimality Condition would erroneously block the application of shortening to each final stem. Rather, the overall string must be regarded as a word like [čeehé], [š'eeš'é], and [hanį́p] regardless of compounding, reduplication, or inflection. That is why I proposed in section 2.1 that these morphological processes are all induced on the uni-domain level. Conversely, the blocking of shortening occurs in the case of multi-domain verbal compounds like *hajǎ́pį́į* 'able to see S43: 122' (< *hajǎ́* 'see S43: 47, M79: 31, 32, HWE80: 123' + *pį́į* 'to be able, good S43: 113') and *horók'ų́ų* 'to join S43: 17' (< *horók* 'to be a member of S43: 17' + *'ų́ų* 'to do S43: 17'), because they form distinct phonological domains as in [hajǎ́][pį́į] and [horók]['ų́ų]. A minimal contrast with the former example is seen in *hajǎpį́* 'good-looking S43: 122, 123' a uni-domain compound to which non-initial stem shortening does apply. A similar contrast is also seen between *pąną́pį́į* 'able to have an odor S43: 14, 123' and *pąnąpį́* 'sweat-smelling S43: 14, 123' (< *pąną́* 'to smell S43: 123' + *pį́į* 'to be able, good S43: 113').

A question to be addressed then is the ordering relation of this rule in the rule-based system: where does non-initial stem shortening find its position among other cyclic rules? In the previous section, we saw that it should be ordered after reduplication at the very least. Moreover, the forms of *ranįpšą́ną* and *hagųssą́ną* force it to be ordered <u>before</u> construction of prosodic structures, or otherwise they would have wrong accents as in **ranípšąną* and **hagússšąną*:[37]

(68) a. shortening > accent:

```
                                        (*      )
                                     <(*   .)>(*     .)
                                      σ μ  σ μ  σ μ  σ μ
   /ra-nįįp-šąną/ → ranįpšąną → ra nį  pšą  ną
```

b. accent > shortening

```
                      (*           )            (*          )
                   <(*)> (*)   (.     .)     <(*)> (*) (.     .)
                    σ μ   σ μ μ  σ μ  σ μ      σ μ  σ μ  σ μ  σ μ
   /ra-nįįp-šąną/ → ra   nįį  pšą ną    → *ra   nį  pšą ną
```

It follows then that the ordering relation is reduplication (copying and template matching), non-initial stem shortening, and construction of prosodic structures (moraification, syllabification, metrification, etc.). Concerning the ordering problem, there is an apparently-controversial but interesting example which Miner (1989: 151) gives: *šeré* 'you go'. The derivation of this form might appear to proceed as /š-ree/ → *š<u>e</u>ree* (Dorsey's Law) → *šere* (shortening) and not as /š-ree/ → *šree* (shortening, which is blocked by the Minimality Condition) → *š<u>e</u>ree* (Dorsey's Law). That is, Dorsey Law would apply first before shortening. I claim, however, that Dorsey's Law applies <u>after</u> shortening as well as prosodic structure construction. In fact, I assume that the word in question should be realized with the rise-fall tone at the end, represented as $\underset{L}{\textit{še}}\,\underset{HL}{\textit{ree}}$, where the final syllable is long. As is the case with the derived forms in (65) and (66b), whether the final syllable is long or short relies on the presence or absence of L in its tone contour: $\underset{H}{\text{CV}}$ or $\underset{HL}{\text{CVV}}$. Thus, I claim that the correct form is *seree*, which implies the ordering of shortening before Dorsey's Law. Describing a vowel length is sometimes an intricate problem; for example, Miner (1989) transcribes a vowel of the same word as either long or short, as in *poropóoro* 'spherical M89: 154' and *poropóro* 'spherical M79: 26, M89: 155,' although such a case seems to be rare with him (but in this case, the vowel must be short because it is a Dorsey's Law vowel). What I mean is that the accented vowel is often lengthened phonetically and somewhat difficult to transcribe phonologically.

2.6.4. Moraification, Syllabification, and Metrification

In section 2.6.2, we argued for the detailed mechanism of reduplication in Winnebago. Immediately after copying and template matching, any segment in the reduplicants that remains unassociated to the prosodic template σ is erased by floating erasure, as illustrated in (59a, b). Both bases and reduplicants are then provided with prosodic structures by moraification, syllabification, and metrification in that order. I assume that the prosodic template for reduplication is utilized as a morphological entity, which is distinct from the phonological one (although copying and template matching themselves are phonological processes). In other words, phonological processes as well as morphological ones naturally involve prosodic categories like mora, syllable, foot, and so on. Thus, not only bases but also reduplicants undergo prosodic structure construction (i.e. a phonological process) within the same domain, and that is why the words in (58) can be assigned accent as in *gihuhú* 'to wag its tail,' *račgąčgą́* 'to drink repeatedly,' *hit'et'é* 'to speak repeatedly', etc.

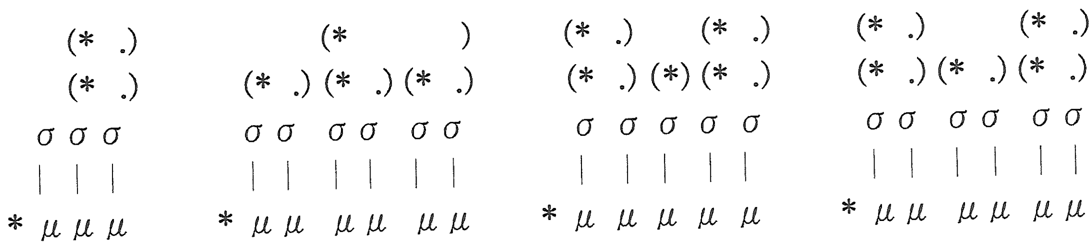
This is not restricted to reduplicated forms, of course. In general, any word must have prosodic structures such as moras, syllables, and feet, which are aligned by moraification, syllabification, and metrification, respectively, by the requirement of the following general principle (cf. Hayes (1989: 204), Tanaka (1990: 16–17, 1991: 146–147)):

(69) Strict Layer Hypothesis (Cyclic)

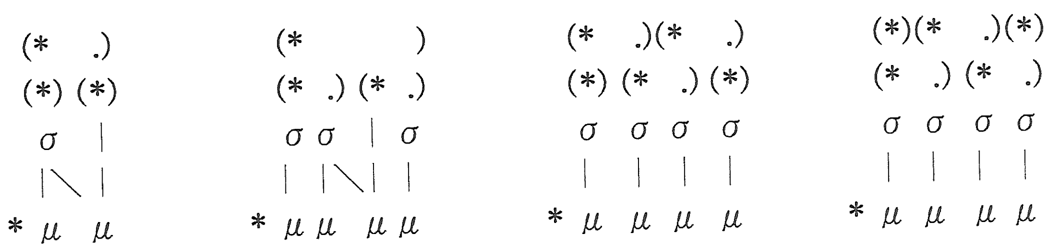
The categories of the prosodic hierarchy may be ranked in a sequence C_1, C_2, ... C_n, such that 1) all segmental material is directly dominated by the category C_1 and 2) for all categories C_i, $i \neq 1$, C_i immediately dominates all and only constituents of the category C_{i-1} without any category split.

Here, the inventory of prosodic categories contains the mora, syllable, foot, prosodic word, and so on, which are constructed from the bottom of the hierarchy. Thus, the terminal category of C_1 is the mora, and any category above the mora dominates all and only constituents of the category immediately below (e.g. the syllable, foot, and prosodic word directly dominate all and only constituents of the mora, syllable, and foot, respectively). Since lower categories must always be dominated by higher ones, any word is required to have full prosodic structures by this principle. In addition to the function as a requirement on derivation, it also serves as a well-formedness condition on representation, as Tanaka (1990: 16–17, 1991: 146–147) demonstrates. For example, the following hypothetical representations are all ill-formed, because a category does not govern all the lower constituents as in (70a) or governs not only the constituents immediately below but also the still lower constituents as in the former two examples of (70b). The latter two examples as well as the former two of (70b) show the ill-formedness due to the split dominance, which means that a constituent is dominated by more than one higher categories ambiguously:[38]

(70) a. Undominance



b. Split Dominance



Although a constituent governed by two higher categories at the same time is prohibited absolutely as in (70b), it may happen that a segment is governed by two moras; for instance, in the case of a long vowel or a geminate consonant, a segment is dominated by two moras, which causes no violation of (69). This is because a segment is not a prosodic category.

On the other hand, there may also be cases where a constituent is not incorporated into a higher category and yet is free from the requirement of the Strict Layer Hypothesis. They are exactly the cases in which a certain constituent is marked as extrametrical. Such an extrametrical constituent is limited to be the one at the left or right edge, as is required by the Extrametricality Condition (52) in section 2.6.1. Thus, the former two examples in (70a) are made well-formed if the left syllable and the left foot are extrametrical (as in (71a)), whereas the latter two in (70a) are not well-formed even if the syllable and the foot are extrametrical due to their violation of the Extrametricality Condition (as in (71b)):

```
(71) a.   (* .)          (*        )       b.  (* .)    (* .)       (* .)      (* .)
          (* .)      <(* .)>(* .) (* .)        (* .)    (* .)       (* .)<(* .)>(* .)
        <σ>σ σ        σ σ   σ σ   σ σ          σ σ<σ>σ σ            σ σ   σ σ   σ σ
         |  | |       | |   | |   | |          | |  |  | |          | |   | |   | |
         μ  μ μ       μ μ   μ μ   μ μ        * μ μ  μ  μ μ        * μ μ   μ μ   μ μ

     c.                               <(*        )>
                      <(* .)>          (* .) (* .)
          <σ>           σ σ            σ σ   σ σ
           |            | |            | |   | |
         * μ          * μ μ          * μ μ   μ μ
```

As shown in (71c), Hayes (1995) and other metrical phonologists follow Hayes (1981) in assuming a 'non-exhaustivity' condition on extrametricality, saying that "[a]n extrametricality rule is blocked if it would render the entire domain of the stress rules extrametrical" (Hayes (1995: 57)). But note here that this effect is guaranteed not by such a separate condition but is derived by the Strict Layer Hypothesis, since higher categories cannot dominate any lower constituents if extrametricality exhausts the phonological domain.

As for the concept of extrametricality, I adopt the following definition throughout the present study, which may be somewhat different from what Hayes (1981, 1982, 1995) or Halle and Vergnaud (1987) have assumed implicitly or explicitly:

(72) The Definition of Extrametricality

Extrametricality is the invisibility of a constituent to any application of rules on that tier and on the higher tiers, or to any effect of constraints in Universal Grammar, although lower constituents dominated by the extrametrical constituent are visible to all of them.

For example, final-consonant extrametricality guarantees the consonant's invisibility to copying, template matching, moraification, syllabification, and construction of any higher prosodic structures (see section 2.6.2), while initial-foot extrametricality as in the second form of (71a) guarantees the foot's invisibility to metrification, construction of higher prosodic structures, and tone association (see sections 2.6.6. and 3.2.4.2). And yet syllables, moras, and even segments dominated by the initial extrametrical foot are all visible to rules applying on those tiers (syllabification, moraification, segmental rules and so on) or to any other effects of constraints. What is made invisible is the category itself and not the overall structures dominated by the category. This definition is crucial for resolving the long-standing paradox between accent assignment and Dorsey's Law, as will be discussed in section 3.2.4.1.

Finally, although the Extrametricality Condition and the Strict Layer Hypothesis are general principles monitoring both the derivation and representation of prosodic structures, each has its own parameter settings concerning the prosodic hierarchy, because of the language-particular nature of prosodic structures:[39] one is the parameter of the target (category) and directionality (edge) of extrametricality, and the other is the parameter of the size and type of constructed prosodic structures including the mora, syllable, foot and so on. As for the former, Winnebago has the values of final consonants and initial feet, as has been stated. As for the latter, moras are assigned first on the bottom tier according with the following value:

(73) Moraification in Winnebago (Cyclic, Structure-Building)

Associate a mora μ with each vowel.

In other words, all vowels count as moras in Winnebago. From the viewpoint of syllable weight, CV and CVC are considered as light, and CVV and CVVC as heavy in this language. Given other values (syllabification and metrification in sections 3.1.3.1 and 3.2.4.1), construction of prosodic structures proceeds as in the following way, where *-ire* is a cyclic morpheme marking the third-person plural forms:

(74) a. 1st Cycle: hit'et'é 'to speak S43: 9, 10, 47, M89: 149'

```
                                                                      (*)
                                                                <(*   .)>(*)
                                                 σ   σ   σ        σ   σ    σ
                                                 |   |   |        |   |    |
                               μ  μ  μ           μ   μ   μ        μ   μ    μ
                     mora      |  |  |  syllable /|  /|  /| other rules /| /|  /|
       /hit'et'e/     →        hit'et'e    →     hi t'e t'e   →      hi t'e  t'e
```

b. 2nd Cycle: hit'et'é-ire 'they speak M79: 29'

```
                                                                         (*  .)
                                                                   <(*   .)>(*  .)
                                              σ   σ   σ    σ         σ   σ   σ   σ
                                              |   |   |\   |         |   |   |\  |
                           μ  μ  μμμ          μ   μ   μ μ  μ         μ   μ   μμ  μ
                   mora    |  |  || |  syllable /| /| /| |/| other rules /| /| /|  |/|
    /hit'et'e/+/ire/  →  hit'et'eire   →   hi t'e t'e i re     →     hi t'e t'e i re
```

Note here that after the suffixation of *-ire*, the third syllable *t'ei* counts as a single heavy syllable and not two light syllables, and the same holds true for such alternations as *mąąčé* 'to cut a piece off' / *mąąčáire* 'they cut a piece off M79: 29, M89: 150' and *keré* 'to leave returning'/ *karáire* 'they leave returning M79: 29, M89: 150'.[40] There is no doubt then that moraification, syllabification, metrification, and construction of even higher categories are all cyclic rules.

2.6.5. Non-Cyclic, Structure-Changing Rules

This section is devoted to introducing a set of structure-changing rules which account for the morpho-phonemics of certain verbal paradigms and to demonstrating that all of these are structure-changing and belong to the non-cyclic level on which some general constraints on the previous level are not effective.

First, let us consider the morpho-phonemic changes observed in the first-person singular forms of the following verbal paradigms, where the vowels with a single underline are inserted by Dorsey's Law (*-ha-* and *-h-* are first-person markers; *-ra-* and *-š-* are second-person markers; and ϕ is a third-person marker):

(75) a. 1st: haakítǰik 'I pull taut HWE80: 118, 120, 126' (< /ha-ha-ki-h-ruǰik/)

2nd: harakíšuruǰik 'you pull taut HWE80: 126' (< /ha-ra-ki-š-ruǰik/)

3rd: hakirúǰik 'he pulls taut HWE80:126' (< /ha-ϕ-ki-ϕ-ruǰik/)

b. 1st: boáta 'I hit WE82: 317' (< /boo-ha-ta/)

2nd: booráta 'you hit WE82: 317' (< /boo-ra-ta/)

3rd: bootá 'he hits WE82: 317' (< /boo-ϕ-ta/)

c. 1st: waaní̜p 'I swim in it WE82: 317' (< /ho-ha-nįįp/)

2nd: horaní̜p 'you swim in it WE82: 317' (< /ho-ra-nįįp/)

3rd: honí̜p 'he swims in it WE82: 317' (< /ho-ϕ-nįįp/)

d. 1st: waakít'e 'I speak to HWE80: 121' (< /ho-ha-kit'e/)

2nd: horakít'e 'you speak to HWE80: 121' (< /ho-ra-kit'e/)

3rd: hokit'é 'he speaks to HWE80: 121' (< /ho-ϕ-kit'e/)

e. 1st: yaakóroho 'I prepare, dress HWE80: 128' (< /hi-ha-kroho/)

2nd: hirakóroho 'you prepare, dress HWE80: 128' (< /hi-ra-kroho/)

3rd: hikorohó 'he prepares, dresses M79: 30, HWE80: 128' (< /hi-ϕ-kroho/)

f. 1st: yaat'ét'e 'I speak WE82: 316' (< /hi-ha-t'et'e/)

2nd: hirat'ét'e 'you speak WE82: 316' (< /hi-ra-t'et'e/)

3rd: hit'et'é 'he speaks S43: 9, 10, 47, M89: 149, WE82: 316' (<hi-ϕ-t'et'e/)

The derivation of the second- and third-person forms in (75a-f) are straightforward, while the derivation of the first-person forms involves somewhat complicated procedures. They can be accounted for by a series of rules in (77), which I assume are non-cyclic and apply after the cyclic rules in (76):

(76)	a. Underlying Representation:	/ha-ha-ki-h-ruǰik/	/ho-ha-niip/	/hi-ha-kroho/
	b. Glide Fortition:	ha ha ki htu ǰik	–	–
	c. Dorsey's Law:	–	–	hi ha ko ro ho
(77)	a. Intervocalic *h*-Deletion:	ha a ki htu ǰik	ho a nip	hi a ko roho
	b. Syllable Merger:	haa ki htu ǰik	hoa nip	hia ko roho
	c. Nasalization:	–	hoa nįp	–
	d. Glide Formation:	–	hwa nįp	hya ko roho
	e. Compensatory Lengthening:	–	hwaa nįp	hyaa ko roho
	f. Preconsonantal *h*-Deletion:	haa ki tu ǰik	waa nįp	yaa ko roho

Glide fortition (76b) changes /r, w, y/ into [t, p, č], respectively, at the position after [h], which was discussed in (27) of section 2.5.1; after intervocalic *h*-deletion (77a), a heterosyllabic vowel sequence (i.e. a hiatus) is merged into the same syllable by syllable merger (77b), while nasalization (77c) nasalizes vowels with an onset nasal, as has been discussed earlier; glide formation (77d) changes the [–low] vowels (*u, o* and *i, e*) into the corresponding glides *w* and *y*, so that the resulting mora lengthens the tautosyllabic vowel compensatorily; finally, preconsonantal *h*-deletion (77f) deletes [h], which precedes [w, y] by glide formation (77d) or [t, p, č] by glide fortition (76b). Since reordering of any of the rules in (77) would result in wrong outputs, they must apply in the order given above. Note also that the forms in (75d) undergo non-initial stem shortening as well.

Now we are in a position to adduce evidence showing that the rules in (77) belong on the non-cyclic level. In section 2.3.4, I pointed out that (77c) is a non-cyclic rule which is not subject to the Strict Cycle Constraint. Moreover, this rule must be ordered <u>after</u> syllable merger, precisely because it nasalizes the postnasal vowels only in the same syllable. Since syllable merger should be a non-cyclic rule as will be known below, the non-cyclicity of nasalization is sustained again. Specifically, note in (78) that the first-person marker *-ha-* is a non-nasal vowel underlyingly and that the only way to nasalize it is to merge it into the preceding nasal-initial syllable, just as the initial syllable of *boáta* in (75b) is a result of merger (/boo-<u>ha</u>-ta/ → boo á ta → [boá ta]):

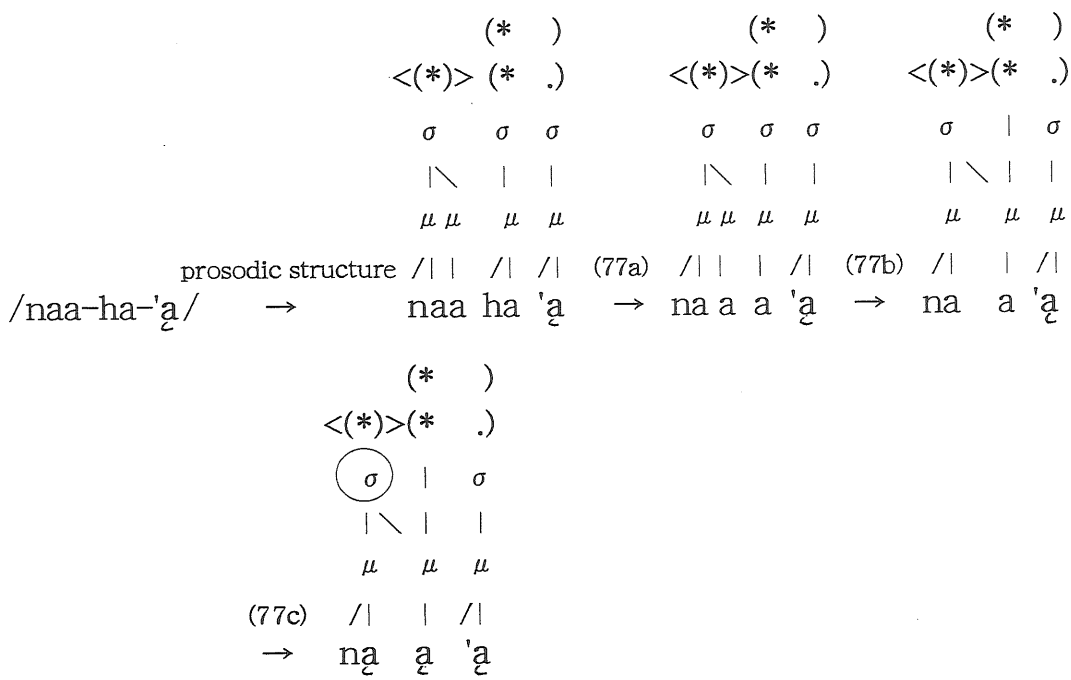
(78) a. nąą́'ą 'I weigh HWE80: 121' (< /naa-<u>ha</u>-'ą/)

nąą́wą 'I sang S43: 8, 10, 12' (< /naa-<u>ha</u>-wą/)

nąą́še 'I took him away S43: 73' (< /naa-<u>ha</u>-še/)

mįą́nąk 'I sit HWE80: 130' (< /mii-<u>ha</u>-nak/)

b.



It must be pointed out that the prosodic structure after syllable merger violates the Strict Layer Hypothesis, because the second mora is dominated immediately not only by the preceding syllable but also by a foot: a split domination as in (70b). Or conversely, if prosodic structure construction were to apply after nasalization, accent would be misassigned as in **nąą'ą́* and

**mį̈ą̈nǻk*.[41] It follows then that all the rules in (77b–f) must belong to the non-cyclic level where neither the Strict Cycle Constraint nor the Strict Layer Hypothesis do not hold. This implies that Miner's (1989: 149) ordering of nasalization before Dorsey's Law as mentioned in section 2.5.3 would lead to wrong results, since Dorsey's Law must be cyclic and nasalization must be non-cyclic for every reason. For more evidence in favor of nasalization <u>after</u> Dorsey's Law, see section 3.1.5.

In spite of the rule ordering in (77), there is poor evidence at present determining whether intervocalic *h*–deletion is the last cyclic rule or the first non-cyclic rule. The fact that it only applies to derived forms might indicate its obedience to the Strict Cyclic Constraint on the cyclic level, but this alone is not sufficient for the decision, since the same is true for other rules in (77) except for nasalization. Hereafter, I will assume tentatively that it is a non-cyclic rule, thinking much of its structure–changing nature (cf. the criterion in (12)) just like other rules in (77).

Lastly, there are other structure–changing rules than those in (77) on the non-cyclic level: clash deletion and clash movement, which serve as repair strategies for rhythmic adjustment wiping out any violation of the Clash Avoidance Principle. Recall that clash deletion and clash movement are free from Structure Preservation (see (14c, d) in section 2.3.3) and the Strict Cycle Constraint (see (20) in section 2.3.4), both of which work on the cyclic level. This fact allows us to conclude that they must be non-cyclic rules just like those in (77). I will discuss these rules in detail in section 3.2.4.1, but at least it can be said at present that there is a distinct non-cyclic level in the Winnebago Lexicon, where all rules are characteristically structure–changing or feature–changing.

2.6.6. Obligatory Postlexical Rules

I have argued in sections 2.2 and 2.3.3 that non-adjacent clash movement (14d) and intrusive schwa (8a) are optional postlexical rules, and in section 2.6.1 that other postlexical rules (49b-d) such as cancellation of extrametricality, stray neutralization, and stray adjunction apply obligatorily. This fact shows that the postlexical level can be divided into two distinct sublevels which are quite different in rule application: optional level and obligatory level. In addition to the manner of application, there is another argument for the distinction, for example, with respect to the nature of rules. The former level is made up of phonological rules sensitive to phonetic factors such as speech rate and rhythm but still subject to phonological principles, whereas the latter level consists mainly of the final adjustments which allow all phonological representations to be fully interpreted in phonetics. More specifically, rules on these levels are indeed equally free from the constraints on the lexical level, and thus can apply to either derived or underived environments in either structure-building or structure-changing way, but the effects of general constraints partially remain only on the former optional level: the Clash Avoidance Principle and the Coda Condition (recall the discussion in (14) and (54)). In this respect, the obligatory level seems to be farther from the core of phonology and nearer to phonetic implementation, where phonological constraints are not effective any longer.

Focusing our attention on this level only, we need the two rules in (79) other than those in (49b-d):

(79) a. Tone Association

b. Default & Redundancy Rules

(79a) is a rule which associates the H tone to the highest grid and the M tone to other lower grids and is ordered before cancellation of extrametricality. After the cancellation, all segmental and prosodic representations become visible, and (79b) fills in default and redundant values concerning segmental or tonal features as a consequence of (contrastive) underspecification in the underlying representations. Particularly relevant here is the insertion of default tonal value L (L-insertion). The examples in (80a) illustrate the output representations immediately after non-adjacent clash movement on the optional level, which then undergo tone association, cancellation of extrametricality, and default & redundancy rules (L-insertion) on the subsequent obligatory level (cf. (14d)):

(80) a. Non-Adjacent Clash Movement

```
        (*            )              (*            )
   <(*)> (*   . ) (*   . )     <(*)> (*   . ) ( .   *)
    σμμσμ σμ  σμ σμ              σμμ σμ σμ  σμ σμ
    wii  ra gu̯  šge ra           wii  ra gu̯  šge ra
```

b. Tone Association

```
        (*            )              (*            )
   <(*)> (*   . ) (*   . )     <(*)> (*   . ) ( .   *)
    σμμσμ σμ  σμ σμ              σμμ σμ σμ  σμ σμ
    wii  ra gu̯  šge ra           wii  ra gu̯  šge ra
          |       |                    |          |
          H       M                    H          M
```

c. Cancellation of Extrametricality

```
        (*            )              (*            )
     (*) (*   . ) (*   . )        (*) (*   . ) ( .   *)
    σμμσμσμ  σμ σμ               σμμσμσμ  σμ σμ
    wii  ra gu̯ šge  ra           wii  ra  gu̯ šge ra
          |       |                    |          |
          H       M                    H          M
```

d. Default & Redundancy Rules (L–Insertion)

```
 (*              )              (*              )
(*) (*    . ) (*    . )        (*)  (*    . ) ( .    *)

σμμσμσμ  σμ  σμ                σμμσμσμ σμ  σμ
wii  ra gu̯ šge  ra              wii  ra gu̯ šge ra
||   |   |    |   |            ||   |   |    |  |
LL  H  L    M   L              LL  H  L    L M
```

If extrametricality were canceled before tone association, the initial syllable would bear the M tone as a result of tone association in (80a, b), which is not a desired output in either case. Thus, cancellation of extrametricality must be induced <u>after</u> tone association and <u>before</u> L–insertion.

Output representations like the ones in (80) on the obligatory postlexical level are then subject to implementation in the phonetic component. In section 3.2.2.1, I will discuss the relation between metrical structure and its phonetic interpretation, laying a particular emphasis on the role of metrical structure as an organizing principle of phonological systems. See also section 3.2.2.2 for the relation of metrical structure to pitch accent in conceptual terms.

Notes to Chapter 2

[1] At the same time, Hargus and Kaisse (1993: 1) also remark that there has been a pervasive similarity at least in the sorts of questions that Lexical Phonologists ask when they describe a language: questions about the nature of rule application and rule ordering. But the authors nevertheless agree on the lack of a common methodology or a coherent theoretical viewpoint among the researchers concerned, when they actually attempt to answer these questions. What is similar is only the questions themselves and not the ways to answer them.

[2] The classification and naming of the processes in (1) are due to me. Some compounds in (1c) appear to be just like phrases in meaning but still can be said to be compounds in form (accent), having a uniform domain. See the discussion below, and compare the compounds in (1c) with the phrases in (3a). In Winnebago, phrases are gradually lexicalized to be compounds, as is the case with other languages. See also note 11.

I may ignore subsidiary accent here and below, when it is irrelevant to discussion. See sections 3.2.2.2 and 3.2.3.1 for details of subsidiary accent.

[3] According to Miner, this rule of final voicing only occurs when the sonorant–initial suffixes or words are of a certain type, like *–ra* 'the,' *–na̧k* 'sitting,' *–nį̨k* 'little' and the examples in (3a). Note that final voicing bleeds Dorsey's Law since the latter rule applies to the cluster of a voiceless obstruent and a sonorant. However, I will present an alternative account to this voicing analysis of Miner's in section 2.6.1, because it also appears to apply before non–sonorants as in *'aabú* 'blossom S43: 67, 125' (< *'áap* 'leaf S43: 67, 125' + *húu* 'to come S43: 67, 125') and *čeebį́* 'to consume S43: 56, 67' (< *čéep* 'finished S43: 56' + *hį́i* 'to do S43: 56,' although the following *h* is lost by

elision.

[4] For details of intervocalic *h*–deletion and other phonological processes, see section 2.6.5. Non–initial stem shortening will be discussed in section 2.6.3 in much detail.

[5] Again, they function as prefixes or infixes as in *wažók* 'to mash HWE80: 124, 130' / *šawažók* 'you mash HWE80: 124, M89: 153' or *howažá* 'to be sick HWE80: 125' / *hošawažá* 'you are ill HWE80: 125, M89: 155', like the three (i.e. *ha*, *ra*, and *ϕ*) above. In *šawažók*, the *a* of the initial syllable is inserted by Dorsey's Law, which copies the following vowel in the (voiceless) obstruent–sonorant cluster (the same is true of the second syllable of *hošawažá*). Compare the example with *gúu* 'to leave returning here M89: 151' / *šgúu* 'you leave returning here M89: 151,' to which Dorsey's Law does not apply.

[6] Certain verbs are sometimes marked with respect to their person by two affixes of the same type. Thus, in *harakíšurujik* 'you pull taut,' which alternates with *hakirújik* 'to pull taut' (cf. (1d)), both of the second–person markers *ra* and *š* are infixed at the same time, although it should be noted again that the vowel of *šu* is inserted by Dorsey's Law.

[7] I will be concerned with the detailed mechanism and analysis of reduplication in section 2.6.2. See also section 3.1.5 for its interaction with Dorsey's Law.

[8] Again, I am responsible for the classification and naming of the processes in (3). The phrases in (3a) might appear to be compounds in meaning; however, they still can be said to be phrases, or even dvandvas, in the sense that each element of the sequence behaves as if it forms a separate phonological domain. Note also that many phrases are right–headed as seen in (3b) as well as (3a), as compared to the compounds in (1c). See also note 11.

[9] Notice here that 'utterances' are like ordinary sentences in both meaning and form, which consist of several separate domains.

Incidentally but interestingly, *kų̀nųgá* and *heenąga* reflect the naming practice in Winnebago culture, which mean first-born and second-born sons respectively, according to White Eagle (1982: 308). This practice is parallel to *Taroo* '一郎, 太郎' and *Jiroo* '二郎, 次郎' in Japanese, but there is a difference: Winnebago has their female counterparts *hįnųgá* (a first-born daughter) and *wihągá* (a second-born daughter). It is not clear, though, whether the naming convention has an option of female order-of-birth names or not shows the difference between the two languages even in the convention of succeeding to a family estate: the co-existence of matriarchy and patriarchy or the patriarchal system only.

[10] In this study, I will not examine in detail whether this operation applies in the morpho-syntactic component of the Lexicon or in the postlexical syntactic component. I will adopt the former assumption here and below.

[11] For the opposite stance, non-interactionism, which posits a model where the overall morphological component precedes the phonological component, see Halle and Vergnaud (1987), Szpyra (1987), and Odden (1993). These non-interactionists can be said virtually to espouse a resurrection of the model in Chomsky and Halle (1968).

[12] We mentioned the voicing rule (i.e. *peeǰ* < /peeč/) in the course of the above discussion, but see note 3. For details of non-initial stem shortening, see section 2.6.3.

As for the difference between phrases and compounds, we sometimes find rather ambiguous cases like *hišǰasú* 'eye S43: 57, M79: 28' (< *hišǰá* 'face S43: 57' + *súu* 'seed S43: 57'), *'iinį́* 'saliva S43: 123' (< *'íi* 'mouth S43: 123' + *nį́į* 'water

S43: 123, M89: 149, 150'), and *hąąhéwi* 'moon S43: 58, 123' (< *hąąhé* 'night S43: 58' + *wį́į* 'sun S43: 58'), which can be thought of either as a phrase in that it is right-headed, or as a compound in that it has a lexical meaning, is assigned a uni-domain accent, and undergoes non-initial stem shortening. Since a phrase generally turns into a compound as time goes by, this ambiguous nature of the word is not so unnatural. In either way, I assume that in principle, compounds and phrases are formed in uni-domain level and multi-domain level morphology, respectively.

[13] I have some comments on other characteristics than the ones mentioned here. First, (6a, b, j, k) may also be true for Winnebago phonology, but I do not have relevant data and await further research. Second, the distinction in (6h) does not make sense in this polysynthetic language, because a word cannot be classified into lexical and functional categories. Rather, a word incorporates all material that is equivalent in meaning to lexical and functional categories. Finally, I will argue against (6d, f, g) in section 2.3. In particular, I will show that lexical rules are not always cyclic, subject to the strict cyclicity effect, or structure-preserving: there is a certain level on which rules are non-cyclic, immune from the strict cyclicity effect, and non-structure-preserving, like those on the postlexical level, and yet are lexical. It is because of the existence of this lexical but non-cyclic (postcyclic) level that there is so much dispute over the criteria in (6).

[14] For more detailed discussion about cyclicity, especially about the distinction in derivation between cyclic and non-cyclic levels, see section 2.3.

[15] The English data of shifted forms are taken from Kenyon and Knott (1953). This phenomenon as optional accent shift is also discussed in section 3.2.4.1.

[16] Note that as mentioned above, the cases I have been dealing with have non-adjacent clashing environments, which must be distinguished from those with adjacent clashing environments. For the latter cases, either deaccenting or accent shift applies obligatorily depending to the foot structure concerned. For details of these mechanisms, see section 3.2.4.1.

[17] See also note 3 for the voicing rule before the application of intrusive schwa.

[18] Besides non-adjacent accent shift and intrusive schwa, there are other obligatory postlexical rules ordered after the two optional rules, which will be discussed in section 2.6.6.

[19] For discussion about the two lexical conditions belonging to the cyclic level, see sections 2.3.3. and 2.3.4.

[20] For our assumption on underspecification theory, see section 2.5.

[21] There is another possibility, namely, that clash deletion and clash movement in the adjacent environments apply on the postlexical level as well, e.g. some obligatory sublevel distinct from the optional sublevel. This idea, however, seems to lack explicit evidence, as compared to the line of reasoning given above.

[22] In fact, Clark (1990) claims that the Strict Cycle Constraint is in effect not only on all the lexical levels but also on a certain postlexical level, invoking the tonal system of Igbo, one of the Kwa languages in Africa. More recently, in Kiparsky's (1993) approach, both lexical and postlexical rules may all obey or resist this constraint. However, I will not consider the possibility of the effect on the postlexical level to simplify the discussion here. In fact, it will be known in later discussion that the application of all postlexical rules is not sensitive to the (non-)derivedness of the environments (i.e. not subject to the

effect) at least in Winnebago.

[23] It can be roughly defined that a morphological process brings about a change in both meaning and form whereas a phonological process creates a change in form only. In either case, what matters here is the change in form, so that both processes are relevant to 'the cyclicity problem' I pose in this section.

[24] For other morpho-phonemic changes than /hw/ → [p] and /hr/ → [t], see section 2.5.1.

[25] More correctly, the underlying representation of *hačá* 'I see' is /ha-h-ǰa/, which results in the intermediate stage [ha-h-ya] through a certain rule converting /ǰ/ into [y] in this environment. It is this stage that serves as an input to glide fortition (27c), and this analysis explains why the infinitival form *haǰá* 'to see' and the second- and third- person forms *hašǰá* 'you see' and haǰá 'he sees' surface as they are:

(i) a. /haǰa/ → haǰa

b. /ha-h-ǰa/ → hahya → hahča → hača

c. /ha-š-ǰa/ → hašǰa

d. /ha-ϕ-ǰa/ → haǰa

But for simplicity, I write the intermediate stage as underlying in (27c).

Alternatively, the underlying form might be /ha-h-ya/ and not /ha-h-ǰa/. If so, aside from the first-person form *hačá*, the second- and third-person forms would undergo another rule changing /y/ into [ǰ], as in *hašǰá* 'you see' from /ha-š-ya/ and *haǰá* 'he sees' from /ha-ϕ-ya/ as well as the infinitive *haǰá* 'to see'. This rule is ordered before Dorsey's Law, or otherwise the second-person form would surface as **hašayá*. It appears to me that the former assumption is favored over the latter, but I will leave open the question of opting between these two analyses.

In addition to the problem with the underlying form, the verbal paradigm in (27c) involves another complexity about the infix vowel: Hale and White Eagle (1980: 123) write the first-person singular form as *hačá*, whereas Miner (1979: 32) writes it as *haačá*. If we adopt Miner's assumption, the underlying representation for this form is /ha-ha-ǰa/, which undergoes intervocalic *h*-deletion discussed below.

[26] The fact that there are no palato-alveolar stops in Winnebago might also constitute evidence showing that affricates function as stops. In fact, I assume that the palato-alveolar affricates *č/ǰ* are not contour segments having both of the [±cont] values, but serve as palato-alveolar stops with the value of [-cont] only. This is demonstrated by invoking the lack of the OCP effect in the consonant cluster. See section 2.5.2 for detailed arguments.

[27] Susman gives some apparent geminates as in *hą̨ąppį́* (*hą́ąp* 'day S43: 66, M93: 123' + *pį́į* 'good S43: 66, 113) 'good day S43: 66' and *hinų̨ggúuną* (*hinų́k* 'woman S43: 42, 123' + *guuną́* 'she came S43: 66') 'the woman came S43: 66.' Since she observes that "[i]n normal rapid speech, clusters of identical and corresponding consonants are replaced by the second member," I will regard them as single stops (or *k'* in the former case), although they surface "with long contact" phonetically (see Susman (1943: 65, 66)). There are other seemingly complex cases including triconsonantal clusters, which will be discussed in section 2.6.1.

[28] If I followed Archangeli's (1984, 1988) Theory of Radical Underspecification in assuming that obstruents are specified only for the marked value, i.e. [+voi], in the underlying representations, then the OCP effect on voicing would exist, excluding the [+voi]-[+voi] sequence (*bg, gb,*

bz, zb, etc.) and licensing the well-formed consonant clusters. But I must abolish this possibility, partly because there is full evidence for the Theory of Contrastive Underspecification in Winnebago, as has been and will be discussed, and partly because *[+voi]-[+voi] does not exclude sequences with [+voi]-[ ] such as *bk, gp, bs, zp,* and so on. Instead, these are properly prohibited by (35).

[29] In strict terms, the conditions in (35) may be formulated more simply by erasing [-son] as in the following way:

```
(ii) a.  * C        C              b.  * C        C
           |        |                    |        |
        [-voi] [-voi, -con]           [-voi] [+voi, +con]
```

This is because the underlying specification of either [-voi] or [+voi] implies that the consonant in question is an obstruent (i.e. [-son]) which is contrastive with respect to voicing. In contrast, sonorants (i.e. [+son]) are non-contrastive with respect to voicing, so they cannot have any underlying specification of voicing.

[30] Interestingly, this morpho-phonemic change is also observed in such alternations in Japanese as *ame* 'rain'/ *ama-gasa* 'umbrella', *sake* 'liquor'/ *saka-mori* ' drinking party', *tsume* 'nail'/ *tsuma-hažiki* 'fillip (exclusion)', *hune* 'ship'/ *huna-yoi* 'seasick', *kaze* 'window'/ *kaza-guruma* 'toy with a propeller', *kane* 'metal'/ *kana-mono* 'hardware', *me* 'eye'/ *ma-buta* 'eyelid', *mune* 'chest'/ *muna-ge* 'chest hair', *na(w)e* 'seedling'/ *nawa-*širo 'seedling field', *te* 'hand'/ *ta-dzuna* 'rope for gripping', *u(w)e* 'up'/ *uwa-me* 'upward sight' and so on. But this rule does not always apply, relying on the second head noun, as in *ame* 'rain'/* *ama-agari*/ *ame-agari* 'rain stop' and *sake* 'liquor'/* *saka-nomi*/ *sake-nomi* 'heavy drinker'.

The difference in rule application between the two languages is the types of categories: the targets of this rule are verbs in Winnebago while they are nouns in Japanese.

[31] Miner (1993: 121) gives the following data in (iii) as examples of triphthongs, which are said to be very uncommon in this language:

(iii) nį̣oisą́ 'faded' šį̣ą́į̣gexǰį̣ 'I am clumsy'

wioiré 'west' čioiǰás 'tent'

It may also be assumed that these words are not cases of triphthongs but of falling diphthongs syllabified as in *nį̣ . oi . są́, šį̣ . ą́į̣ . ge . xǰį̣*, and so on. This is because nasalization, which nasalizes any tautosyllabic vowel with a nasal onset, applies to the initial single vowel and not to the 'triphthong' of the first word (i.e. **nį̣oį̣ . są́*); however, its accent position would be predicted to be **nį̣ . ói . są̣* if it contained a diphthong. In this case, a triphthong approach correctly predicts its accent as in *nį̣oi . są́*, but would locate a wrong accent in the case of **šį̣ąį̣ . gé . xǰį̣*.

Because these trivocalic sequences are few in number and suffer from difficulties with accent, I will not discuss the matter here and below.

[32] This is also called the Peripherality Condition by Hayes (1981,1995). See section 2.6.4 for the relation of the Extrametricality Condition to a general principle called the Strict Layer Hypothesis.

[33] Needless to say, there is no sequence of a voiceless obstruent plus a sonorant at this stage, because Dorsey's Law has already applied to such a sequence on the lexical level.

[34] The verbs in (58) have an obvious meaning relation between non-reduplicative and corresponding reduplicative forms, while the adjectives in (60) have reduplicative forms only. But I assume here that these adjectives are

also derived by the non-reduplicative underlying forms shown on the left of each example, since some adjectives clearly show alternations just like verbs, as in *parás* 'flat S43: 71, M79: 27, 29, 30' / *parapáras* 'wide M79: 29' and *šará* 'bold S43: 33, M79: 29, M89: 149' / *šarašára* 'bold in spots S43: 33, M79: 29, M89: 149' (for the anomaly of their bisyllabic suffixes, see the examples in (62) and the analysis thereafter). Thus, the lack of non-reduplicative forms in (60) might well be accidental.

[35] Of course, other rules apply after non-initial stem shortening. Particularly relevant here are postlexical rules such as cancellation of extrametricality (49b), stray neutralization (49c), and stray adjunction (49d).

[36] Alternatively, (67b) can also be stated as "a word contains at least one bimoraic foot." The bimoraicity of a foot has often been discussed in the literature (McCarthy and Prince (1986), Tateishi (1989), Poser (1990), Itô (1990), Tanaka (1992a), Kubozono (1995), and so on). But what is at issue here is a bimoraic requirement on a word and not on a foot. In fact, there are word-internal monomoraic feet in Winnebago, which will be clear in the course of the discussion in section 3.2.4.1. In this respect, the bimoraicity of a foot does not stand in Winnebago, which also constitutes evidence against the Strict Binary Hypothesis in the sense of Kager (1989) and Hayes (1995).

[37] Again, see section 3.2.4.1 for the detailed mechanism of metrification.

[38] The Strict Layer Hypothesis with the definition in (69) requires prosodic structures to be strictly layered, excluding all the representations in (70). But Selkirk's (1984: 26) definition, though originally called the 'Strict' Layer Hypothesis, is somewhat weaker than the above one in that only the former two examples in (70b) are judged as ill-formed and the others as well-formed, since she simply states that "a category of level *i* in the hierarchy immediately

dominates (a sequence of) categories of level *i–1*." On the other hand, Itô (1986: 2) also upholds weak layering by utilizing Prosodic Licensing, which is defined as "all phonological units must be prosodically licensed, i.e., belong to higher prosodic structure (modulo extraprosodicity)." This condition excludes the structures in (70a) correctly but licenses the ones in (70b) erroneously. See also Itô and Mester (1992) for more discussion of weak layering.

[39] Other general constraints also involve some parameters. See section 2.6.3 for a minimal word requirement of the Minimality Condition, section 3.1.3.1 for the General Sonority Hierarchy concerning the Dispersion Principle, and section 3.2.4.1 for the notion of foot weight concerning the Clash Avoidance Principle.

[40] For vowel alternation seen in these examples, see the discussion of *e/a* ablaut in sections 2.5.3 and 3.1.5.

[41] Hale and White Eagle (1980: 129–130) give a contrasting pair of *waá'ų* 'I do HWE80: 129' vs. *paažók* 'I mash HWE80: 130,' which is interesting in that the two forms suggest the minimal difference in accentual behavior although they have the same syllable structure at the surface. Such a case is accounted for by the present rule-based system if we assume that they are different in the underlying length of their stem-initial vowel and in the type and position of their first-person marker, as in (iv):

(iv) a. /waa-ha-'ų/ → waa há 'ų → waa á 'ų → waá 'ų

b. /h-wažok/ → hwa žók → hpa žók → pa žók

The form in (iva), whose stem-initial vowel is underlyingly long and hence whose accent is assigned to the second syllable (i.e. *ha*), undergoes intervocalic *h*-deletion and syllable merger, as in *boáta* and *ną́'ą* above. Consequently, accent falls on the second mora of the initial syllable, unlike (ivb). On the other hand, the initial stem vowel in (ivb) is short in both the underlying and surface representations, and hence this form simply undergoes glide fortition and preconsonantal *h*-deletion. Of course, before the application of these rules, accent is assigned to the second syllable like other bisyllabic words in Winnebago. Note that the precise surface form I assume is *pažók*, not *paažók* as Hale and White Eagle transcribe. This is because it is attested that the second- and third-person forms have short stem vowels as in šawažók 'you mash HWE80: 124, M89: 153' (< /š-wažok/) and wažók 'to mash, he mashes HWE80: 124, 130' (< /φ-wažok/), and the surface long stem vowel seen only in the first-person form would be a mystery from the viewpoint of paradigm uniformity.

Chapter 3
Evidence for Syllable and Foot Structures

3.1. Syllable Structure, Sonority Hierarchy, and Dorsey's Law

3.1.1. Mystery: Why is Dorsey's Law Required to Apply?

In the previous chapter, we saw the overall phonological system of the Winnebago Lexicon and its variety of rules and constraints in the level-ordered composition. This chapter will be devoted to elucidating more microscopic aspects of Winnebago phonology: its syllable and foot structures. The questions in (2b, c) addressed in section 1.1 will be given a principled account by proper characterizations of the prosodic structures. Conversely, the occurrence of Dorsey's Law and the surface ordering paradox will constitute substantial evidence for the syllable and foot structures in Winnebago. First, I will be concerned with the question in (2b) and consider the exact reason why Dorsey's Law exists in this language at all. This rule seems to be rather idiosyncratic in the sense that no other languages in the world are said to have such a rule, but it will be clear that the idiosyncrasy comes from the syllable structure, or the sonority hierarchy, of this language and that the rule itself consists of fairly natural processes subject to some general constraints.

Dorsey's Law was first discovered by James Owen Dorsey in 1883 and then termed after his name by a series of Hans Wolff's works (see Dorsey (1885) and Wolff (1950a–c, 1951)). This is seen as a process to break up the cluster of a voiceless obstruent and a sonorant by copying the following vowel, which occurs word-initially or word-medially in both polymorphemic and monomorphemic words, as illustrated below:

(1) a. Derived Forms

šawaší 'you dance M89: 151' (< /šwaši/) cf. waší 'to dance S43: 46, M89: 151'

šurugás 'you tear M89: 151' (< /šrugas/) cf. rugás 'to tear M89: 151'

kurušíp 'to pull down one's own S43: 45, M89: 151' (< /krušip/) cf. rušíp 'to pull down S43: 45, M89: 151'

karačgą́ 'to drink one's own M89: 151' (< /kračgą/) cf. račgą́ 'to drink M89: 149, 151'

b. Underived Forms

parás 'flat M79: 27, 29, 30' (< /pras/) keré 'return M79: 26, 27, 29, M89: 150' (< /kre/)

seréč 'long M79: 27' (< /sreč/) rupiríš 'curl M79: 27' (< /rupriš/)

hirakóroho 'you prepare HWE80: 128' (< /hirakroho/)

waapóroporo 'snowball M79: 30' (< /waapropro/)

wakiripóroporo 'spherical bug HWE80: 131, M89: 155' (< /wakripropro/)

Originally, Dorsey's Law developed as a diachronic process and involved a historical change of the phonotactics (i.e. the possible arrangement of consonant clusters) of this language. That is, each word in (1) is said to have developed from the corresponding reconstructed form in parenthesis. But as Miner (1979, 1989) has correctly proved, it is certain that this process also functions as a synchronic rule, as is clear from its application with the synchronic morphological alternation (i.e. prefixation) in (1a) and its interaction with other synchronic phonological processes like nasalization, *e/a* ablaut, and reduplication discussed in sections 2.5.3, 2.6.2, and especially 3.1.5. Miner (1981, 1989, 1993) writes the rule in a transformational format as given below:

(2) Miner's Formulation of Dorsey's Law

$$\begin{matrix} \begin{bmatrix} -\text{son} \\ -\text{voi} \end{bmatrix} & \begin{bmatrix} -\text{syll} \\ +\text{son} \end{bmatrix} & [+\text{syll}] & \\ 1 & 2 & 3 & \rightarrow \; 1\ \underline{3}\ 2\ 3 \end{matrix}$$

As I demonstrated in chapter 2, I regard rule (2) as a cyclic structure-building process in a synchronic grammar of Winnebago.

Dorsey's Law has long been a mystery to generative phonologists ever since Miner's (1979) synchronic characterization, because no other languages are said to have such a rule and there seems to be no obvious motivation of the rule application. In fact, no principled account has so far been given as to why such a rule is required to apply, even within a constraint (principle)-based framework since the 1980s. In other words, it has not been clear at all why the following vowel must be inserted to break up the sequence. At first glance, it might appear that the sequence of a voiceless obstruent and a sonorant is prohibited by a co-occurrence restriction like the OCP effect. To examine this possibility, it is convenient to invoke Miner's (1979: 26) list of Dorsey's Law sequences, which exhausts the range of possible combinations of the two segments. I assume that the absence of pVwV, čVnV, and čVrV seems to be simply an accidental gap because the latter two are listed in Miner (1989: 153), so I mark these sequences here as ? (cf. Susman (1943: 22):

(3) Types of Dorsey's Law Sequences: C_1VC_2V

C1 / C2	p	k	s	š	č	x
n	pVnV	kVnV	sVnV	šVnV	?	xVnV
w	?	kVwV	sVwV	šVwV	čVwV	xVwV
r	pVrV	kVrV	sVrV	šVrV	?	xVrV

Here, the non-occurrence of *m* and *y* as C2 is also considered simply as accidental, while the obstruents of *t*, *h*, and ' do not appear as C_1 systematically and are not qualified to be the first part of a Dorsey's Law sequence; this is because they do not have the contrast of voicing (their voiced counterpart) and hence the [−voi] value under the Theory of Contrastive Underspecification (see sections 2.5.2 and 2.6.1).[1] Note that this crucial information (i.e. C_1 as a [−voi] obstruent) is incorporated into the rule formulation in (2). That is why these obstruents without any voicing specification constitute a systematic gap as C_1. Instead, all the C_1 obstruents given in (3) have their voiced counterpart and thus the [−voi] value, as is clear from the consonant inventory seen in (25) in section 2.5.1. This voicing requirement also accounts for possible consonants in word-final position in the sense that only *p, k, s, š, č,* and *x* can appear in that position (section 2.6.1).

Recall that in section 2.5.2, I argued against the OCP effect on the consonant clusters in Winnebago with respect to place of articulation, manner of articulation , or voicing. Evidently, this is also true for the Dorsey's Law sequences in (3), because a vowel is in fact inserted between the two consonants even when they are different in place of articulation, manner of articulation, or voicing. Thus, it is not the case that vowel insertion is triggered by a violation of the co-occurrence restriction. What then triggers the vowel insertion phenomenon? It is precisely this point that we will be concerned with in the following section, and we will pursue the possibility that the motivation of the Dorsey's Law application lies in some syllable structure constraints.

3.1.2. Dorsey's Law Sequence OVSV as a Single Heavy Syllable

As far as I know, Alderete (1995) is the only theorist that managed to tackle the long-standing problem concerning the reason for the Dorsey's Law application, although his analysis is based on a non-derivational framework (hence, 'the rule' is not considered to 'apply' there). But it is worth examining the validity of his account, since it entered into the formal mechanism of Dorsey's Law in much detail for the first time in the history of generative-phonological studies of Winnebago.

The uniqueness of his approach lies in the fact that it attributes the vowel insertion phenomenon to the favored sonority curve of segments within a syllable. He assumes the sonority scale for Winnebago consonants, as is shown in (4a). Given the sonority scale, possible and impossible combinations of consonants are defined by the sonority profile in (4b), which is represented by grids and shows the sonority contour of the clusters in question schematically (Alderete (1995: 34)):

(4) a. Sonority Scale

sonorant · voiced fricative > voiced stop > voiceless obstruent

b. Sonority Profile

		x	x	x	sonorant · voiced fricative
x		xx	x	x	voiced stop
xx	xx	xx	xx	xx	voiceless obstruent
sg	ps	br	*pr	*pz	

Recall that [voiceless obstruents + voiced stops], [voiceless obstruents + voiceless fricatives], and [voiced obstruents + sonorants] are regular consonant clusters, as discussed in section 2.5.2 (e.g. *sgáa* 'white M89: 152, M93: 117, 120,' *psįįpsį́č* 'small change M93: 117,' and *haračábra* 'the taste M79: 28,' and so on). Note also that there are no consonant clusters like [voiceless obstruents + sonorants] and [voiceless obstruents + voiced fricatives], since the former sequence undergoes vowel epenthesis and the latter constitutes a systematic gap. Alderete ascribes the anomaly of these two types of clusters to the constraint in (5), reinterpreting the original version of Murray and Venneman's (1983) Syllable Contact Law in a language-particular manner for Winnebago and stating that "clusters may rise in sonority across syllables, e.g. [b . r], but a marked rise in sonority between <u>heterosyllabic</u> clusters is not allowed, e.g. *[p . r]" (Alderete (1995: 34), underlined by S.T.):

(5) Syllable Contact (Syll-Cont)

C1 < C2 by no more than one sonority interval, where C1 and C2 are adjacent, and C1 is syllable-final and C2 is syllable-initial.

Alderete (1995: 48)

That is, a usual sonority rise by one grid is allowed between heterosyllabic clusters like *sg, ps,* and *br,* while clusters like **pr* and **pz* with a sonority jump of two grids are blocked if they are heterosyllabic sequences. Thus, Alderete concludes from this reasoning that Dorsey's Law sequences are <u>tautosyllabic</u>, as in (6a):

(6) Alderete's (1995) Syllabification

a. Tautosyllabic Clusters: pr / pz

b. Heterosyllabic Clusters: s . g / p . s / b . r

Note here that the cluster of [voiceless obstruents + voiced fricatives] is predicted to be tautosyllabic as well, which we will discuss in section 3.1.3.2.3.

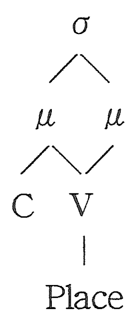
Even if it proves that Dorsey's Law sequences are tautosyllabic, there still remains an untrivial question as to why they are required to undergo epenthesis. Alderete's answer to this question works out in the following way. First, he invokes two relevant constraints for the apparent epenthesis phenomenon within the framework of Optimality Theory. One is 'Syllabify Place,' which is defined as in (7):

(7) Syllabify Place (Syll–Place)

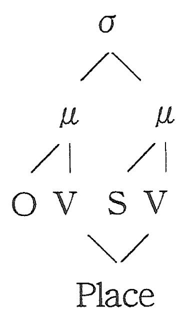
All morae dominating the same Place node must be dominated by the same syllable. Alderete (1995: 38)

In short, this constraint requires that the output of a Dorsey's Law sequence OVSV be tautosyllabic including all the consonants and vowels, just like a long vowel (O and S, needless to say, are a voiceless obstruent and a sonorant, respectively):

(8) a. Long Vowel



b. Dorsey's Law Sequence



Thus, OVSV is regarded as a single heavy syllable with two moras. The other constraint he assumes is Clements's (1990) Sonority Sequencing Principle, as defined in (9):

(9) Sonority Sequencing Principle (Son Seq)

Between any member of a syllable and the syllable peak, only sounds of higher sonority rank are permitted. [underlined by S.T.]

Clements (1990: 285), Alderete (1995: 38)

According to this constraint, a sonority curve must be as near to a 'mountain' as possible within a syllable, and any deeper 'valley' in the domain increases unacceptability. Then, the set of these two constraints, where Syll–Place is ranked higher than Son Seq, ensures the desired output of *hiperés* 'to know S43: 40, 71, M79: 26, M89: 154, M93: 111' provided that they are violable (but their violations must be minimal), as illustrated below:

(10)

/hipres/	Syll-Place	Son Seq
a. x x x xx x xx xx xx hi . pe . res	*!	
b. x x x x x x xxxx hipi . res		* *! *
c. x x xxx xxx xxxx ☞ hi . peres		*

Here, only relevant segments are represented by sonority grids. Candidate (10a) suffers from a crucial violation of Syll-Place in that its two vowels, though dominating the same Place node, are parsed heterosyllabically. Candidate (10b) violates Son Seq, since it contains a deep sonority valley within a tautosyllabic sequence *hipi*. This point neatly captures the basic fact that vowel copying is rightward as in (10c) and not leftward as in (10b). Candidate (10c) also involves a violation of Son Seq in the tautosyllabic domain *peres*, but since its violation is minimal (less serious than (10b)), it proves to be an optimal output.

Alderete's idea that the Dorsey's Law sequence of voiceless obstruents and sonorants should belong to the same syllable is also supported by Hayes's (1995) account of this phenomenon. Hayes (1995: 361-362) adopts the following formulation of Dorsey's Law in order to capture the accentual facts of Winnebago (see section 3.2.3.3 for his treatment of accent), where not only the vowel but also the sonorant are assigned moras underlyingly:

(11) Hayes's Formulation of Dorsey's Law

```
      σ                σ    σ
      | \              |    |
      μ   μ            μ    μ
     /|   |           /|   /|
    O S   V   →      O V  S V
```

As is evident from (11), he considers the underlying sequence concerned as tautosyllabic (although it becomes heterosyllabic after the application of the rule); that is, a Dorsey's Law sequence is a single heavy syllable at the stage of stress assignment, which in principle is the same position as Alderete's and also as Halle and Idsardi's (1995).

Alderete's constraint-ranking account might appear to be appealing, but the assumption of syllable structure in (6) has crucial problems in both empirical and theoretical respects, as I will argue in section 3.1.3.2. In addition, the two vowels in the Dorsey's Law sequence must share the Root node, since they share manner features as well as place features (section 3.1.5.) In the following section, I will put forward a different account of Winnebago syllable structure, claiming that the Dorsey's Law sequence of [voiceless obstruents + sonorants] be heterosyllabic.

3.1.3. Syllable Structure and Phonotactics in Winnebago

3.1.3.1. The General Sonority Hierarchy and the Dispersion Principle

Before discussing the precise mechanism of Dorsey's Law, we will examine how syllabification applies in this language. Unlike (6), I assume that the basic syllable affiliation of consonant clusters should be as in (12):

(12) The Syllabification in Winnebago

a. Tautosyllabic clusters: sg / ps

b. Heterosyllabic clusters: p . r / b . r

According to (12), either voiceless or voiced obstruents followed by sonorants are heterosyllabic clusters, whereas other clusters (voiceless obstruents followed by either voiced stops or voiceless fricatives) belong to the same syllable. Since I will explain in section 3.1.3.2.3 why the sequence of [voiceless obstruents + voiced fricatives] forms a systematic gap (e.g. **pz*), I omit it from our discussion for the time being. For voiceless obstruents followed by voiceless stops, see section 2.5.2 and note 25.

A formal account of this syllabification proceeds in the following way. First, I propose the General Sonority Hierarchy in Winnebago, which is somewhat different from, and more elaborated than, Alderete's sonority scale in (4a). It was also discussed in section 2.5.4 and repeated below as (13):

(13) The General Sonority Hierarchy in Winnebago

vowel (a > o > u > e > i >) > sonorant > voiced fricative > voiced stop > voiceless obstruent

Tanaka (1997a: 17, 1998: 336)

The higher rank of voiced fricatives than voiced stops is not at all unnatural; rather, as is well-known, Jespersen's (1904) version of the sonority theory is similar to (13) in that it ranks voiced fricatives over voiced stops and that it provides voiceless stops and voiceless fricatives uniformly with the lowest rank (see also Alderete (1995: 48) and Clements (1990: 285) for Jespersen's treatment). Given the rank in (13), typical underlying consonant clusters in Winnebago have the following sonority profile represented by grids:

(14) Sonority Profile

a. Tautosyllabic Clusters b. Heterosyllabic Clusters

a.		b.		
x	x	x	x	vowel
x	x	xx	xx	sonorant
x	x	xx	xx	voiced fricative
xx	x	xxx	xx	voiced stop
xxx	xxx	xxx	xxx	voiceless obstruent
sgV	psV	brV	prV	

I assume here that the glottal stop is treated as a voiceless obstruent, so that the sequence of [voiceless obstruents + the glottal stop] (e.g. *p'*, *k'*, *s'*, ...)] has the same sonority profile as *ps* in (14a).

Second, we follow Clements (1990, 1992) in assuming the Dispersion Principle as a general condition on syllabification. In other words, these clusters are syllabified in accordance with this constraint governing the well-formed (optimal) sonority contour of syllable structure:

(15) Dispersion Principle

a. The preferred initial demisyllable maximizes sonority dispersion.

b. The preferred final demisyllable minimizes sonority dispersion.

Clements (1992: 68, 1990: 304)

A 'demisyllable' here is defined as either the first or the second half of a syllable (i.e. (C)CV or VC(C)), and 'sonority dispersion' as the sonority distance between the segments.[2] Thus, "the sonority profile of the optimal syllable type rises *maximally* from the beginning to the peak, and falls *minimally* from the peak to the end. ... the overall dispersion of sonority values is (in the optimal case) maximized in the first half of the syllable, and minimized in the second half" (Clements (1992: 68)). In short, the initial part of a syllable tends to form a sharp and steady rise in sonority, while the final part favors a gradual drop in sonority.

This principle may as well be interpreted as reflecting the general tendency that a vowel must be highlighted by making the onset consonant as lower in sonority as possible, at least in the initial part of a syllable. Thus, in strict terms, 'sonority dispersion' is meant as 'the distance of grid values between the pairs of segments within a demisyllable.' For instance, the sonority dispersion of the consonant clusters in (14) is illustrated as in (16):

(16) The Sonority Dispersion of the Clusters in (14)

a. sgV	gV: 3	>	sg: 1
psV	sV: 4	>	ps: 0
b. brV	rV: 1	<	br: 2
prV	rV: 1	<	pr: 3

In (16a), the vowel-consonant distance of grid values is greater than the consonant-consonant one, so that the sonority dispersion of each initial demisyllable can be maximized as a whole in accordance with (15a). That is why these two clusters must be tautosyllabic and are syllabified into the onset position (i.e. *sgV* and *psV*). On the other hand, in (16b), the grid distance between the two consonants is greater than the one between the vowel and the preceding consonant, so that the vowel sonority would not be made prominent relatively (the sonority dispersion would not be maximized) if *br* and *pr* formed the onset of each syllable. In other words, tautosyllabic sequences like **brV* and **prV* would violate (15a) and highlight not the vowels but the sonorant consonants. Therefore, it follows that only the sonorants are syllabified into the onset position and that the obstruents in (16b) must be heterosyllabic (i.e. *Vb . rV* and *Vp . rV*). But it is still doubtful whether *b* and *p* are equally syllabified into the coda of each preceding syllable. Syllabifying *b* into the coda is indeed licensed because the dispersion of *Vb* as a final demisyllable is not maximized (its distance value is 3), but the dispersion of *Vp* is maximized (its value is 4); namely, voiceless obstruents in coda position would violate (15b), and only voiced obstruents can be syllabified into the coda position on the relevant level of the Winnebago Lexicon (i.e. on the lexical, cyclic level). Consequently, voiceless obstruents before sonorants cannot be syllabified into the following onset (by (15a)) or the preceding coda position (by (15b)), and remain floating just like stray segments. That is why a V slot is inserted by a highly-general requirement that a syllable must have its own nucleus, which should be called the principle of Prosodic Headedness: this is the true motivation of the application of Dorsey's Law. In short, Dorsey's Law is a repair strategy to resolve a violation of a syllable structure condition of high generality.

The processes discussed so far concerning V-insertion can be summarized as in (17):

(17) Dorsey's Law as a Repair Strategy

```
x    x       x   x       x     x       x   x   x     vowel
x   xx       x  xx       x    xx       x   x  xx     sonorant
x   xx       x  xx       x    xx       x   x  xx     voiced fricative
x   xx       x  xx       x    xx       x   x  xx     voiced stop
x  xxx      xx  xx       x  x xx       x  xx  xx     voiceless obstruent
*V . prV  → *Vp . rV  → *V. p . rV  →  V. pV. rV
                                           \ |
                                           Root
```

The inserted V slot must have phonetic features, of course, by the requirement of Full Interpretation, another general principle. This is done by the application of leftward spreading of the Root node, so that the place and manner features of the inserted vowel is identical with those of the following vowel. The reason why the direction is leftward is that it is a kind of assimilation process whose unmarked direction is leftward in the case of gemination (total assimilation) and place assimilation (partial assimilation), as is well-known, although the unmarked direction of voicing assimilation is rightward.

In the following sections, I will present several pieces of evidence for the syllabification of the clusters in (12) and for our account of Dorsey's Law on both empirical and theoretical bases.

3.1.3.2. Evidence and Advantages

3.1.3.2.1. Distributional Asymmetry

The first argument for my account of Winnebago syllable structure is about the distributional asymmetry of consonant clusters. Recall in (12) that the cluster of [voiceless obstruents + voiced stops] or [voiceless obstruents + voiceless fricatives] is tautosyllabic while that of [voiced obstruents + sonorants] is heterosyllabic (repeated below as (18)):

(18) a. Tautosyllabic clusters: sg / ps

b. Heterosyllabic clusters: p . r / b . r

This syllabification is supported by the following distributional facts. First, the sequence of [voiceless obstruents + voiced stops] appears either word-initially or word-medially as below:

(19) Voiceless Obstruent + Voiced Stop

a. Word-initial Position

sgáač	'play M79: 31, M93: 117'	šǰáak	'warm M93: 117'
xgąąsák	'energetic M93: 117'	xǰaaną́ne	'yesterday M89: 152, M93: 117'

b. Word-medial Position

hosgáč	'playground M89: 152'	hišǰasú	'eye S43: 57, M79: 28'

bagáaxge 'chicken S43: 35' hoixį́į 'full S43: 78'

Second, this is also true for the sequence of [voiceless obstruents + voiceless fricatives]:

(20) Voiceless Obstruent + Voiceless Fricative

a. Word-initial Position

psįįpsį́č 'small change M93: 117' pšoopšóč 'fine M93: 117'

ksáač 'stiff M93: 117' kšée 'apple M93: 117'

b. Word-medial Position

heepšį́ 'to sneeze S43: 70' nįįpšą́ną 'he swam WE82: 309'

boiksáp 'I come to M93: 119' mįįkšą́ną 'he lay down WE82: 309'

Finally, however, the remaining cluster of [voiced obstruents + sonorants] occurs only word-medially:

(21) Voiced Obstruent + Sonorant (Word-medial Position Only)

haračábra 'the taste M79: 28' hoočą́gra 'the Winnebago M79: 27'

wanįgnį́k 'little bird M89: 150' wąągwášoše 'brave man S43: 57, 125'

waruǰrá 'the food S43: 59' peeǰnį́ 'whiskey M89: 150'

hirawáhazra 'the license M79: 28' nųųǧrá 'the ear S43: 64'

hinųgwáček 'young woman, virgin S43: 42, 57'

The limited behavior of these clusters may be related to the fact that they are usually seen in derived environments.

The asymmetry of cluster distribution in (19)-(21) requires that the three types of clusters be provided with the syllable structure in (22):

(22) The Syllable Structure of the Three Types of Clusters

a. (V) . sgV / (V) . psV

b. Vb . rV

When voiced obstruents are located before sonorants, they must be syllabified into the preceding coda position as in (22b), and that is why they never appear in word-initial position because there is no more preceding syllable word-initially. The clusters in (22a), however, can stand word-initially or word-medially because they are tautosyllabic. Needless to say, the distributional asymmetry found in the three types of clusters cannot be accounted for by the syllabification in (6).

3.1.3.2.2. Triconsonantal Clusters

The second evidence for the syllabification in (22), or particularly for the claim that only voiced obstruents are licensed in coda position on the lexical level, is found in the following forms with triconsonantal clusters, which also appeared as (55) in section 2.6.1:

(23) a. gúuč 'to shoot' / s'a 'repeatedly' / guuǰs'á 'to shoot repeatedly'

b. gišíp 'to fall' / šgų̨nį 'must (dubitative)' / gišibšgų́nį 'he must have fallen'

c. ką̨nák 'to marry' / sge 'may (uncertain)' / ką̨nągsgé 'he may have married'

cf. M93: 124

Triconsonantal clusters are rare and restricted cases in Winnebago, but we do find some: each of the derived forms in (23) has the configuration of [a voiced obstruent + a voiceless obstruent + the glottal stop (23a) or a voiced stop (23b, c)], whose occurrence is not unnatural according to the syllabification I propose. Since the onset position is said to license maximally two segments only, the existence of such clusters are not accounted for by other syllabification possibilities such as the one in (6).

Phonetically, however, these words surface as *guučs'á*, *gišipšgų́nį*, and *ką̨nąksgé*, with the voiced coda obstruents devoiced. This is because they violate the Coda Condition and become stray on the optional postlexical level, undergoing stray neutralization and stray adjunction on the obligatory postlexical level (section 2.6.1). Note also that the violations of the Coda Condition are not amended by intrusive schwa because each coda position is not followed by a sonorant. In sum, these triconsonantal clusters and their surface forms can only be given a natural account if the present hypothesis on syllabification in (22) is adopted.

3.1.3.2.3. Systematic Gap

As mentioned in section 3.1.2, we do not observe the cluster of voiceless obstruents followed by voiced fricatives in Winnebago, and Alderete (1995: 34) ascribes the systematic gap of the cluster to the sonority jump of two grids across syllables, just like the Dorsey's Law sequence. The sonority profile of the two sequences is represented in (4b), repeated here as (24) (here,][indicates a syllable boundary):

(24) Alderete's Sonority Profile of Ill-formed Clusters

	x		x	sonorant · voiced fricative
	x		x	voiced stop
x	x	x	x	voiceless obstruent
*p	r	*p	z	
C][C		C][C		

Their anomalous nature as a heterosyllabic cluster indeed seems to be represented explicitly by the grids, but Alderete's sonority scale and profile alone does not explain the difference between the two, as it stands: the former cluster is broken up by epenthesis while the latter forms a systematic gap. Particularly, the latter cluster would appear in onset or coda position according to Alderete's prediction, or he would need another syllable structure condition prohibiting the sequence in the same syllable, as well as Sonority

Scale (4a), Syllable Contact (5), Sonority Sequencing Principle (9), and the like.

My account of the difference, on the other hand, is straightforward on the assumption of the Dispersion Principle and the General Sonority Hierarchy only. Let us consider the sonority profile in (25), which is based on the hierarchy in (13):

(25) a. The Sonority Profile of Ill-formed Clusters

x	x	vowel
xx	x	sonorant
xx	xx	voiced fricative
xx	xx	voiced stop
xxx	xxx	voiceless obstruent
prV	pzV	

b. Dispersion Values

prV	rV: 1	<	pr: 3
pzV	zV: 2	=	pz: 2

In the former case of the Dorsey's Law sequence, the initial voiceless obstruent *p* cannot be tautosyllabic with the following vowel, because the consonant-consonant dispersion is greater than the consonant-vowel one, which means that the sonority dispersion of the initial demisyllable *prV* is not maximized and violates the Dispersion Principle in (15a) (hence, the sonority is prominent not of the vowel but the sonorant consonant). But the voiceless obstruent also violates the Dispersion Principle in (15b) if it is syllabified into the preceding coda position. It is this dilemma with respect to syllabification that results in vowel epenthesis, as discussed in 3.1.3.1. In the latter case of the systematic gap, on the other hand, the cluster does not have to be heterosyllabic, since it is not the case that the consonant-consonant dispersion is greater than the consonant-vowel one. In fact, they are equal to each other, as shown in (25b).

That is, there is no violation of the Dispersion Principle in (15a), and yet the sonority of the vowel is no more prominent than that of the sonorant consonant, in spite of the fact that the vowel must 'relatively be the most prominent' within a syllable: another type of dilemma, with respect to syllable sonority. That is why the cluster of [voiceless obstruents + voiced fricatives] constitutes a systematic gap in Winnebago.

3.1.3.2.4. Morpheme Boundary and Syllabification

Besides Alderete (1995) and Hayes (1995), there is another approach to the mechanism of Dorsey's Law based on the idea that the cluster in question is tautosyllabic. Following Saddy (1984), Steriade (1990: 389) observes that "Dorsey's Law does not apply to heteromorphemic VC][CV sequences." For example, the heteromorphemic /kną/ sequence in /wąąk-nąk-ga/ does not become [kąną] (*wąągną́ka* 'that man (sitting) M79: 27, M81: 342, M93: 111'), while the tautomorphemic /kną/ of /hiruknąną/ does (*hiruką́nąną* 'boss M81: 342, M93: 111–112'), undergoing Dorsey's Law. According to her, this is due to the difference of syllabification, which is sensitive to morpheme structure (i.e. cyclicity): before the application of epenthesis on the relevant cycle, the former example is syllabified as [wąąk . nąk], respecting the previous cycle's syllabification of *k* in coda position, while the latter as [hi . ru. kną . ną] from the very first. In short, Dorsey's Law affects only tautosyllabic onset clusters in her analysis.[3]

This account also works out in the following seemingly-problematic cases where, unlike *wąągną́ka*, morpheme boundaries do not agree with syllable boundaries. In Winnebago, there are two prefixes consisting of a single obstruent consonant, which forms an obstruent-sonorant cluster in word-initial position when followed by a sonorant-initial stem. Such words were given in (1a), repeated below as (26) :

(26) The Cluster of /O-VSV/

ša̲waší 'you dance M89: 151'	(< /š-waši/)	cf. waší	'to dance M89: 151'
šu̲rugás 'you tear M89: 151'	(< /š-rugas/)	cf. rugás	'to tear M89: 151'
ku̲rušíp 'to pull down one's own S43: 45, M89: 151'	(< /k-rušip/)	cf. rušíp	'to pull down S43: 45, M89: 151'
ka̲račgą́ 'to drink one's own M89: 151'	(< /k-račgą/)	cf. račgą́	'to drink M89: 149, 151'

Since each derived form on the leftmost column contains a morpheme boundary in the underlying representation, the cluster might not appear to be made tautosyllabic (hence vowel insertion would not occur) if morpheme boundaries simply corresponded to syllable boundaries. This is not the case, of course. Steriade (1990: 395) notes that "a bare C morpheme cannot be independently syllabified, since Winnebago syllables must contain vowels: the C remains therefore syllabically stray until it can be adjoined to an existing syllable." This is what happens in the case of (26), where the initial voiceless obstruent is syllabified into the following onset and Dorsey's Law applies even across the morpheme boundaries.

Unfortunately, however, her approach to Dorsey's Law suffers from a certain problem, insofar as it is based on the cyclic syllabification respecting the information on a previous cycle. In fact, if the syllabification on the first cycle were carried over to the following cycle in such a way, we would miss a significant generalization on the distributional facts discussed in 3.1.3.2.1:

(27) The Cluster of /VC-CV/

nį́įp 'to swim'	/ nįįpšą́ną 'he swam'	ną́ąk 'to run'	/ nąąkšą́ną 'he ran'
gų́ųs 'to teach'	/ gųųsšą́ną 'he taught'	mį́įk 'to lie down'	/ mįįkšą́ną 'he lay down'

WE82: 309, 310

Such biconsonantal clusters as the ones in (27) are syllabified heterosyllabically, because the voiceless obstruents occupying the coda position on the first cycle remain the same on the second cycle, just like the case of *wą́ąk / wąągną́ka*. However, if the prediction held true, we would miss the significant generalization of the distributional asymmetry in section 3.1.3.2.1: it could not give any principled and uniform account of why such clusters as in (27) can occur either word-initially or word-medially, as shown in (20), while such clusters as in *waagnaka* can occur only word-medially, as given in (21). Moreover, it also could not explain why the coda obstruents in (27) do not undergo voicing, or why the voicing rule does not apply before non-sonorants (cf. note 3). Instead, the clusters in (27) must be tautosyllabic, or resyllabified together into the following onset on the second cycle.

It thus follows that Steriade's analysis attributing the (non-)application of Dorsey's Law to the syllabification based on cyclic information is not adoptable, although it is true that syllabification itself is cyclic. The most serious problem with the analysis lies in the assumption that a Dorsey's Law sequence is tautosyllabic. It is much more natural to argue that epenthesis applies precisely because the cluster is heterosyllabic and the stray segment needs a vowel nucleus.

3.1.3.2.5. Dorsey's Law in Early Winnebago

The fifth argument for the proposed syllabification is based on the historical development of Dorsey's Law. Hayes (1995: 356) observes the possibility that diachronically, the vowel copying phenomenon may have begun in word-initial position, adopting Miner's (1989: 167) suggestion that "in fact Dorsey's Law affected, first, words with *initial* obstruent-resonant clusters." Although this development has not yet been fully evidenced as a historical fact in the literature, my proposed syllabification indicates that it is highly likely.

I assume that Early Winnebago licensed either voiced or voiceless obstruents in coda position; in other words, there was no effect of the Dispersion Principle in (15b) in the final demisyllable lexically (but probably its effect was on the postlexical level). The Dispersion Principle in (15a) was present, of course. If this is the case, Dorsey's Law sequences are syllabified differently between word-initial and word-medial positions, as illustrated below:

(28) a. Word-medial Position: Vp. rV

b. Word-initial Position: *p . rV

In those days, voiceless obstruents could appear with the following sonorants in onset position, just like the Present-Day Winnebago, as was banned by (15a). Word-medial voiceless obstruents, then, could be syllabified into the preceding coda position because of the absence of the (15b) effect, as in (28a). Those in word-initial position, however, could not help becoming stray and undergoing vowel insertion, simply because there was no room for syllabification. In this way, the lack of (15b) on the lexical level must have brought about the positional difference in the emergence of Dorsey's Law. Note, however, that the syllabification in (6) (i.e. Alderete's (1995) or Hayes's (1995) assumption) does not provide any principled account for the positional difference of the Dorsey's Law development, since it hypothesizes that the cluster is tautosyllabic.

In section 3.1.4, I will refine and elaborate the account here in more detail on the context of considering the diachronic change of syllable structure from Proto-Winnebago (i.e. Winnebago-Chiwere, outlined in section 1.1) through

Early Winnebago to Present-Day Winnebago. I will also shed light on the relation between Dorsey's Law and intrusive schwa in both synchronic and diachronic respects.

3.1.3.2.6. Extrametricality and the Strict Layer Hypothesis

The final evidence I will adduce below is indirect and theory-internal, but it is necessary to mention it in order to show that the syllabification I have been arguing for is consistent with the metrical structure I will propose in section 3.2.4.1. In other words, since the metrical structure I will propose for Winnebago have independent motivations as discussed in section 3.2.4.2, the coherence of the two, in turn, gives support for the syllabification I have presented so far.

As demonstrated in section 3.2.4.1, I assume that Winnebago has left-dominant feet, initial-foot extrametricality, and the upper left-dominant constituent. This is exemplified in (29) by invoking the metrical structure of *hirakórohò* 'you prepare HWE80: 128' and *kereǰų́sep* 'Black Hawk M79: 30, M89: 154':

```
(29) a.          (*    .)                 (*    .)                (*        )
        <(*   .)> (*    .)       <(*   .)>   (*    .)      <(*   .)> (*   .)  (*)
          σμ  σμ    σμ  σμ         σμ  σμ   σμ σμ  σμ        σμ  σμ  σμ σμ  σμ
          hi  ra  k ro  ho   →  *hi  ra   ko̲ ro  ho   →    hi  ra  ko̲ ro  ho

     b.    (*        )           (*        )                (*   .)
           (*   .) (*)           (*   .) (*)         <(*   .)>(*   .)
            σμ  σμ   σμ          σμ  σμ  σμ  σμ        σμ  σμ  σμ  σμ
          k  re  ju  sep   →   *ke̲  re  ju  sep   →    ke̲  re  ju  sep
```

Tanaka (1996, 1997a, b)

In (29a), whose Dorsey's Law sequence is located word-medially, the voiceless obstruent *k* is made stray by the Dispersion Principle and thus is rescued by the inserted vowel. But the resulting syllable violates the Strict Layer Hypothesis because of the absence of its higher prosodic structure, so that the ill-formedness is repaired by reconstruction (i.e. the reapplication of metrification).[4] Now let us consider the derivation in (29b), where a Dorsey's Law sequence occurs word-initially. Since the word-initial voiceless obstruent *k* is stray for the same reason as (29a), it makes initial-foot extrametricality unapplicable due to the Extrametricality (Peripherality) Condition.[4] Other processes are the same as in (29a), which involve the application of Dorsey's Law and the reassignment of metrical structure to repair the violation of the Strict Layer Hypothesis.[5]

A crucial point to make here is the following. Concerning the relation between syllabification and metrification, it is important to note in (29b) that if a Dorsey's Law sequence were tautosyllabic, accent would incorrectly falls on the syllable *sep*, as shown below:

(30) *ke re ǰų́ sep

```
                (*)                     (*)
   <(*     .)>  (*)      <(*   .    .)> (*)
    σμ   σμ    σμ         σμ  σμ   σμ   σμ
   kre   ǰų    sep   →    ke  re   ǰų   sep  (no violation)
```

In this case, initial-foot extrametricality does apply because of the tautosyllabicity of the voiceless obstruent with the following SV. The representation after the application of Dorsey's Law, then, involves no violation of the Strict Layer Hypothesis, since the inserted position is within an extrametrical constituent that is invisible to the constraint (so the lack of higher prosodic structure does not pose any problem with the extrametrical foot). Due to the invisibility, the foot in question does not violate Structure Preservation, either, even though epenthesis results in a ternary constituent.

Thus, there would be no motivation of reconstruction, and an erroneous accent pattern would be produced.[6]

To conclude, it is the heterosyllabic syllabification of a Dorsey's Law sequence that causes the violation of the Strict Layer Hypothesis and triggers the concomitant reapplication of foot assignment, as in (29b).

3.1.4. Gestural Overlap: The Historical Origin of Dorsey's Law

My account of Dorsey's Law, which has been advocated so far, is in principle based on an interaction between constraints on syllabification and repair strategies. The repair strategies in question involve two processes, V-insertion and leftward spreading, which are triggered by the Prosodic Headedness (syllable nucleus) requirement on a stray consonant and the Full Interpretation requirement on an empty V slot (section 3.1.3.1). The reason that the application of spreading is leftward can be related to the fact that it is the unmarked directionality for total or partial assimilation in place of articulation, unlike voicing assimilation. Dorsey's Law is thus viewed here as a kind of total assimilation or vowel harmony on the lexical level.

Concerning an account of Dorsey's Law, there is another possibility, as maintained by Steriade (1990), that it is simply a gestural phenomenon on the phonetic level, not a lexical process on the phonological level like the one above. Her account can be summarized in the following way. First, recall her assumption reviewed in section 3.1.3.2.4 that a Dorsey's Law sequence is a tautosyllabic cluster in that a voiceless obstruent and a sonorant together constitute a complex onset. Furthermore, she follows Browman and Goldstein (1986, 1989, 1990, 1992) in assuming that a phonological segment is phonetically a gesture with internal duration and that <u>within a syllable</u>

consonantal gestures are superimposed on a vowel gesture. In other words, speech is a domain where vocalic and consonantal gestures are overlapping in duration with one another. For example, the syllable [pra] is represented as in (31) in this gestural model:

(31) The Representation of [pra]

```
      Tier                              Gestures
                                            a
   Tongue Body:       [--------------------------------]
                                r
   Tongue Tip:            [-------]
                            p
   Lips:              [-------]
```

Here, each segment as a gesture has its own internal duration represented as [---], and the three are overlapping within the domain of a syllable. Since a Dorsey's Law sequence is tautosyllabic, (31) is the very example of such a case.

Now, it is important to note that phonological processes are considered as changes in timing between gestures. Thus, Dorsey's Law can then be viewed as just a change in the relative timing of the three gestures, or the effect of a single timing adjustment. In particular, it is a gestural delay in the onset of the sonorant that appears to create a copying phenomenon of the following vowel between the complex onset, as Steriade (1990: 390–391) observes. The sequence of [para], then, is represented as in (32):

(32) The Representation of [para]

```
      Tier                              Gestures
                                            a
   Tongue Body:       [--------------------------------]
                                            r
   Tongue Tip:                        [-------]
                            p
   Lips:              [-------]
```

Within this framework of Articulatory Phonology, a vocalic gesture is interpreted as a monosyllable only if all the superimposed consonantal gestures are peripheral, as in (31). Since Dorsey's Law creates a sequence where a consonantal gesture has come to be non-peripheral as in (32), it automatically turns a monosyllable into a disyllable.

This approach might at first appear to be appealing, but a crucial problem arises when we take intrusive schwa into consideration as well as Dorsey's Law. It is intrusive schwa, instead of Dorsey's Law, that would be represented as in (32) if such an approach were adopted; or a clear distinction could not be drawn by the gestural representation in (32) between the two processes, which are somewhat similar but different in various respects. Before arguing for this claim, let us examine again some basic examples of intrusive schwa, which, unlike Dorsey's Law, occurs between a <u>voiced</u> obstruent and a sonorant consonant:

(33) Examples of Intrusive Schwa

a. gr, gw, gn:

hihagərégi	'on top S43: 13, 60'	hoočą́gəra	'the Winnebago M79: 27'
wa'ųną́ągəra	'what they want S43: 54'	saanį́gəruǰįp	'unbalanced S43: 125'
wiǰugəwą́ąk	'male cat S43: 57'	wąągəwášoše	'brave man S43: 57, 125'
hinųgəwáček	'young woman, virgin S43: 42, 57'	wiǰugənį́k	'little cat WE82: 313'
wanįgənį́k	'little bird M89: 150, S43: 68'	wanįgənį́gəra	'the little bird M89: 150'
wąąkšígənągu	'path (Indian Road) S43: 58'		
wąągəną́ka	'that man (sitting) M79: 27, M81: 342, M93: 111'		

b. br, bw:

hąąbərá	'the day, the light S43: 18, 40, 65'	haračábəra	'the taste M79: 28'
čeebəwáhi	'he consumed something S43: 34'		

c. ǰr, ǰw, ǰn:

waruǰə̱rá	'the food S43: 59'	waruǰə̱róožu	'dish of food S43: 59'
hi'ąǰə̱rá	'the father S43: 78'	peeǰə̱wáč	'locomotive cf. M89: 150, M93: 123'
peeǰə̱nį́	'whiskey M89: 150'	waraǰə̱nįą́nąga	'you do not eat and S43: 53'

d. zr, zn:

hirawáhazə̱ra	'the license M79: 28'	hiperézə̱roogų	'he wanted to know S43: 40'
woogų́zə̱ranągə̱re	'this creation S43: 48, 52'	hirapérezə̱nįnąąną	'you would not know S43: 53'

e. gr:

nųųǧə̱rá	'the ear S43: 64'	nųųǧə̱rínįįk	'I am deaf S43: 64'

In addition to their structural description, there are other differences between this rule and Dorsey's Law. First, as was discussed in section 2.2 and elsewhere, Dorsey's Law is an obligatory lexical rule, while intrusive schwa is an optional postlexical rule. In fact, it is a phonetic process, as Miner (1979: 27, 1989: 150, 1993: 112) argues for the existence of this rule while he usually does not write the schwa in his phonemic transcription. This is also true for Susman's (1943) transcription. Second, as (34) shows, there is a crucial difference in accent computation between Dorsey's Law cases and intrusive schwa cases (the data sources of intrusive schwa are taken from (33)):

(34) The Difference in Accent Location

Dorsey's Law		Intrusive Schwa	
mąąšá̱rač	'you promise S43: 106, HWE80: 127, M89: 154'	peeǰə̱wáč	'locomotive cf. M89: 150, M93: 123'
boopé̱res	'to sober up M89: 154'	hąąbə̱rá	'the day, the light S43: 18, 40, 65'
nįįpšá̱nąge	'because he swam cf. S43: 64'	wąągə̱ną́ka	'that man (sitting) M79: 27, M81: 342'
hanįpšá̱ną	'I swam WE82: 309, 310'	waruǰə̱rá	'the food S43: 59'
ranįpšá̱ną	'you swam WE82: 309, 310'	wiǰugə̱nį́k	'little cat WE82: 313'
hirakó̱roho	'you prepare, dress HWE80: 128'	hinųgə̱wáček	'young woman, virgin S43: 42, 57'

Winnebago accent usually falls on the third mora counting from the beginning of a word with more than two moras. As is clear in (34), the vowel inserted by Dorsey's Law is visible to, and counted by, accent assignment, whereas the one inserted by intrusive schwa is not. In fact, it is only a Dorsey's Law vowel that bears accent in the third-mora position of a word. This difference in accent visibility between the two types of vowels requires epenthesis to apply on the two levels before and after accent assignment, or in this case, the level distinction between the lexical (phonological) and postlexical (phonetic) rule applications. Finally, intrusive schwa can be thought of as a phonetic version of Dorsey's Law; namely, it may be either a process of inserting a schwa or a process of copying the following vowel on the phonetic level, as Miner (1979: 27) notes that the inserted vowel concerned is "a barely audible intrusive vowel having more or less the quality of a short version of the following full vowel."

Taking into account these phonetic properties of intrusive schwa as compared to Dorsey's Law, we can conclude that it is not Dorsey's Law but intrusive schwa that would suggest a gestural treatment like 'the effect of a timing adjustment' in (32), if we adopted such a framework. However, the timing adjustment in (32) leads the consonantal gesture (i.e. the tongue tip gesture) to be non-peripheral, which means that the sequence is disyllabic. If the intrusive schwa process were represented as in (32), this syllabification would contradict the fact that since the schwa never forms a syllable as in (34), the sequence is monosyllabic. Thus, Steriade's approach falls into a dilemma if (32) represents intrusive schwa; or if it represents Dorsey's Law, this approach does not account for intrusive schwa or draw a distinction between the two processes.

Needless to say, the gestural analysis in (32) suffers from a serious problem, from the very first, with its assumption that the Dorsey's Law cluster is tautosyllabic. As was demonstrated in sections 3.1.3.2.1–3.1.2.2.6, the sequences of both Dorsey's Law and intrusive schwa (e.g. *pra* and *bra*) must be heterosyllabic. Thus, her gestural model of Dorsey's Law within the framework of Articulatory Phonology can be said to be untenable in terms of the tautosyllabicity of the cluster as well as the lack of the distinction between Dorsey's Law and intrusive schwa. The latter criticism is also true for Alderete's (1995) and Heiberg's (1995) treatment of Dorsey's Law, since Optimality Theory does not assume the level distinction, either. Instead, the distinction is straightforward within the framework of Lexical Phonology: Dorsey's Law and intrusive schwa belong to the lexical and postlexical level, respectively, whose difference leads to the optionality in rule application and the invisibility in accent computation.

Then, one might ask what is the precise mechanism of the application of intrusive schwa (e.g. the trigger of this rule) as compared to Dorsey's Law. I assume that on the lexical level, coda consonants are licensed only if they are voiced obstruents as the Dispersion Principle in (15b) requires, but that the effect of the constraint is canceled on the postlexical level. This is because it is a lexical constraint on syllabification. Instead, the Coda Condition is effective on the optional postlexical level, which bans any consonants in coda position. Thus, intrusive schwa is a consequence of some repair strategies to amend violations of the following constraints including the Coda Condition, as shown in (35). The effect of the Coda Condition is optional, and when it works out, it makes the coda consonant stray, whose violation of Prosodic Headedness is repaired by V–insertion, as is the case with Dorsey's Law. The feature filling of the inserted empty V slot as required by Full Interpretation is done either by leftward spreading or by default value insertion.

(35) Derivations by Dorsey's Law and Intrusive Schwa

Levels & Rules	Derivations		Constraints
Underlying Level	/VprV/	/Vb-rV/	-
Lexical Level (Obligatory)			
Syllabification	V. p. rV	Vb. rV	Dispersion Principle
V-insertion	V. pV. rV	-	Prosodic Headedness
Leftward Spreading	V. pV. rV	-	Full Interpretation
	\\|		
	Root		
Postlexical Level (Optional)			
Resyllabification	-	V. b. rV	Coda Condition
V-insertion	-	V. bV. rV	Prosodic Headedness
Leftward Spreading	-	V. bV. rV	Full Interpretation
		\\|	
or		Root	
Default Value Insertion	-	V. bə. rV	

That is why Miner (1979: 27) describes this rule in an ambiguous way as "a slight schwa (or more precisely, a barely audible intrusive vowel having more or less the quality of a short version of the following full vowel) intervenes between the obstruent and the sonorant."

In contrast, when an underlying voiced obstruent is followed not by a sonorant but by a word boundary (i.e. it stands in word-final position), it devoices as in *péeč* 'fire M89: 150, M93: 123, 124,' *hą́ąp* 'day, light S43: 40, 66, M93: 123' *wą́ąk* 'man S43: 56, M79: 27, HWE80: 130, M81: 342, M93: 111,' *ną́ąp* 'hand S43: 71,' *ną́ąk* 'to run S43: 71,' *šóoč* 'foggy S43: 71' *rúuṡ* 'to take S43: 71,' *rúuš* 'to drop S43: 71,' *gį́įx* 'around S43: 71,' and so on. For this devoicing mechanism in coda position, see section 2.6.1.

The synchronic model of Dorsey's Law and intrusive schwa in (35), which is based on Lexical Phonology, has a significant advantage in terms of the historical development of Winnebago grammar. As Kaisse (1993: 344) states, the direction of movement of a rule over time has been correctly agreed among Lexical Phonologists to be 'upward' within the levels of a particular grammar: diachronically, sound changes begin as variable rules of phonetic implementation, are gradually grammaticalized as postlexical rules, and move into the Lexicon as they are incorporated into the grammar (see also Kiparsky (1984, 1988), Zec (1993)). In particular, it is natural to think that Dorsey's Law has been grammaticalized as an upward change of intrusive schwa whose application still remains on the postlexical level as well. This type of rule development is not a simple upward change but can be called a 'residual upward change.' As shown in (36a), my hypothesis is supported by Miner's (1979: 27, 1989: 167) comparison between Dorsey's Law sequences in Winnebago and their corresponding counterparts in Chiwere, a cognate language:[7]

(36) The Genesis of Dorsey's Law

a. Dorsey's Law Sequences and Their Cognates

Winnebago	Chiwere	gloss	correspondences
hoiké̱we	ugwé	'to enter'	kewe / gwe
wasų̱nų́	waθlų́	'to spit roast'	sų̱nų / θlų
ǰike̱ré	ǰiglé	'to become'	kere / gle
ke̱ré	glé	'to return'	kere / gle
pa̱rás	bláθge	'flat'	para / bla
ke̱repą̱ną	gléblą	'ten'	kere / gle, pą̱ną / blą

b. The Development of Synchronic Grammars

Types of Syllabification	DP (15a)	DP (15b)
Proto-Winnebago (Winnebago-Chiwere) Word-initial Position: /gre/ → gre → g^{ə}re Word-medial Position: /ǰigre/ → ǰi . gre → ǰig^{ə}re	Postlexical	Postlexical
Early Winnebago Word-initial Position: /kre/ → *k . re → kere Word-medial Position: /ǰikre/ → ǰik . re → ǰik^{ə}re	Lexical	Postlexical
Present-Day Winnebago Word-initial Position: /kre/ → *k . re → kere Word-medial Position: /ǰikre/ → *ǰi . k . re → ǰikere	Lexical	Lexical

In descriptive terms, as is clear from the examples in Chiwere, a Dorsey's Law sequence once consisted of a voiced obstruent and a sonorant in Proto-Winnebago (i.e. Winnebago-Chiwere, shown in (1) of section 1.1), to which intrusive schwa was allowed to apply on the postlexical level, as Miner (1979: 28) states that "[t]he cognates with CCV in other Siouan languages to which Winnebago fast sequences [i.e. Dorsey's Law sequences] correspond are generally phonetically C^{ə}CV." The inserted schwa was then established as a full lexical vowel copying the following one as the voiced obstruent became voiceless, while it remained as it was when preceded by the voiced obstruent which occurred across morpheme boundaries.

Theoretically, this development is expressed by the 'upward' movement of the effects of the Dispersion Principle, which gives a principled account for both Dorsey's Law and intrusive schwa in Proto-Winnebago, Early Winnebago, and Present-Day Winnebago. First, in Proto-Winnebago, the cluster of [a voiced obstruent + a sonorant] could appear in onset position lexically, because neither (15a) nor (15b) were effective on that level; instead, they held true on the postlexical level only in those days. Thus, the voiced obstruent became stray due to the postlexical effect of (15a) and was rescued by V-insertion (i.e. intrusive schwa) both word-initially and word-medially. Second, Early Winnebago is the stage at which (15a) was lexicalized and the voiced obstruent was restructured as voiceless in the underlying representations. Here, recall the discussion in section 3.1.3.2.5 and Miner's (1989: 167) remark that "in fact Dorsey's Law affected, first, words with *initial* obstruent-resonant clusters." This asymmetry is captured by the fact that in word-initial position, the voiceless obstruent could be syllabified neither into the following onset nor the preceding coda due to (15a) and underwent V-insertion (i.e. Dorsey's Law) on the lexical level. On the contrary, it could be syllabified into the preceding coda word-medially because of the lack of the (15b). However, the postlexical effect of (15b) forced it to become stray and to be amended by V-insertion (i.e. intrusive schwa). Lastly, (15b) was also lexicalized in Present-Day Winnebago, which allowed Dorsey's Law to apply regardless of the word-internal position of the cluster.

This is all about the genesis and development of Dorsey's Law, whose relation to intrusive schwa can be properly captured as an 'upward movement' of the Dispersion Principle in the model of Lexical Phonology.

3.1.5. The Interaction between Dorsey's Law and Other Segmental Processes

In addition to its apparent peculiarity of application as well as its relation to accent, syllable, and intrusive schwa, there is another reason why Dorsey's Law is so interesting: it often interacts with other segmental processes on the lexical level, as discussed before in sections 2.5.3 and 2.6.2 and summarized in (37). The examples in ii) are ones with Dorsey's Law sequences:

(37) The Interaction of Dorsey's Law with Other Lexical Rules

a. Nasalization

i) mą́ą 'earth S43: 79, M79: 28, M89: 149' (</maa/)
nį́į 'water S43: 123, M89: 149, 150' (</nii/)
wamąnų́ke 'thief M89: 149' (</wamanuke/)

ii) ką̲ną́k / *ka̲ną́k 'to marry M89: 149, M93: 124' (< /knak/)
sį̲nį́ / *si̲nį́ 'cold M79: 29, M89: 149' (< /sni/)
boopų̲́nųs / *boopú̲nųs 'to hit at random M89: 149' (< /boopnus/)

b. *e/a* Ablaut

i) wara-ré 'work! M89: 150' (< waré 'to work M89: 150')
taa-ną́ 'I could go M89: 150' (< tée 'I go S43: 79, M89: 150, M93: 123')
mąąčá-ire 'they cut a piece off M79: 29, M89: 150'
(< mąąčé 'to cut a piece off M79: 29, M89: 150')

ii) ka̲rá-ire / *ke̲rá-ire 'they leave returning M79: 29, M89: 150'
(< ke̲ré 'to leave returning M79: 29, M89: 150')
mąąpá̲ra-ną /*mąąpé̲ra-ną 'could slice thin M89: 150'
(mąąpé̲re 'to slice thin M89: 150')

c. Reduplication

i) gihuhú 'to swing its tail M89: 149' (< gihú 'to swing M89: 149')
hit'et'é 'to speak repeatedly S43: 9, 10, 47, M89: 149' (< hit'é 'to speak M79: 28')
mąąnį́nį 'to walk a little S43: 33' (< mąąnį́ 'to walk S43: 33')

ii) čį̲wįčį̲́wį / *čį̲wįwį́ 'sound causing vibration M79, 26, M89: 149'
(< čį̲wį́ 'sound M89: 149')

ša̱rašá̱ra / *ša̱rará 'bald in spots S43: 33, M79: 29, M89: 149'

(< ša̱rá 'bald S43: 33, M79: 29, M89: 149')

Recall that the first rule nasalizes any vowel preceded by an onset nasal, that the second turns the stem-final *e* into *a* immediately before certain suffixes, and that the third copies the final monosyllable of a base as its suffixal reduplicant. What is at issue is that the first and the second rules affect not only underlying vowels but also inserted ones as in ii) of (37a, b) and that the third rule copies a disyllabic sequence as a reduplicant as in ii) of (37c).[8] These rule interactions have been seen as evidence showing that Dorsey's Law is now a synchronic rule since the advent of Miner (1979), and the peculiarity of Dorsey's Law vowels must be accounted for in some way in a synchronic grammar of Winnebago.

Although reduplication is unambiguously ordered before Dorsey's Law as in (38c), the ordering might appear to be ambiguous in the other two cases: as shown in (38a, b), Dorsey's Law might be either preceded or followed by each of the rules (for the [−back] value of *a*, see section 2.5.3):

```
(38) a. i) ONV̨  (nasalization)      →  OV̨NV̨  (Dorsey's Law)
            |                             \|
           Root                          Root
            |                              |
          [+nas]                         [+nas]

       ii) OVNV  (Dorsey's Law) →  OV̨NV̨  (nasalization)
             \|                       \|
            Root                     Root
                                       |
                                     [+nas]
```

```
b. i)    OSa  (e/a ablaut)        →     OaSa  (Dorsey's Law)
          |                               \|
         Root                            Root
          |                                |
  [-high, -back, +low]            [-high, -back, +low]

   ii)   OeSe  (Dorsey's Law)  →      OaVa  (e/a ablaut)
          \|                              \|
         Root                            Root
          |                                |
  [-high, -back, -low]            [-high, -back, +low]

c. i) OSV OSV  (reduplication)  →  OVSV OVSV  (Dorsey's Law)
       |    |                        \|    \|
     Root  Root                     Root  Root

   ii) OVSV  (Dorsey's Law)     →  * OVSV  SV  (reduplication)
        \|                             \|    |
       Root                           Root Root
```

Unlike Miner's (1989: 149–150) ordering of Dorsey's Law after nasalization or *e/a* ablaut, there is a possibility in the present model that the former rule applies earlier than the other two, since the consecutive vowels share the same Root node as a result of leftward spreading.

One might claim that this ordering relation violates Hayes's (1986: 331) Linking Constraint, or more simply the effect of inalterability, which captures the fact that long segments with a binary structure (e.g. geminate consonants or long vowels) often resist the application of rules that would otherwise be expected to apply to them.[9] That is, under the hypothesis with this ordering, nasalization and *e/a* ablaut would exhibit unusual manner of application in the sense that they could apply to the doubly-linked structure created by Dorsey's Law. However, these two rules are 'quality' rules, which affect melodic (or segmental) features only and thus do not have to respect the Linking Constraint. It is only to rules referring to both 'quality' and 'quantity' (i.e.

melodic and prosodic features alike) that the Linking Constraint becomes relevant (Hayes (1986: 349)). Thus, this ordering relation is not at all unnatural.

But recall that *e/a* ablaut is subject to Structure Preservation and the Strict Cycle Constraint, which together are effective on the cyclic level (section 2.5.3), and that there is full evidence showing that the rule is ordered before reduplication (section 2.6.2). So it can safely be said that *e/a* ablaut is a cyclic rule ordered <u>before</u> Dorsey's Law. On the other hand, recall also that nasalization is a non-cyclic rule not subject to the Strict Cycle Constraint (sections 2.3.4 and 2.5.3) and that it must be ordered after syllable merger, which violates the Strict Layer Hypothesis (section 2.6.5). In other words, nasalization is a non-cyclic rule, which means that it applies <u>after</u> Dorsey's Law. To conclude, the ordering relations between Dorsey's Law and its interacted rules can be summed up in the following way:

(39) The Summary of Ordering Relations

a. (38aii): Dorsey's Law (Cyclic) → Nasalization (Non-cyclic)

b. (38bi): *e/a* Ablaut (Cyclic) → Dorsey's Law (Cyclic)

c. (38ci): Reduplication (Cyclic) → Dorsey's Law (Cyclic)

As mentioned above, the rule application in (38aii) does not violate the Linking Constraint because it affects a doubly-linked structure: nasalization, a type of 'quality' rule, is immune from the effect of inalterability.

3.2. Metrical Structure, Extrametricality, and Foot Weight

3.2.1. Mystery: A Long-Standing Ordering Paradox

We have so far been concerned primarily with segmental phenomena, or featural and prosodic structures below foot. This section is devoted to elucidating the pitch accent system of Winnebago which is directly related to prosodic structures above syllable: metrical structures. The usual assumption of Winnebago accent is that primary accent falls on the third mora from the initial end of a word with more than two moras and that subsidiary accent forms binary or ternary rhythms hereafter.[10] Our interest here is the location of primary accent, and this is simply illustrated in (40), which classifies the data in terms of the number of syllables and the syllable weight in word-initial position:

(40) The Location of Primary Accent

	Initial Heavy		Initial Two Lights	
1	zíi	'yellow M89: 152, M93: 117, 119, 120'	—	
	sgáa	'white M89: 152, M93: 117, 120'		
2	čii ną́k	'town M89: 152'	hi wą́x	'to ask M89: 152'
	boo ką́	'to knock over M89: 152'	wa ǰé	'dress HWE80: 118, M89: 152'
3	xǰaa ną́ ne	'yesterday M89, 152, M93: 117'	hi pi rák	'belt M79: 28, M89: 152'
	taa nį́ žu	'sugar M89: 152'	wa xi rí	'to squash M89: 152'
4	boo ką́ ga ǰą	'obviously knockdown M89: 152'	ha ra čáb ra	'the taste M79: 28'
	taa nį́ žu ra	'the sugar M89: 152'	ha są ǰé ǰa	'on the far side M79: 28'
5	wii rá gų šge ra	'the stars M79: 28, HWE80: 117'	ho ki wá haz ra	'the license M79: 28'

I will claim in section 3.2.3.1 that this generalization of primary accent on the third mora must be revised in light of certain types of data, but I basically adopt this assumption here to simplify the discussion, for it is sufficient for my purpose at present.

Before discussing the details of accentual phenomena and constructing an adequate descriptive generalization, I must mention a long-standing ordering paradox of accent location and Dorsey's Law which still remains unresolved. In short, generative studies on Winnebago accent since the early 1980s has been a history of 'paradox resolution'. The problem is that in some cases as (41a) accent falls on the third mora inserted by Dorsey's Law, which indicates that epenthesis precedes accent assignment, while in others as (41b) accent is shifted one mora to the right (i.e. it falls on the fourth mora) by the application of Dorsey's Law, which implies that accent assignment applies first:

(41) The Ordering Paradox of Accent and Epenthesis

a. Dorsey's Law → Accent Assignment

hirakóroho	'you prepare HWE80: 128'	hanįpšą́ną	'I swam WE82: 309'
ranįpšą́ną	'you swam WE82: 309'	hirupį́nį	'to twist M89: 154, M93: 111'
hoǰisą́ną	'recently M89: 154'	hačąkére	'with difficulty M89: 154'
hičakóro	'friend closer than brother S43: 35'	warečáwa	'twins S43: 35'
boopéres	'to sober up M89: 154'	haapúruč	'common elder M89: 154'
nįįpšą́ną	'he swam WE82: 309, 310'	nąąkšą́ną	'he ran WE82: 309'
gųųsšą́ną	'he taught WE82: 309'	rookéwe	'dress, paint face S43: 13, M79: 30'
waapórohi	'snowball making M79: 30'	waapóroporo	'snowball M79: 30'
reečáwa	'navel S43: 35'	mąąšárač	'you promise S43: 106, HWE80: 127, etc.'

b. Accent Assignment → Dorsey's Law

hikurunį́	'tangled M89: 155'	ruxuruké	'because he earns it S43: 64'
hosįnirá	'in the cold S43: 143'	ruxuruk'é	'he often earns it cf. S43: 65'
hošawažá	'you are ill HWE80: 125, M89: 155'	hakewehášge	'six times perhaps S43: 135'
rakerekǰą́ne	'you will return S43: 138'	rakerekǰą́nąheeną	'you will go home S43: 47'
hok'awanége	'so that he could come in L45: 6, Hg95: 156'		
hikorohó	'he prepares S43: 35, 48, M79: 30, HWE80: 128, M89: 155'		

Interestingly, in extreme cases as in (42), the paradox happens to occur word–

internally: accent falls on the fourth mora which is inserted by Dorsey's Law (Dorsey's Law → accent assignment), and yet the fourth-mora accent is taken to be shifted from the third by the Dorsey's Law application to the second mora (accent assignment → Dorsey's Law):

(42) Word-internal Paradox

giką̲nąką̲́nąp 'shiny M89: 155'   giką̲nąką̲́nąpšą̲ną 'it is shiny M89: 170

waki̲rikí̲rik 'slippery elm M89: 155'   waki̲ripá̲ras 'flat bug M79: 30, HWE80: 131, M89: 155'

waki̲ripó̲ropo̲ro 'spherical bug HWE80: 131, M89: 155'

They can be called cases of a 'word-internal paradox.' Such cases as in (41) and (42) are directly related to phonological opacity, and that is why they have been regarded as an important issue in both derivational and non-derivational frameworks.

In the history of generative studies, there have been roughly four types of attempts to give a uniform account of Winnebago accent and Dorsey's Law (or tackling this long-standing problem), although their paradoxical relation in question is often not addressed explicitly: 'accent-shift' analyses (Miner (1979, 1981, 1989), Hayes (1995)); 'restructuring' analyses (Hale and White Eagle (1980), Hale (1985), Halle and Vergnaud (1987)); 'constraint-ranking' analyses (Alderete (1995), Heiberg (1995)); and 'extrametricality' analyses (Tanaka (1996, 1997a, b)). Among these attempts, Miner (1979) is a pioneering work, where accent shift is assumed to be a crucial mechanism: it not only is a historical event but also work in the present accentual system. This is also the case with Miner (1989), a generative-grammatical version of Miner (1979) with the same spirit. In particular, he postulates that at the early stage of Winnebago, accent had been placed on the second mora of a word and that this accent was shifted one mora to the right after the establishment of

Dorsey's Law. He continues to claim that the present accentual system reflects this diachronic development. Thus, such words as in (41a) and (41b) with accent on the third and fourth moras, respectively, are derived in the following way:

(43) Miner's (1979, 1989) Accent-Shift Analysis

/hirakroho/	/hikroho/	/wakrikrik/	Underlying Representations
hirákroho	hikróho	wakríkrik	Accent Placement
hiráko̲roho	hiko̲róho	waki̲ríki̲rik	Dorsey's Law
hirakó̲roho	hiko̲rohó	waki̲rikí̲rik	Accent Shift

This account might seem to be a simple solution based on the historical facts, but in the case of words in (44a, b), it causes another ordering paradox between accent placement and Dorsey's Law:

(44) Another Paradox

a.

ke̲reǰų́sep	'Black Hawk M79: 30, M89: 154'	ša̲wažókǰį	'you mash hard M89: 154'
pa̲raǧų́čge	'information M89: 154'	xo̲roǰíke	'hollow M89: 154'
po̲ropó̲ro	'spherical M89: 155'	pa̲rapá̲ras	'wide M79: 29'
ki̲rikí̲ris	'striped, spotted S43: 33, 67'	ke̲reké̲reš	'colorful M79: 26'
ša̲rašá̲ra	'bald in spots S43: 33, M79: 29, M89: 149'		
čįwįčį́wį	'sound causing vibration M79, 26, M89: 149'		

b.

/kreǰųsep/		/kreǰųsep/	
kreǰų́sep	Accent Placement	ke̲reǰųsep	Dorsey's Law
ke̲reǰų́sep	Dorsey's Law	ke̲réǰųsep	Accent Placement
*ke̲reǰųsép	Accent Shift	ke̲reǰų́sep	Accent Shift

If accent placement applies before Dorsey's Law in the same way as (43), accent erroneously falls on the fourth mora; and if they apply in the reverse ordering, the correct output is obtained. However, this opposite ordering, in turn, does not account for the data in (41b) and (42), and Miner's apparent simple solution with accent shift falls into a dilemma, or another ordering paradox.

Thus, Miner (1979, 1989) stipulates that historically, accent was assigned to the first mora of a word only if it began with the Dorsey's Law sequence. In other words, the initial Dorsey's Law sequence was considered as a single heavy syllable having two moras, which is much the same approach as those examined in section 3.1.2. This amendment indeed allows him to derive accent correctly in the case of (44a) without changing the ordering of the two rules concerned:

(45) a. The Initial Dorsey's Law Sequence as a Heavy Syllable

/kreǰųsep/	
kréǰųsep	Accent Placement
ke̲réǰųsep	Dorsey's Law
ke̲reǰų́sep	Accent Shift

b. Empirical Problem

/hikrooke/		/hikrooke/	
hikróoke	Accent Placement	hiko̲rooke	Dorsey's Law
hiko̲róoke	Dorsey's Law	hikó̲rooke	Accent Placement
*hiko̲rooké	Accent Shift	hiko̲róoke	Accent Shift

But the stipulation concerning the initial cluster seems to be problematic, since the Dorsey's Law sequence cannot be a tautosyllabic complex onset in any way, as was often discussed in section 3.1. Moreover, it still has an empirical problem in that as shown in (45b), it does not capture the accent position of *hiko̲róoke* 'great grandmother, female ancestor S43: 35,' where the Dorsey's Law sequence appears not word-initially but word-medially. Rather, this word needs the 'reverse ordering' solution in (44b), which is problematic for every reason.

An extended version of this account is Hayes (1995), which posits that a Dorsey's Law sequence is a heavy syllable in every position of a word (section 3.1.2). It is true that 'accent shift' analyses are appealing and convincing, because many problems with 'restructuring' analyses such as Hale and White Eagle (1980), Hale (1985), and Halle and Vergnaud (1987) have been pointed out and resolved by Miner (1989) and Hayes (1995); in other words, they have much more empirical coverage. Especially, Hayes (1995) can be said as one of the refined and elaborated accounts in the framework of Metrical Stress Theory. On the other hand, 'constraint-ranking' analyses like Alderete (1995) and Heiberg (1995) also cannot be ignored and are worth scrutinizing if we take current trends of phonological theory into consideration. But I will claim that these current analyses suffer from certain problems in either empirical or theoretical respects (sections 3.2.3.2 and 3.2.3.3) and will adduce evidence for 'extrametricality' analyses advocated in Tanaka (1996, 1997a, b) (section 3.2.4).

But before examining the current three types of analyses above (i.e. Hayes (1995), Alderete (1995), and Heiberg (1995)), let us turn to the most essential question when we enter into Winnebago accent, or language accent in general: what is metrical structure? This question is fundamental in considering accent location, regardless of such frameworks as Metrical Stress Theory and Optimality Theory. In any framework, accent is assumed to be computed by metrical structure. Unfortunately, however, its nature and function may tend to be not discussed in explicit terms. In the following section, I will thus give an explicit answer to this essential question and show that the discussion counts as introducing the basic tenet of Metrical Stress

Theory, or the theoretical background on which my 'extrametricality' analysis relies. My arguments are principally based on Hayes's (1995) Metrical Stress Theory.

3.2.2. Aspects of the Pitch Accent System

3.2.2.1. The Abstract and Parasitic Nature of Stress and Its Relation to Metrical Coherence

There might be readers who think that any form of Metrical Stress Theory is simply a theory for explaining the location of stress in a particular language or in all languages, but this is a serious misconception as Tanaka (1997b) discusses in much detail. Rather, Metrical Stress Theory has been a promising theory not only for explaining the computation of stress distribution but also for discovering an organizing principle of phonological systems themselves. The central claim of Metrical Stress Theory is that metrical structure functions as an organizing principle in the phonology of a particular language and even in the phonological component of Universal Grammar.

This essential claim can be ascribed to the nature of stress itself: stress has no authentic physical or phonetic correlate and thus is parasitic. Pitch is the phonetic cue for tone in true-tone languages and for intonation in many languages; duration is the phonetic cue for vowel length which is phonemic in many languages or otherwise for consonant length in some languages. However, loudness (intensity) is <u>not</u> the genuine phonetic cue for stress as was demonstrated by Fry's (1955, 1958) perceptual experiments. This is why stress <u>parasitizes</u> the physical resources of pitch and duration which serve other phonological ends, and metrical structure is likely to interact with a wide range of phenomena in phonology and to unify them in a coherent way.[11, 12]

The broad set of phenomena, in turn, can be adduced as evidence for the existence of metrical structure, which appears to lack its phonetic correlate. The most likely candidates are intonation and segmental length, but they are merely two examples out of many others.

The interactions between metrical structure and other processes can be examined from a viewpoint of height (i.e. grids), boundary (i.e. brackets), and type and size (i.e. foot inventory); this is because metrical structure, usually referring to feet, is represented by bracketed grids in Hayesian Metrical Stress Theory. First, concerning the set of phenomena sensitive to grid marks, nuclear intonational tones in English intonational phrases can be invoked as an example:[13] the starred tone of each tune in (46), whose inventory is taken from Pierrehumbert (1980), consistently docks to the same syllable in each word, namely to the one with the highest grid, or to that with main stress (Hayes (1995: 10–11)).

```
(46) [   as si mi lá tion   ]
     |              |        |
     M              H*       L       declarative tune
     M              L*       H       interrogative tune
     H              M*       L       downstepping tune
     L              L*+H     L       scooped tune
```

Other examples sensitive to grid height are non-nuclear tones of 'surprise-redundancy' and 'chanted vocative,' where L* and M* tones dock to the syllable with the lower grid (to that with secondary stress) which precedes/follows the main-stressed H* (Hayes (1995: 16–18)):

(47) a. surprise-redundancy tune b. chanted vocative tune

```
a.  [  col là bo rát ion !  ]        b.  [  Póin dèx ter !  ]
    |      |     |          |                |      |  /
    H      L*    H*         L                H*     M*
```

Moreover, there are segmental phenomena which are sensitive to the presence or absence of a grid (Hayes (1995: 12–16)): 1) flapping — /t, d/ may be realized as the flap /ɾ/ word-internally when preceded by a vowel or glide and followed by a vowel without a grid (*dáta* [deyɾə] vs. *attáin* [əteyn]); 2) intrusive stop — the sequence /ns/ can receive an optional transitional epenthetic /ť/ when followed by a vowel without a grid (*Ménsa* [mɛnᵗsə] vs. *insáne* [ɪnseyn]); 3) *l*-devoicing — /l/ can optionally become voiceless when preceded by /s/ and followed by a vowel without a grid (*Íceland* [ayslֽ̥ənd] vs. *Icelándic* [ayslændɪk]); and 4) medial aspiration — word-medial voiceless stops are aspirated when they are in the onset position of a syllable with a grid mark and are not preceded by a strident (*appénd* [əpʰɛnd] vs. *cámpus* [kʰæmpəs]). The Rhythm Rule, a stress shift phenomenon discussed in Liberman and Prince (1977) and Hayes (1984) among others, is also controlled by the presence of a grid position, because a higher grid can shift only to the existing lower grid as a landing site (*Chrìstine Smíth* [krɪstɪn] vs. **Lòmont Cránston* [ləmant]).

The second kind of examples, where the boundary structure (i.e. brackets) is crucial, involve the directionality of stress shift under vowel deletion, which was also observed by Halle and Vergnaud (1987): when a vowel with a grid is deleted as underlined in (48), the grid should shift rightward in languages with left-dominant feet, and leftward in languages with right-dominant feet. This is a direct consequence of the grid position in relation to its bracket structure (Hayes (1995: 42)):

(48) Stress Shift Under Vowel Deletion

a. Rightward

```
( *    . ) ( *    . )      ( *    . ) (      * )
CV   CV   CV̲   CV    →    CV   CV    C   CV
```

b. Leftward

```
( .    * )  ( .    * )      ( *    ) ( .    * )
CV   CV̲   CV   CV    →    CV C       CV   CV
```

Hayes (1995) discusses various cases in addition to those which have been presented in the earlier literature (the following numbers indicate pages): Unami (211–215), Central Alaskan Yupik (253–257), Pacific Yupik (343–345), Asheninca (289–290), Cyrenaican Bedouin Arabic (228–239). The English Rhythm Rule is also sensitive to the presence of a bracket (Hayes (1995: 43–45)):

```
(49) a.     (                        *)
            (*◄──────────────  )    (*)
            (*        )  ( *◄─ )    (*)
          . (*       .)  ( * )(* )  (*)

             2            3          1
          a hundred    thirteen     man
```

```
     b.  (                          *)
         (*◄─────────────  )       (*)
         (*◄─ *◄)X( )              (*)
         (*  .) (*  )     (*)      (*)

          2     3                   1
       * overdone      steak     blues
```

```
     c.  (                          *)
         (*◄─────────────  )       (*)
         (* ◄──  )     (*)         (*)
         (*  .)( * )   (*)         (*)

          2             3           1
     cf. overdone     steak      blues
```

For example, the word *thirteen* of the phrase in (49a) can undergo the Rhythm Rule, whereas the word *steak* of the phrase in (49b) cannot, due to the blocking of the boundary. In short, grid movement occurs within a constituent and is not allowed across grid boundaries.

The final piece of evidence showing the presence of metrical coherence is the most significant: the type or size of the feet Hayes (1995) proposes function as an organizing principle of the phonological systems in various languages: the Moraic Trochee, the Syllabic Trochee, and the Iamb. First of all, according to Hayes, segmental phonology is often directed towards reinforcing the maximal shapes of the three feet on the surface, following the Iambic/Trochaic Law (Hayes (1995: 80)). His cross-linguistic survey in fact demonstrates empirically that generally (though not universally), stressed syllables are lengthened (i.e. undergo vowel lengthening or gemination) in languages with the Iamb while they are shortened in languages with the Moraic Trochee. This fact is predicted precisely by the Iambic/Trochaic Law and its governed foot type: such rules apply when the syllable in question is dominated by the non-maximal form of each foot type, as shown below (Hayes (1995: 83, 145–147)):

(50) a. Iambic Lengthening

```
( .   *)      ( .    * )        ( .   *)              ( .    * )
 ◡    ◡        ◡     —           ◡    ◡                ◡     —
CV   CV  →   CV   CVV          CV   CV  CiV   →   CV   CVCi  CiV
```

b. Trochaic Shortening

```
( * )          (*    .)
  —             ◡    ◡
CVV  CV   →    CV   CV
```

Here, ◡ and — represent light and heavy syllables, respectively. The lengthening and shortening phenomena are not accidental for each type of language, because either type of foot, though proper as it stands, needs to be converted into its most canonical form as the Iamb or the Moraic Trochee.[14] Second, the inventory of the three feet is also tied to prosodic morphology. As seen in McCarthy and Prince (1986), the prosodic targets for morphology at the foot level, which are relevant for such processes as reduplication and truncation, are precisely those three. It is thus uncontroversial that the foot type used in a language's prosodico-morphological system is the same in most cases as that used in its stress system. Finally, as mentioned in section 2.6.3, if there is a minimal word requirement that every phonological word contain at least one foot, there can be no content words consisting of a single light syllable in quantity-sensitive languages or of any single syllable in quantity-insensitive languages, though there is some parametric variation in this prohibition. In either case, without the inventory, the minimal word requirement could not be specified across languages.

3.2.2.2. From Stress to Pitch Accent

Now we are in a position to ask what relation holds between stress and accent, or more strictly between stress accent and pitch accent.

As we have seen earlier, stress has no physical or phonetic correlate and in that sense, it is highly abstract by nature. Because of its abstractness, it is represented by metrical structure (i.e. bracketed grids, in technical terms). On the other hand, stress is parasitic at the same time, depending on other phonetic cues like pitch or duration. The abstract and parasitic nature of stress is attributed to its lack of physical correlates, and it is owing to this parasitic character that stress interacts with phonological phenomena concerning the pitch, quantity, or quality of sounds. In other words, metrical structure representing stress dominates various phonological phenomena in terms of grids, brackets, and foot inventory, as demonstrated in section 3.2.2.1; namely, the phonology of languages is often sensitive to metrical structure. Pitch-accent languages are no exception to the rule. In fact, pitch accent is derived from stress accent, or metrical structure, just like intonation.

Winnebago is a pitch-accent language, as Miner (1979: 25) states that "[a]n accented syllable in Winnebago has noticeably high pitch relative to unaccented syllables in the same word" and that "[a]lthough pitch seems to be the chief acoustic correlate of accent in this language, an accented syllable may have relatively greater intensity as well." In the same way, Susman (1943: 11) also remarks that in this language "[p]itch is a phonetic characteristic of stress and length combinations, but has no significance in itself, except as a sentence feature" [15] and that "[s]tressed syllables are higher in pitch than surrounding unstressed syllables." These characterizations suggest that Winnebago stress phonetically parasites such complex physical resources as pitch, intensity, and duration but that it has much more to do with pitch than the other two. In other words, stress is realized primarily as pitch, and that is why this language is considered as pitch-accented.

Phonologically, this task is done by assuming that tonal structure representing pitch realization is derived, or technically 'mapped,' from metrical structure representing abstract stress position. In particular, metrical structure consists of grids and brackets, while tone structure comprises tone melodies like H and L. This derivation (mapping) is illustrated in (51):

(51) The Mapping from Metrical Structure to Tonal Structure

haračábra 'the taste M79: 28':

```
            (*   )                 (*   )
 <(*   .)> (*   .)          (*   .) (*   .)

  σμσμ     σμ σμ            σμσμ  σμ  σμ
  ha ra    čab ra    →      ha ra čab ra
                             |  |   |   |
                             L  L   H   L
```

Since pitch (i.e. tonal structure) is derivative by nature in this language, I can imagine that it "has no significance in itself" as Susman (1941: 11) remarks. What is significant grammatically is stress as a primitive entity in phonological derivation, or abstract grid position represented by metrical structure; in contrast, pitch or tonal structure functions as a secondary means in phonetic realization. Note here that this is another example of metrical coherence as suggested in section 3.2.2.1. For details of metrical rules and tonal rules, see sections 2.6.6 and 3.2.4.1.

Another characteristic of Winnebago pitch-accent phenomena is that a word can have more than one accent within its domain. In fact, there are reasons why Winnebago accent should be transcribed on the primary and subsidiary scales. First, Susman (1943: 11) maintains that "[i]n slow speech, consecutive stresses are about equal, but in normal rapid speech, all stresses after the first in a phrase are weakened, creating a characteristic falling off of intensity and pitch within a phrase." What Susman calls "a phrase" here is equivalent to the 'word' which I defined in section 2.1. Furthermore, with respect to this multiple accent, Miner observes that "[w]hen more than one syllable in a word or stretch of utterance is accented, there is a downstep or terracing effect, each successive accented syllable having a slightly lower pitch and intensity than the last preceding" (Miner (1979: 25)), or that "an accented syllable in a word or stretch of utterance never has more accent (higher pitch, greater intensity) than the last accented syllable preceding" (Miner (1979: 26)). To draw an explicit distinction between primary and subsidiary accents, I adopt the three-way tonal representations in which the tone melody on the intermediate scale, M, is assumed as well as H and L, as in the following way:

(52) The Three-way Distinction of Tone Melodies

hokiwáhazrà 'the license M79: 28':

```
            (*        )               (*          )
<(*   . )> (*    . )(*)         (*   . ) (*    . ) (*)

 σμ σμ    σμ  σμ σμ             σμ σμ  σμ  σμ  σμ
 ho  ki   wa haz ra      →      ho  ki wa haz  ra
                                |   |   |   |   |
                                L   L   H   L   M
```

As is clear in (52), the highest grid (i.e. primary accent) corresponds to the H-toned melody, the second highest to the M-toned melody except for the extrametrical grid, and all other positions to the L-toned melody by default. Tonal rules involve tone association (deriving H and M), cancellation of extrametricality, and the default rule (L-insertion), as introduced in section 2.6.6.

Hereafter, I will generally use the term 'accent' instead of 'stress' to refer to the prominent positions in a word, for it involves a complex of pitch, intensity, and duration at the surface. The topic in the following section is on the valid descriptive generalization of accent distribution, where I claim that syllables have a fairly vital role as well as moras.

3.2.3. The Computation of Accent Location

3.2.3.1 Generalization: Mora-Counting but Syllable-Accenting

Descriptively, the distribution of accent in Winnebago is rather difficult to capture. Miner (1979: 28) proposes a general accent rule for regular words (i.e. not containing Dorsey's Law sequences) as in the following manner: accent falls on every third mora until three moras are no longer available; otherwise, it falls on a second mora.[16] For example, it produces patterns like CVCV́, CVCVCV́, CVCVCV́CV, CVCVCV́CVCV́, CVCVCV́CVCVCV́, and so forth.

Since this generalization does not capture the difference in scale between primary and subsidiary accents, it is revised by Miner (1989: 153) as in (53):[17]

(53) Miner's (1989) Generalization

a. Words with two moras in length receive accent on their second mora.

b. All other words receive primary accent on their third mora, and secondary accent on each <u>even</u>-numbered mora thereafter.

Note here that with respect to secondary accent, a different prediction is made between Miner (1979) and Miner (1989) in the case of words with six moras: CVCVCV́CVCVCV́ vs. CVCVCV́CVCV́CV. This difference seems to reflect a variation (optionality) and complexity of the location of secondary accent.[18]

In fact, accent placement is not so simple for primary accent as well as for secondary one. As Miner (1979: 28, 1989: 169) characterizes correctly, Winnebago is a 'mora-counting but syllable-accenting' language. It is true that units counted in accent placement are moras, but accent-bearing units are syllables. Thus, I claim that accent is associated not with the third mora but with the syllable containing it: it is the syllable head determined by the sonority scale that actually bears accent. Moreover, Tanaka (1997a: 6, 1997c: 36, to appear a) observes that it is also a 'quantity-sensitive' language, whose accentuation is sensitive to syllable weight (or syllable quantity). In other words, a heavy syllable is always accented in any position. The key properties in computing accent of this language are then summarized as below:

(54) Key Properties in Accent Computation

Accent-counting Units:	mora
Accent-bearing Units:	syllable
Syllable-head Variance:	more sonorous vowel
Quantity-sensitivity:	yes

Consequently, it is not always the case that primary accent falls on the third mora, with secondary accent forming an alternating rhythm.

Let us present some arguments for this claim. First, we can see that primary accent may fall on <u>the second or fourth mora</u> when we rearrange data by taking into account the relative position of light and heavy syllables (Tanaka (1997c: 36, to appear a):[19]

(55) Accent Location Classified in terms of Syllable Weight

a. Light + Light + Light ...

ha ra pé	'you waited for him S43: 10'	hi t'e t'é	'he was talking S43: 9, 10, 47, M89: 149'
ha ru wą́k	'eight S43: 11'	šu ru xé	'you ran after him S43: 9'
ra čgą čgą́	'he drank repeatedly M89: 149'	ho čį čį́ nįk	'boy HWE 80: 118'
ha ra čáb ra	'the taste M79: 28'	ha ra pé ge	'because you waited for him S43: 10, 12'
hi 'e nį́ že	'he did not find it S43: 28'	ha ra pé gį nį	'you waited for him already S43: 10'
ho kǰa ké ya ǧep	'wild plants S43: 29, 59, 67'	hi ro kí ya po ro kše	'he rolled them up S43: 29, 68'

b. Heavy + Light ...

nąą wą́	'to sing, he sang S43: 8, 10, 12, 105'	haa pé	'I waited for him S43: 8, 11'
hoo čák	'Winnebago M79: 27'	mąą táč	'I promise HWE80: 127'
nąą wą́ ge	'because he sang S43: 10'	taa nį́ žu	'sugar M89: 152'
hoo čą́g ra	'the Winnebago M79: 27'	čeeb wá hi	'he consumed something S43: 34'
hią bó šip	'you and I shot him down S43: 28, 29'	roo rá ke we	'you dressed him S43: 13'
woo xé te hi	'to love S43: 35'	hoo 'ó 'o ke	'owl S43: 35'

c. Light + Light + Heavy ...

hi t'a t'áak	'he (moving) talked S43: 10, 11, 47'	wi ǰug wą́ąk	'male weasel S43: 57'
hi t'e t'éi re	'they speak M79: 29'	ho gi hį́i žą	'one hundred S43: 36'
ki ri nį́į ną	'he did not return S43: 47'	ha go réi žą	'sometimes S43: 67'
ha go rée žą	'sometime in the future S43: 76'	ha ra pée ną	'you were waiting for him S43: 10, 12'

wa 'ų ną́ąg ra 'ones who do this, what they do S43: 50, 54'

wa raǰ nį́ą nąga 'you do not eat and S43: 53'

d. Light+Heavy ...

ha ǰáak	'he (moving) saw S43: 10, 11, 47'	ha pée ną	'he was waiting for him S43: 12'
ki ríi ną	'he returned H90: 149'	hi ǰái ra	'more S43: 36'
wa žái ǰa	'where it was wiped S43: 75, 109'	ka rái re	'they departed returning M79: 29, M89: 150'
hi nį́ą nąk	'we (sitting) slept S43: 11'	hi gái ra ną ga	'they said to him and S43: 53'
ke riák	'he (moving) barked S43: 75'	wa šiák	'he moving danced S43: 47, 76'
hi ruá kų	'I used it S43: 74'	ha guá hi	'to go to get S43: 79'
wa 'ų́ą kše	'he (moving) did it S43: 72'	gi pį́é sge	'enjoyable S43: 66'
he riá ną ga	'he was and S43: 75'	ho 'ųó ka hi	'whenever you do it S43: 79'
hi t'eó ki rač	'to speak different languages S43: 67'		

e. Heavy+Heavy ...

nąą wą́ąk	'he (lying) sang S43: 10, 11'	mąą čái re	'they cut a piece off M79: 29, M89: 150'
čaa hái žą	'a deerskin S43: 29, 78'	nąą wą́ą ną	'he was singing S43: 10, 12'
wee čą́į ǰa	'where it was folded S43: 109'	nąą hái či	'bark house S43: 125'
wąą gią́	'a man S43: 67, 79'	raa bią́	'a beaver S43: 67'
taa nįó žu	'to offer tabaco S43: 58'	waa sgió ke re	'waiter S43: 76'
hąą hió ka hi	'every night S43: 62'	čuu giá są nąp ge	'kingbird cf. M81: 342'
čoo wió mį nąk	'the leading-place S43: 29, 76'		

A heavy syllable is defined here as a syllable with a long vowel or a (falling or rising) diphthong. Recall that the head mora of a heavy syllable is determined by the General Sonority Hierarchy, as seen in sections 2.5.4 and 3.1.3.1, and receives primary accent instead of the less sonorous mora within the domain:

(56) The Syllable Head

a. The General Sonority Hierarchy in Winnebago

vowel (a > o > u > e > i >) > sonorant > voiced fricative > voiced stop > voiceless obstruent

b. Examples: V_1V_2

V_1 \ V_2	i	e	u	o	a
a	ái		(falling)		áa
o	ói	óe		óo	oá
u	úi	úe	úu	uó	uá
e	éi	ée		eó	eá
i	íi	ié	(rising)	ió	iá

When a word begins with a light syllable followed by a heavy one with a long vowel or a falling diphthong, primary accent is placed on the second mora (*ha ją́ąk* and *hi ǰái ra* in (55d)). It may be located on the fourth mora when a word begins with two light syllables or a heavy syllable followed by another heavy one with a rising diphthong (*wa raǰ nįą́ ną ga* in (55c) and *wąą gią́* in (55e)). Thus, the generalization in (53b) cannot capture all the patterns correctly, as it stands.

The type of metrical structure proposed in Hale and White Eagle (1980), Halle and Vergnaud (1987), and Heiberg (1995) cannot account for the cases in question, either, because they all assume initial-mora extrametricality and right-headed feet assigned from left to right; more specifically, this mora-based analysis does not consider syllables as accent-bearing and always makes the third mora accented. The erroneous assumption here is that Winnebago is a 'mora-counting and mora-accenting' language, where the notion of syllable does not have a vital role in accent assignment.

The fourth mora of a word can also receive primary accent when the vowel on the second mora is epenthesized by Dorsey's Law, as we saw in (41b) and (42). It then follows that (53b) must be revised and that a proper generalization for primary accent is something like the one in (57) (Tanaka (1997c: 36, to appear a):

(57) Revised Generalization for Primary Accent

In the case of words with more than two moras, primary accent falls on the syllable containing the third mora, except for words whose second mora is epenthetic.

As far as primary accent is concerned, all the patterns of words with three or more moras are captured by (57) even if they contain Dorsey's Law sequences elsewhere: (41a), (44a), and (55). Given the General Sonority Hierarchy in (56a), these patterns are surely accounted for by the Moraic Trochee, or left-headed feet which immediately dominate syllables and are assigned from left to right, together with initial-foot extrametricality and the upper left-dominant constituent. This system exhaustively incorporates the information given in (54). Detailed illustration will be presented in section 3.2.4.1.

On the other hand, the distribution of secondary accent seems to be much more difficult to characterize. Indeed, a word may exhibit an alternating rhythm after primary accent when it consists exclusively of light syllables and non-Dorsey's Law sequences. Unfortunately, however, secondary accent is also sensitive to quantity sensitivity and syllable head variance in (54), just in the case of primary one, which together often cause violations of the 'pure' alternating rhythm. That is, secondary accent is always placed on a heavy syllable regardless of rhythmic alternation and shifts to the more sonorous vowel within the heavy syllable; and this is because Winnebago is a quantity-sensitive language whose accent bearing units are syllables. Consider the following examples:

(58) Secondary Accent on a Heavy Syllable

a. Long Vowel or Falling Diphthong

nįį žú gùu 'rainy weather S43: 125' wia gé phùu 'sunrise S43: 17, 67'

wąą kší k'ìi 'to live S43: 124' paa šiá ǰèe ną 'I (standing) danced S43: 51'

ha nį nį́ žùi šge 'if it rains on you S43: 48' wa šiá hą̀ąg wi 'they (moving) danced S43: 51'

ha ra gį́ ną̀į če 'you will suffer for it S43: 49, 139'

wii rá pe rèe ste 'you will learn this S43: 49, 65, 75'

ha ra ká ra gi ną̀į 'you are going to fast for it S43: 49'

šu ru xú ru kìi sge 'if you succeed, if you reach there S43: 48'

ra ke ré kǰą ną hèe ną 'you will go home S43: 47'

nį kši kši nį kǰą nèe ną 'it will not be weak for you S43: 41'

b. Rising Diphthong

wioi ré gìe re rà 'the west S43: 78'

taa wú šìa ną gà 'it was very dry S43: 65'

ǰaa gú ra nįą̀ šį nį gì 'whatever good things you have S43: 62'

wąą kší go 'įą̀ šį nį rà 'your life S43: 62'

hi žą kìi čą šgu nįą̀ ną gà 'nine and M79: 25'

wa ǧį ǧį́ gi šga p'ùį že reà ną gà 'baseball player and M79: 25'

žii gó ga nį xǰį 'eò ra wà ša ra wiè ge 'Don't ever go that way again! S43: 78'

As is known from the underlined syllables in (58), secondary accent can be assigned to an odd-numbered mora counting from the primary one if it is incorporated into a heavy syllable, as in *nįį žú gùu*, *ha ra ká ra gi ną̀į*, and the like. In addition to these cases with heavy syllables, the distribution of secondary accent becomes even more complex in cases with Dorsey's Law sequences. So I will not attempt to generalize the location of secondary accent here. It will be known in section 3.2.4.1 that its placement automatically follows from the metrical system I will propose therein. Needless to say, the analyses in Hale and White Eagle (1980), Halle and Vergnaud (1987), and Heiberg (1995) cannot capture the assignment of secondary stress, because they are based exclusively on moras. In the following two sections, I will examine other recent analyses in more detail and show that they also suffer from some problems in empirical and/or theoretical respects.

3.2.3.2. Constraint-Ranking Analyses

There are two optimality-theoretic approaches to Winnebago accent and Dorsey's Law: Heiberg (1995) and Alderete (1995). First, the former analysis can account for relatively simple cases with and without Dorsey's Law sequences, but not for cases with heavy syllables as in (55) and (58). This is because, as mentioned earlier, Heiberg assumes that right-headed binary feet are built on moras with the proviso that the initial mora is invisible to foot construction, so that words without Dorsey's Law sequences would always receive primary accent on the third mora and secondary one on even-numbered moras thereafter (if they have three or more moras). Therefore, the empirical problems with Heiberg's analysis originate from the fact that he does not consider accent-bearing units as syllables and that he ignores the quantity sensitivity and syllable-head variance of this language.

Second, the latter analysis, Alderete (1995), seems to be more refined and elaborated, entering more into the phonological system of Winnebago. He attempts to analyze the mechanism of Dorsey's Law by utilizing certain constraints on syllable structure, which were seen in section 3.1.2 but argued against in section 3.1.3.2. As for metrical structure, he correctly assumes that in this language, a word is provided with Moraic Trochees on syllables (and not on moras) and that the initial foot is invisible in constructing the higher left-headed constituent. In that sense, this assumption is equal with mine, although this task is done not by derivational rules but by ranked constraints.[20]

However, his proposed ranking of constraints suffers from a serious problem: certain constraints exhibit a paradox or contradiction of their ranking even for very simple cases without any Dorsey's Law sequences. Specifically, Alderete assumes the set of constraints defined in (59a) to create the metrical structure of this language, whose ranking is indicated by the lines in (59b):

(59) Alderete's Constraint Ranking for Winnebago

a. Lx=Pr (Lexical = Prosodic): Lexical categories correspond to prosodic categories.
WSP (Weight-to-Stress Principle): If heavy, then stressed.
Non-Initiality: Every head (i.e. a syllable, a foot, etc.) is non-initial.
Align-L (Ft-head, Wd): The head of a foot is aligned at the left edge of a word.
*Clash: Avoid adjacent syllable heads.
Parse-Syll (Parse-Syllable): Syllables are parsed by feet.
FtType (Foot Type): Feet are moraic trochees.
FtBin (Foot Binarity): Feet are binary at the level of syllable or mora.
Align-R (Ft, Wd): All feet are aligned at the right edge of a word.

b.
Lx=Pr WSP
\ /
Non-Initiality
|
Align-L
|
*Clash
/ \
Parse-Syll FtType
/ \
FtBin Align-R

This ranking, indeed, guarantees the third-mora accent, as shown in (60a):

(60) xǰaaná̧ne 'yesterday M89: 152, M93: 117'

/xǰaanane/	WSP	Non-Initiality	Align-L	*Clash	Parse-Syll	FtType	FtBin	Align-R
a. x x x x x x ☞ (xǰaa)(na̧ ne)			xǰaa	*				na̧ne
b. x x x x x x (xǰaa)(na̧ne)			xǰaana̧ !			*		na̧ne
c. x x x x x x (xǰaa) na̧ (ne)			xǰaana̧ !		*		*	na̧ne
d. x x x x x x x (xǰaa)(na̧)(ne)			xǰaa	** !			**	na̧ne ne
e. x x x x x x (xǰaa)(na̧ ne)		* ! *		*				na̧ne
f. x x x x x x (xǰaa) na̧ (ne)		* ! *			*		*	na̧ne
g. x x x x x xǰaa (na̧ ne)	* !	*	xǰaa		*			

This is a typical case of words with the initial heavy syllable. As is clear from a careful comparison between (60a) and (60b), it is crucial that Align-L is ranked over *Clash, or the reverse ranking would predict (60b) to be the optimal output erroneously. Unfortunately, however, the same ranking, Align-L >> *Clash, does not work well in the case of words beginning with two light syllables: the desired output is (61a), which represents the third-mora accent well-formedly, but the form with the second-mora accent in (61b) would be predicted to be optimal by this ranking. The wrong winner is indicated here as ☜:

(61) hipirák 'belt M79: 28, M89: 152'

/hipirak/	WSP	Non-Initiality	Align-L	*Clash	Parse-Syll	FtType	FtBin	Align-R
a. x x x x x x (hi pi)(rak)			hipi !				*	rak
b. x x x x x x ☜ (hi)(pi rak)			hi	*			*	pirak
c. x x x x x x (hi pi)(rak)		* ! *					*	rak
d. x x xx x (hi pi) rak		* ! *			*			rak
e. x x x x x x (hi)(pi rak)		* ! *		*			*	pirak
f. x x x x x hi (pi rak)		* !	hi		*			

In order to make (61a) the optimal candidate, the ranking must be *Clash ≫ Align-L, but we find that this consequence contradicts with the one in (60), running into ranking paradox:

(62) Ranking Paradox

a. Words with the initial heavy: Align-L ≫ *Clash

b. Words with the initial two lights: *Clash ≫ Align-L

It thus follows that Alderete's constraint-ranking analysis in (59) is problematic in the empirical sense that it does not account for the third-mora accent of words with two light syllables initially, as well as in the conceptual sense that it falls into ranking paradox as it stands.

3.2.3.3. Tone-Shift Analyses

Now let us scrutinize Hayes's (1995) account of the accentual system in Winnebago. In short, he thinks highly of the historical development of its accent, basically following Miner's (1979) insight. According to Miner (1979), Mississippi Valley Siouan languages like Winnebago and Chiwere had in common a quantity-sensitive accent rule for their proto-language, which placed primary accent on the second syllable if the initial syllable was light or otherwise on the initial syllable, as in *wasóse* 'brave M79: 31, H95: 356' and *kíiða* 'fight M79: 31, H95: 356'; in addition, Winnebago also incorporated the accent shift rule, which resulted in the present forms *wašošé* and *kiizá*. In this respect, Miner (1979) and Hayes (1995) reject restructuring, and assume that the historical changes still function as synchronic rules. Hayes, moreover, assumes that the proto-language accent rule is reflected on the metrical representation and the accent shift rule on the tonal representation, adopting a biplanar approach. Splitting the representation into the metrical and tonal planes has been the usual practice in the metrical treatment of pitch-accent languages since the enlightenment by Halle and Vergnaud (1987) and Haraguchi (1991). More specifically, Hayes proposes the following rule-based system in which each of the rules is applied in the order shown below:

(63) a. Foot Parsing

Form Iambs from left to right persistently with either Strong or Weak Local Parsing and with the strong prohibition on degenerate feet;[21]

b. H-Tone Assignment

Associate an H tone with the sonority peak of a syllable that is the head of its foot;

c. Dorsey's Law

Copy a vowel into an immediately preceding cluster consisting of a voiceless obstruent followed by a sonorant ($OSV_i \rightarrow OV_iSV_i$);

d. Tone Shift

Shift an H tone one syllable to the right if it is associated with a light syllable or an initial heavy syllable;

e. Twin Sister Convention

Delete one of the two H tones linked to a single syllable (or they will be interpreted phonetically as one);

f. Tone Deletion

Delete the second of the consecutive H tones if it is associated with a light syllable.

For expository purposes, I will discriminate cases with Dorsey's Law sequences from those without them. The examples in (64) illustrate typical derivations of the latter cases. Note that since degenerate feet are prohibited in his theory

(Hayes (1995: 86–87)), only bimoraic feet are constructed as stated in (63a):[22, 23]

M79: 28

```
(64) a. (.  *)(.  *)
        ◡ ◡  ◡ ◡ ◡
        hoki  wáro ké   'swing (n.) M79: 28'
               |    |
               H    H

     b. (.  *)
        ◡ — ◡
        ki ríi ną        'returned H90: 149'
           |
           H

     c. (*) (.  *)
        —   ◡ ◡ ◡
        wai  péresgá     'linen M79: 28'
              |    |
              H    H

     d. (. *)(*) (.  *)
        ◡ ◡  —   ◡  ◡ ◡
        hižą  kíi   čąšgu nį́   'nine M79: 25'
              /|           |
              H H          H

     e. (. *)   (.  *) (*) (. *)
        ◡ ◡  ◡  ◡  ◡   —   ◡ ◡
        wağį ğį́ gišga p'ų́į  žeré   'baseball player M79: 25'
             |         /|     |
             H         H H    H

     f. (*)   (. *)(.  *)
        —   ◡ ◡ ◡  ◡  ◡
        hii žú goki rúsge   'double-barreled shotgun M79: 28, HWE80: 117, M81: 341'
            |        |  |
            H        H  H

     g. (.  *)(.  *)
        ◡ ◡  ◡ — ◡
        hara gínái če       'you will suffer for it S43: 49, 139'
              | |
              H H
```

Each of the above representations is the one immediately after tone shift (63d) is applied. As stated above, this rule can apply if the H tone is associated with a light syllable and there is one syllable available to the right as in the case of the first H tone of (64a), whereas it cannot apply to the form in (64b) since the H tone is associated with a heavy syllable; however, it does apply to the form in (64c) since the heavy syllable is located initially. (64d) and (64e) are candidates to undergo the Twin Sister Convention in (63e), which is adopted from Clements and Keyser (1983); and tone deletion (63f) applies to (64f) but not to (64g) because the second H should be associated with a light syllable.

With respect to foot parsing (63a) before tone shift, it is essential here to make two remarks. First, the binary feet on *žere* in (64e) and on *rusge* in (64f) are constructed on the assumption of persistent footing, or otherwise no feet could be constructed here due to weak local parsing and the strong ban on degenerate feet. Second, Hayes notes that whether a form is parsed strong-locally or weak-locally is specified word by word, depending on morphological and possibly lexical factors. In the extreme case below (*wiiragu̯šgera* 'the stars M79: 28, HWE80: 117'), two outcomes are in fact allowed, which can be explained by setting both strong and weak values for this form (Hayes (1995: 347)):

(65) a. Strong Local Parsing   b. Weak Local Parsing

```
     (*) (.  *)  (.  *)            (*)   (.    *)
     —   ◡  ◡   ◡  ◡              —   ◡   ◡   ◡   ◡
    wiirágu̯šgéra                  wiirágu̯šgerá
         |       | |                   |         |
         H       H H                   H         H
```

The final H tone in (65a) is of course deleted at the final stage by tone deletion (63f).

More complex are cases with Dorsey's Law sequences. Hayes (1995: 361-362) claims that the Dorsey's Law sequence of the form OSV counts underlyingly as a single heavy syllable, where the sonorant consonant as well as the following vowel is assigned moras. When the sequence undergoes the rule, it becomes disyllabic by resyllabification ((11) in section 3.1.2, repeated here as (66)):

(66) Dorsey's Law and Resyllabification

```
      σ                σ     σ
      |＼               |     |
      μ  μ             μ     μ
     /|  |            /|    /|
    OS  Vi     →     OVi   SVi
```

Examples are shown in (67), where each triplet of the representation includes the stages before and after the application of Dorsey's Law, followed by tone shift, but the procedural details contained in (66) have been omitted:

```
(67) a.  (*) (. *)
         — ◡ ◡        ◡ ◡ ◡ ◡        ◡ ◡ ◡ ◡
         kre ǰųsep → kere ǰųsep → kere ǰų́sep   'Black Hawk M79: 30, M89: 154'
          |    |        |    |           | |
          H    H        H    H           HH

     b.  (.  *)
         ◡ — ◡        ◡ ◡ ◡ ◡        ◡ ◡ ◡ ◡
         hi kro ho → hi koro ho → hi koro hó   'he prepares S43: 35, 48, M79: 30, HWE80: 128, M89: 155'
             |            |               |
             H            H               H

     c.  (.  *) (*) (*)
         ◡ —  —  —     ◡ ◡ ◡ ◡ ◡ ◡ ◡     ◡ ◡ ◡ ◡ ◡ ◡ ◡
         wa kri pro pro → wa kiri poro poro → wa kiri pó́ro póro   'spherical bug HWE80: 131, M89: 155'
             |   |   |         |    |    |            |    | |
             H   H   H         H    H    H            H    HH

     d.  (*) (*) (*)
         —  —  —        — ◡ ◡ ◡ ◡        — ◡ ◡ ◡ ◡
         waa pro pro → waa poro poro → waa póro póro        'snowball M79: 30'
          |   |   |       |    |    |      |    | |
          H   H   H       H    H    H      H    H H
```

Again, the final H tones in (67a, c, d) are the inputs to tone deletion.

In spite of the apparent lack of empirical problems, the proposed system for Winnebago accent seems to suffer from several conceptually serious problems, most of which can be said to come from the malfunction of metrical coherence; that is, the metrical structure constructed does not work as an organizing principle of the proposed system but is utilized as a mere computational device of the accent positions undergoing other tonal operations. If so, the metrical structure proposed for this language is simply an arbitrary construct. The following are the principal reasons for such a claim.

First, as a consequence of tone shift, there occur cases, as seen in (64), where metrical and tonal structures disagree in almost all outputs; that is, 1) in some cases the H tone goes out of the right bracket of a foot, 2) in others it settles on the non-head position of a foot, and 3) in extreme cases it shares the head position of a foot with another H tone. All the three types of cases violate the principle of metrical coherence to the effect that bracket structures of feet should be respected and that culminative elements like H and * should agree, or have a one-to-one correspondence between tonal and metrical representations. In that sense, the Twin Sister Convention seems to be an artifact, resulting from some sort of strain in the theory. Hayes (1995: 357) remarks that tonal analysis of some Bantu languages necessitates the tone shift rule, and that the three types of cases avoid violations of the Faithfulness Condition on metrical representations.[24] However, Bantu languages are not pitch-accent but true-tone languages, and thus do not have metrical representations, so that the disagreement of tonal and metrical structures naturally does not occur even when tone shift is applied. Moreover, it is true that, as Hayes himself mentions, the Faithfulness Condition on metrical structure is not violated in the tone-shift analysis concerned (Hayes (1995: 365)). But this line of reasoning appears to be a kind of escape hatch; this is because it is a common practice that in pitch-accent languages, the effect of an apparent tone shift is obtained by first moving the head position * of a foot on metrical representations and then associating an H tone with it, and not in the opposite order. It is evident that this way of shifting not only meets the Faithfulness Condition but also the principle of metrical coherence.

Second, Hayes's tone-based analysis does not explain why only the H tone associated with a light syllable is shifted and deleted by tone shift (63d) and tone deletion (63f) respectively, or why initial heavy syllables behave in tone shift as if they were light. The applicability of the two rules is obviously metrical in character, and not tonal, as Hayes (1995: 364) himself admits, since it is sensitive to syllable weight (or quantity quantity). If so, a more natural assumption is that both shift and deletion, if any, of a culminative element are reflected on metrical representations. Furthermore, as mentioned in section 3.2.2.1, pitch (i.e. the phonetic correlate of tone) and duration (i.e. the phonetic correlate of syllable quantity) are mutually independent issues in phonology; in fact, there seem to be few cases in true-tone languages where tone assignment is sensitive to syllable quantity. In contrast, only stress represented by metrical grids, essentially lacking its phonetic correlate, can be dependent on pitch and/or duration, i.e. on tone and/or syllable quantity; and stress of pitch-accent languages may be dependent on both tone and syllable quantity, the former being reflected on tonal representations and the latter on metrical representations. Incidentally, the fact that initial heavy syllables never bear the H tone due to accent shift might just as well be attributed to left extrametricality, which makes them invisible to H-tone assignment.

Further problems with his proposed system include the following. First, H-tone assignment, which associates an H tone with the grid, has generally been assumed to be a phonetically-interpreting rule in pitch-accent systems, because again stress lacks its phonetic resource and thus relies on pitch, or phonologically on tone. But unexpectedly, H-tone assignment (63b) would be a lexical rule on the grounds that it precedes Dorsey's Law, a cyclic lexical rule. Second, the special assumption for Dorsey's Law sequences in (66) is difficult to accept, partly because the cluster can never be considered as tautosyllabic as demonstrated in section 3.1.3.2, and partly because there seem to be no other cases attested than this one where prevocalic sonorant consonants bear moras. Moreover, even if there are any such cases in other languages, a conceptual problem will arise for the Winnebago case; for example, if this assumption were true, an anomalous trimoraic syllable structure would occur when a Dorsey's Law sequence is followed by a diphthong in the underlying representation (/k$\overset{\mu\,\mu\,\mu}{\text{rai}}$ re/ < *k*$\underline{a}$ *rái re* 'they leave returning M79: 29, M89: 150.' The trimoraicity of a superheavy syllable, however, is not manifested or motivated anywhere else in Winnebago, for there is no distinction between bimoraic and trimoraic syllables in accentual behavior. Third, the output candidates in (65) seem to be ascribed not to the parametric variation but to the optionality of rule application. In fact, a parameter value should be specified language by language in general; specifying it word by word as in (64) or specifying both values for a word as in (65) is quite unusual in any sense. Finally, a diachronic account, including the quantity-sensitive iambic rule followed by accent shift in any form, would be better replaced by a synchronic account utilizing a quite different accent rule. This is partly because generative phonology is concerned primarily with synchronic grammar and partly because there are other reasons to replace it as has been mentioned so far.

In the next section, I will bring forward a synchronic and metricallycoherent account which is immune to such problems as outlined above, and will also develop the notions of foot weight and grid distance that are crucial to Winnebago accentology.

3.2.4. Metrical Structure as an Organizing Principle of Winnebago Phonology

3.2.4.1. Metrification and Other Rules

Before demonstrating that my account can produce the desired outputs, let us review Winnebago syllable structure. As discussed in section 2.5.2, underlying consonant clusters are limited to the following five types: [voiced obstruents + sonorants] (e.g. *br, zr, gn, ...*), [voiceless obstruents + sonorants] (e.g. *pr, sr, kn, ...* = Dorsey's Law sequences), [voiceless obstruents + voiced stops] (e.g. *sg, xǰ, čg, ...*), [voiceless obstruents + voiceless fricatives] (*ps, pš, kš, ...*), and [voiceless obstruents + the glottal stop] (*p', k', s', ...*).[25] Recall also that as given in section 3.1.3.2, there are several types of arguments in favor of the fact that the former two clusters are syllabified as heterosyllabic while the latter three as tautosyllabic (i.e. *b . r, p . r* vs. *sg, ps, p'*), a quite different claim from Alderete (1995), Hayes (1995), Steriade (1990), and so on. Particularly, this syllabification is contrary to Hayes's assumption in (66), where Dorsey's Law sequences are tautosyllabic previous to copying the following vowel.

As for metrical structure construction, I will assume with Tanaka (1996, 1997a, b) that the language has the following system consisting of three levels:

(68) Lexical Level

a. Cyclic Level	b. Non-cyclic Level
Foot Type: Moraic Trochee	Clash Deletion
Extrametricality: Leftmost Foot	Clash Movement

End Rule: Left

Dorsey's Law

(69) Postlexical Level

a. Optional Level

Non-Adjacent Clash Movement

b. Obligatory Level

Tone Association (H and M)

Other Rules[26]

The way of application of rules (68a) and (69b) is trivial as we have often seen them before, but that of (68b) and (69a) deserves some comments. Both clash deletion and clash movement are non-contextual repair strategies which are assumed to apply when universal or language-particular constraints are violated, here the Clash Avoidance Principle (for the definition of repair strategies, see a series of Paradis's work originating from Paradis (1988)). Although they are non-contextual, their mode of application crucially involves the mechanism of foot weight and grid distance. First, foot weight is divided into foot prominence (i.e. the height of grids) and foot quantity (i.e. the number of moras), which is parallel to the division of syllable weight into syllable prominence and syllable quantity.[27] Second, grid distance is defined in terms of the number of syllables intervening between the clashing grids (i.e. the adjacency of clashing grids). The representations in (70) illustrate the entire range of repair applications in terms of foot weight and grid distance in the specific metrical configuration of Winnebago:

(70) a. Clashing and Adjacent Grids

i) Different Weight: Deletion (68b)

```
 *               *
(*)  >  (*)  /  (*)  >  (*    .)  /  (*)  >  (*)
σμμ     σμ      σμμ     σμ   σμ      σμμ     σμ
```

ii) Equal Weight: Movement (68b), if possible

```
                        *
(*)  =  (*    .)  /  (*)  =  (*)
σμμ     σμ   σμ      σμ      σμμ
```

b. Clashing but Non-Adjacent Grids: Movement (69a), if possible

```
 *
(*    .)  >  (*    .)  /  (*    .)  =  (*    .)
σμ   σμ      σμ   σμ      σμ   σμ      σμ   σμ

 *
(*    .)  >  (*)  /  (*    .)  >  (*)
σμ   σμ      σμμ     σμ   σμ      σμ
```

In the adjacent cases in (70a), which of the two rules applies is determined by the weight of the feet concerned: if there is a difference in either prominence or quantity between the clashing feet, clash deletion naturally applies because it is the primary means for clash resolution at the word level; but if they are equal, clash movement applies as a secondary means. Note the following three points here. First, the target of deletion is necessarily the grid of a lighter foot, while the target of movement is the grid of a binary foot in which a room for grid shift is available. Second, both deletion and movement apply on the non-cyclic level, because their applications result in violations of Structure Preservation (in other words, the Faithfulness Condition in the former, and Prosodic Headedness in the latter) while they are obligatory. Third, as stated in note 26, the weight relation seen in (70a) varies among languages. For instance, the feet in (70aii) are <u>not</u> equal in weight in the case of syllable-counting languages, and are therefore the target of clash deletion. On the other hand, in the non-adjacent cases in (70b), the weight relation between feet becomes irrelevant, and yet is seen as clashing in Winnebago, so that a secondary resolution, or movement, applies at the postlexical level:

postlexical, because its application is optional and sometimes sensitive to phonetic length. This movement is exactly parallel to the English Rhythm Rule as in *Mìssissippi Ríver*, which applies optionally in clashing but non-adjacent contexts.

Given the system in (68) and (69), as well as the repair algorithm based on foot weight and grid distance, the desired outputs without Dorsey's Law sequences are derived simply as in (71):

(71) Forms without Dorsey's Law Sequences

```
a.          (*        )
      <(*    .)>(*    .) (*)
        σμ  σμ  σμ  σμ σμ
        ho  ki  wá  ro kè
                |      |
                H      M

b.       (*     )
      <(*)>(*)  (. )
        σμ  σμμ σμ
        ki  ríi ną
            |
            H

c.            (*          )
      <(*)> (*    .)  (*)
        σμμ  σμ σμ   σμ
        wai  pé re   sgà
             |       |
             H       M

d.          (*                 )
      <(*   .)> (*)  (.      .) (*)
        σμ σμ  σμμ  σμ   σμ σμ
        hi žą  kíi  čą   šgu nį̀
               |             |
               H             M

e.          (*                                       )
      <(*    .)>(*    .) (. )  (*)   (.    *)
        σμ σμ  σμ σμ  σμ  σμμ  σμ σμ
        wa ǧį  ǧį́ gi  šga p'ų̀į  že rè
               |           |       |
               H           M       M

f.        (*                   )
      <(*)>(*    .)  (.   *)  (. )
        σμμσμ σμ σμ σμ   σμ
        hii žú go ki rù   sge
            |       |
            H       M

g.        (*            )
      <(*    .)>(*)  (*)  (. )
        σμ σμ  σμ  σμμ  σμ
        ha ra  gí  nąį̀   če
               |   |
               H   M
```

Clash deletion (68b) applies to (71b, d, e, f, g); clash movement (68b) to (71e); and Non-adjacent clash movement (69a) to (71f). It is not clear whether the non-shifted version of (71f) is in fact allowed. As Hayes (1995: 350) points out, there is a difference among previous studies in the interpretation of the accent location in certain words like (72) (= (65)):

```
(72) a.        (*           )          b.        (*            )
         <(*)> (*   . ) (*   . )              <(*)> (*   . ) (.    *)

         σμμ  σμ σμ   σμ σμ                   σμμ  σμ  σμ   σμ σμ
         wii  rá gų   šgè ra                  wii  rá gų   šge rà
               |       |                            |           |
               H       M                            H           M
```

Hale and White Eagle (1980) favor binary over ternary forms, while Susman (1943) and Miner (1979) favor the opposite. This variance of secondary accent was mentioned in section 3.2.3.1. I conjecture that current Winnebago accent tends to prefer binarity, because Miner (1989) includes various binary data. If so, the tendency is construed as the recent loss of postlexical clash movement (69a) in the environment of (70b).

What is interesting is the comparison between monosyllabic words like *wą́ąk* 'man S43: 56, M79: 27, HWE80: 130, M81: 342, M93: 111' and bisyllabic words like *hi žą́* 'one S43: 29, 50, 67, 76, 78, 79, M79: 28', which are both bimoraic by the requirement of minimality (section 2.6.3). The metrical and tonal structures of these words are derived by the following way:

(73) Monosyllabic and Bisyllabic Words

a. Monosyllabic

```
                              (*)        (*)
      <(*)>            <(*)> (*)         (*)

        σμμ              σμ    μ          σμμ
     * wąąk    →    * wą    ąk    →     wą́ąk
                                          |
                                          H
```

b. Bisyllabic

```
                            (*)        (*   .)          (*)
   <(*    .)>        <(*)> (*)         (*   .)    <(*)> (*)

    σμ σμ              σμ   σμ          σμ σμ        σμ   σμ
  * hi  žą    →       hi   žą    →    * hi  žą   →   hi   žą́
                                                          |
                                                          H
```

In both cases, their only foot cannot be extrametrical because it would make the construction of higher structures impossible, violating the Strict Layer Hypothesis.[28] But since this language seems to resist strongly to primary accent in word-initial position, initial-foot extrametricality applies by making the initial foot monomoraic. This non-maximal foot construction and its concomitant extrametricality are required by the constraint of Non-Initiality. In (73a), even these applications still causes a violation of the Strict Layer Hypothesis (in that the second foot immediately dominates the second mora), extrametricality is blocked after all. In contrast, in (73b), initial-foot extrametricality does apply at the cost of the Maximality Condition, or otherwise it would violate the requirement of Non-Initiality. In other words, Non-Initiality is favored over the Maximality Condition, so that there seems to be a constraint ranking in Winnebago as the Strict Layer Hypothesis >> Non-Initiality >> Maximality Condition.

Now let us examine how words containing Dorsey's Law sequences are assigned their correct accent. The following are the representations before and after the application of Dorsey's Law:[29]

(74) Forms with Dorsey's Law Sequences

```
a.  (*        )           (*    )
    (*  . ) (*)      <(*  . )>(*  . )

    σμσμ  σμ          σμσμ  σμσμ
  k  re  ǰų  sep  →  ke  re  ǰų́  sep
                              |
                              H

b.            (*)                 (*)
     <(*   .)>(*)       <(*  .   .)> (*)

     σμ   σμ σμ         σμ σμσμ σμ
     hi k ro  ho   →    hi ko ro  hó
                                  |
                                  H

c.          (*     )                (*          )
   <(*    . )> (*    .)    <(*   .   .)> (*  . ) (*  . )

    σμ   σμ   σμ   σμ      σμ σμσμ  σμσμ  σμσμ
   wa  k ri  p  ro p ro  →  wa ki ri  pó ro  pò ro
                                      |      |
                                      H      M
```

```
d.          (*      )             (*              )
   <(*)>    (*      .)      <(*)> (*    . )  (*    . )

     σμμ     σμ    σμ        σμμ  σμ  σμ   σμ  σμ
    waa    p  ro p  ro   →   waa   pó  ro   pò  ro
                                   |        |
                                   H        M

e.        (*                 )          (*              )
   <(*)> (*       .)   (*)      <(*)> (*     . )  (.     *)

    σμμ  σμ     σμ    σμ          σμμ  σμ  σμ    σμ  σμ
    raa   ga  k  na    šge   →    raa   gá  ka    na  šgè
                                        |               |
                                        H               M

f.            (*                    )                (*                     )
   <(*   . )>(*    . ) (*         . )     <(*   . )> (*   . ) (.    * ) (.    *)

     σμ σμ  σμ  σμ  σμ        σμ          σμ σμ   σμ σμ  σμ σμ  σμ σμ
     ha ra  ki  š ru  ǰi   k š na    →    ha  ra   kí  šu  ru  ǰì  kša  nà
                                                   |          |        |
                                                   H          M        M
```

When Dorsey's Law applies to the lefthand intermediate stage of each example, copied vowels are situated either inside or outside the feet, both of which violate general constraints: the former cases (i.e. (74c, d, e, f)) violate Structure Preservation because the copied vowels result in ternary feet, and the latter cases (i.e. (74a, c, d)) violate the Strict Layer Hypothesis because they are not dominated by any higher prosodic structures. These anomalous structures are reconstructed as repair strategies by the metrification rules in (68). The righthand representation of each example is after the application of reconstruction due to the violation of Structure preservation or the Strict Layer Hypothesis. Note, however, that the left extrametrical feet in (74b) and (74c), though ternary as a result of Dorsey's Law, are never reconstructed because of the very nature of their invisibility to Structure Preservation. This invisibility also functions as the immunity of the leftmost feet from tone assignment. In addition, this is the very reason why initial heavy syllables never bear accent, even though Winnebago is a quantity-sensitive language. In this way, the accentual behavior of the problematic cases given as (41) and (42) in section 3.2.1 is provided with a principled account uniformly, and the long-standing paradox has come to an end.

Unlike the cyclic rules in (68a), Structure Preservation does not hold for non-cyclic clash deletion and movement (68b) as well as for postlexical clash movement (69a). (74c-f) are likely candidates to undergo postlexical movement (69a), but this rule applies only to (74e) and (74f) here. As mentioned earlier, the application of this rule is somewhat obscure, but at least it can be said that it is sensitive to phonetic length precisely because it is postlexical. Since the Dorsey's Law sequence of OV̲SV is relatively shorter or spoken faster than the underlying CVCV sequence (Susman (1943: 9-10), Miner (1979: 26)), the clashing distance of grids becomes closer at the postlexical level only in the case of (74e) and (74f). As has been underlined, their vowels are inserted by Dorsey's Law and thus shorter than the underlying vowels of (74c) and (74d), and that is why postlexical clash movement, possibly sensitive to phonetic factors, only applies to the former cases. See also section 2.2 for other examples of the same type.

Comparing Hayes's (1995) account of Winnebago accent with my own, readers will naturally find that the former takes maximal advantage of tonal structures, and the latter of metrical structures. A clue to the evaluation of the two, which may be related to the problems indicated in section 3.2.3.3, lies in what they have in common. Unlike any other approaches so far, both involve some forms of deletion and movement in the phonological system of Winnebago. What will matter then is whether they can give a principled explanation of why deletion and movement phenomena must occur in this language, but unfortunately, the tone-based approach that Hayes proposes seems unable to answer this question. This disadvantage results from the fact that accent deletion and accent movement are metrical by nature, governed by the Clash Avoidance Principle. In pitch-accent languages, there are indeed languages like Japanese whose systems may appear to share more with true-tone languages (Pierrehumbert and Beckman (1988)), but Winnebago must be said to share more of its system with stress-accent languages. In my account, tone association (70b) and other rules like L-insertion are the only tone-related rules functioning as phonetic implementation or interpretation.

3.2.4.2. Evidence for Metrical Structure and Extrametricality

Evidently, my account advocated in the previous section adduces full evidence for metrical structure and extrametricality in various respects. First, the distribution of secondary accent in Winnebago is rather obscure and too difficult to generalize in descriptive terms, not necessarily forming a simple alternating rhythm. But theoretically, it is given a principled account in terms of foot weight (foot prominence and foot quantity) and grid distance, which, in turn, argue for the metrical structure of this language. Moreover, metrical structure is necessary for stress-accent and pitch-accent languages, because of the parasitic and abstract nature of stress, just as tonal structure is necessary to true-tone languages. Pitch-accent languages like Winnebago have both metrical and tonal structures.

Second, the presence of extrametricality is also strongly motivated in the present analysis for the following three reasons. 1) The invisibility of the initial foot to the End Rule: Left in (68a) (i.e. construction of the left-headed constituent above feet) accounts for the reason why primary accent falls on the syllable containing the third mora from the initial position. 2) The invisibility of the initial foot to Structure Preservation and the visibility of other feet to Structure Preservation and the Strict Layer Hypothesis neatly capture the difference in accent location between (41a) and (41b), and make it possible to resolve the ordering paradox. 3) The invisibility of the initial foot to tone association is also significant in the sense that the domain never bears secondary accent even if it is a heavy syllable like (75b):

```
(75) a.        (*         )            (*        )              (*        )
           <(*   .)>(*   .) (*)      (*   .) (*   .) (*)      (*   .) (*   .) (*)

           σμ  σμ  σμ  σμ σμ         σμ  σμ σμ  σμ σμ         σμ  σμ σμ  σμ σμ
           ho  ki  wa  ro  ke   →    ho  ki  wa  ro  ke   →   ho  ki  wá  ro  kè
                   |       |                 |       |        |   |   |   |   |
                   H       M                 H       M        L   L   H   L   M

     b.       (*        )             (*        )             (*        )
           <(*)> (*  .)  (*)      (*)  (*  .)  (*)        (*)  (*  .)  (*)

           σμμ  σμ σμ  σμ         σμμ σμ σμ  σμ           σμμ σμ σμ  σμ
           wai  pe re  sga   →    wai  pe re  sga    →    wai  pé re  sgà
                |      |               |      |            ||  |  |   |
                H      M               H      M            LL  H  L   M
```

As shown above, cancellation of extrametricality and default L-insertion apply after tone association. Conversely, before initial-foot extrametricality is canceled, the head of the initial foot is not associated with the M tone by tone association, since it is still invisible to it in the case of the initial two lights in (75a) and the initial heavy in (75b). Winnebago is a quantity-sensitive language, and a heavy syllable is always accented unless it is in initial position. Thus, this exceptional nature of the initial heavy is ascribed only to initial-foot extrametricality.

The arguments for metrical structure and extrametricality can be summarized as in (76):

(76) a. Metrical Structure

i) Bracketed Grids

Parasitic and abstract properties of stress

ii) Foot Weight and Grid Distance

Location of secondary accent

b. Extrametricality

i) Invisibility to the Effects of Constraints

Paradox resolution

ii) Invisibility to the End Rule: Left

Location of primary accent

iii) Invisibility to Tone Association

Quantity-insensitivity of heavy syllables in word-initial position

Recall that final-consonant extrametricality is also motivated in light of reduplication facts discussed in section 2.6.2. As seen in such alternations as *ǰúuk/ǰuuǰúk/*ǰuukǰúk* 'tender M79: 29,' the resistance of the final consonant to copying is accounted for only by assuming that it is rendered extrametrical before the copying process.

3.2.5. Japanese Accent as a Mirror Image

As generalized in (57), we have seen that in Winnebago, primary accent falls on the syllable containing the third mora from the left in the case of words with three or moras (unless they have an epenthetic vowel on the second mora). The aim of this section is to demonstrate that this pattern is not so unnatural from the viewpoint of Metrical Stress Theory by invoking a language with a similar pattern, or more specifically by characterizing Japanese accent as its mirror-image pattern. Although this language is typologically unrelated to Winnebago, it has been known thus far as a pitch-accent language whose accent location is computed by the 'mora-counting, but syllable-accenting' procedure (McCawley (1968: 133-134)). Additionally, I will show that its accent in fact exhibits the mirror image of Winnebago accent.

In theoretical terms, Japanese has both metrical and tonal representations like Winnebago on the grounds that it is a pitch accent language. As a first approximation, I simply use the accent mark here to indicate accent position instead of metrical structure. The following are examples of native monomorphemic words represented in such a way:

(77) Native Monomorphemic Words

```
hí 'fire'     šúu 'week'    ya má 'mountain'    á ra ši 'tempest'
|             ||            |  |                |  |  |
H             HL            L  H                H  L  L

ko kó ro 'heart'    ká ma ki ri 'praying mantis'    mu rá sa ki 'violet'
|  |  |             |  |  |  |                      |  |  |  |
L  H  L             H  L  L  L                      L  H  L  L
```

Traditionally, the accent of this language is defined as the rightmost H tone immediately followed by the L tone. Thus, the H tone of *hi* and *ya ma* is followed by the L tone when the nominative marker *-ga* is suffixed to these words: *hí* ga and *ya má ga*. On the other hand, there are accentless
(H L; L H L)
words with no pitch fall in Japanese: they have no metrical structure, so that the H tone is not followed by the L tone, even if they are suffixed by the nominative marker. The accentless nature of these words is easy to understand when we compare them with final-accented words as above:

(78) Native Monomorphemic Words with the Nominative Marker

a. Final-accented

```
hí ga  'fire (nom.)'    ya má ga  'mountain (nom.)'    a ta má ga  'head (nom.)'
|  |                    |  |  |                        | |  |  |
H  L                    L  H  L                        L H  H  L
```

b. Accentless

```
ke ga  'hair (nom.)'    ha na ga  'nose (nom.)'    sa ku ra ga  'cherry tree (nom.)'
|  |                    |  |  |                    |  |  |  |
L  H                    L  H  H                    L  H  H  H
```

The presence or absence of accent and its position is lexically specified, but what is important is that tone structure can be predicted by the position of accent. I follow Tanaka (1997c) in assuming that Japanese tone structure is derived by the following set of rules:

(79) Tonal Rules for Japanese

a. Tone Association (HL)

b. Initial L-Assignment

c. Rightward Spreading

d. H-Insertion (default)

Some derivations by these rules are illustrated below:

(80) Examples

Tonal Rules / Accent Position	(79a)	(79b)	(79c)	(79d)
a. hí (ga):	hí (ga) | HL	-	hí (ga) | / HL	-
b. ya má (ga):	ya má (ga) | HL	ya má (ga) | | L HL	ya má (ga) | | / L HL	-

<table>
<tr><td>c. ká ma ki ri (ga):</td><td>ká ma ki ri (ga)
|
HL</td><td>–</td><td>ká ma ki ri (ga)
| / / /
HL</td><td>–</td></tr>
<tr><td>d. a ta má (ga):</td><td>a ta má (ga)
|
HL</td><td>a ta má (ga)
| |
L HL</td><td>a ta má (ga)
| | /
L HL</td><td>a ta má (ga)
| | | /
L H HL</td></tr>
<tr><td>e. ke (ga):</td><td>–</td><td>ke (ga)
|
L</td><td>–</td><td>ke (ga)
| |
L H</td></tr>
<tr><td>f. sa ku ra (ga):</td><td>–</td><td>sa ku ra (ga)
|
L</td><td>–</td><td>sa ku ra (ga)
| | | |
L H H H</td></tr>
</table>

Note that the target of rightward spreading (79c) is the basic tone melody HL. That is why it does not apply to accentless words in (80e) and (80f), so that default H-insertion exhausts the remaining domain of these words.

In this way, tonal structure is predictable from the location of accent, but the latter is basically specified word by word and hence unpredictable in the case of native monomorphemic words. However, in the case of foreign words and compounds, the situation is fairly different: their accent can generally be predicted as it falls on the syllable containing the third mora from the end, although these two classes also include accentless words. This generalization is originally based on McCawley's (1968: 134) and Haraguchi's (1991) insight for foreign accent, but it holds well for compounds with foreign, Sino-Japanese, or native origin, as shown in the following data (Tanaka (1997c, to appear a, b)):

(81) Foreign Words and Compounds

a. ... Light + Light + Light

ka fe té ri ya	'cafeteria'	ši zen ká ga ku	'natural science'
pi ya ní su to	'pianist'	gen gó ga ku	'linguistics'

b. ... Heavy + Light

re in kóo to	'raincoat'	i do ba ta kái gi	'chat'
dai ya món do	'diamond'	see nen gáp pi	'birthday'

c. ... Light + Heavy

pa to roo rú kaa	'patrol car'	kan šá sai	'thanks-giving day'
mai ku ró hon	'microphone'	u gui sú ǰoo	'female announcer'

d. ... Heavy + Light + Light

yu ni báa sa ru	'universal'	zu gái ko tsu	'skull'
su ku rán bu ru	'scramble'	re ki ši hát ta tsu	'historical development'

e. ... Heavy + Heavy

suu páa man	'superman'	ša kai kái soo	'social class'
wa šín ton	'Washington'	on see gák kai	'Phonetic Society'

In (81a-e), words on the left column are of foreign origin while those on the right are mainly Sino-Japanese compounds. If we compare (81) with (55), we see that, as far as accent is concerned, this pattern exactly constitutes the mirror image of Winnebago primary accent, although tone realizations in each language appear to be wholly different at the surface: both languages receive accent on the syllable containing the third mora from the left/right end.

In addition to the directionality of accent computation, there are other differences in mora and syllable structure between the two languages. First, in Japanese, any segment in the rime serves as a mora: this language licenses vowels, nasals, or voiceless obstruents in coda position, which are all counted by accent computation. Moreover, a second difference of Japanese is that the syllable head is uniformly determined for its position unlike Winnebago: the left vowel nucleus always counts as the head of a syllable, regardless of its sonority scale. Thus, descriptively, we can summarize their common and different properties in overall phonological structure as in (82):

(82) Properties concerning Mora, Syllable, Foot, and Tone Structure

Prosodic and Tonal Structure	Japanese	Winnebago
a. Mora:	all rime segments	all rime vowels
b. Syllable Head:	the left vowel	the left or the more sonorous right vowel
c. Foot Type:	Moraic Foot	Moraic Foot
d. The Source of Directionality:	Right	Left
e. Foot Head:	Right	Left
f. Foot Extrametricality:	Right	Left
g. End Rule:	Right	Left
h. Tonal Association:	HL	H and M
i. Other Rules:	Initial L-Assignment Rightward Spreading	Cancellation of Extrametricality
j. Default Rule:	H	L

We have seen before that Japanese and Winnebago are pitch-accent languages in which accent computation is mora-counting but syllable-accenting. This is due to the fact that they both have tone-related rules in common and also have moraic feet whose accent-bearing units are syllables. But note that the differences of tone-related rules give rise to the lack of secondary accent in Japanese. The representations in (83) clearly show how the above mechanisms capture the mirror-image relation in accent and the totally different surface tone realizations between the two languages:

(83) The Comparison of Metrical and Tonal Structures

a. Japanese

```
(     *)          (          *)            (      *)         (    *)            (    *)
(*) (. *)<(. *)>  (. *) (. *) (*)<(*)>     (*) (. *)<(*)>    (*) (*)<(. *)>    (*) (*)<(*)>
σμ σμ σμ σμ σμ    σμ σμ σμ σμ σμμ σμ       σμμ σμ σμ σμμ     σμ σμμ σμ σμ      σμμ σμμ σμμ
ka fe té ri ya    i do ba ta kái gi        mai ku ró hon     zu gái ko tsu     suu páa man
|  |  |  /  /     |  |  |  |  |/  /        ||  |  |  //      |  |/  /  /       ||  | / //
L  H  HL          L  H  H  H  HL           LH  H  HL         L  HL             LH  HL
```

b. Winnebago

```
      (*   )            (*   )          (*)            (*)          (*)
<(*  .)>(*  .)     <(*)>(*  .)     <(*  .)>(*)     <(*)>(*)     <(*)>(*)
σμ σμ σμ σμ        σμμ σμ σμ       σμ σμ σμμ       σμ σμμ       σμμ σμμ
ha ra čáb ra       hoo čą́g ra      hi t'a t'áak    ha ǰáak      wąą gią́
|  |   |   |       ||   |  |       |  |   ||       |  ||        ||  ||
L  L   H   L       LL   H  L       L  L   HL       L  HL        LL  LH
```

We also realize no matter how many varieties such typologically-unrelated languages may have on the phonetic level, their phonological structures underlying the surface forms prove to be not so different, when we see them through the looking glasses of Metrical Stress Theory. This is one of the advantages of the principles-and-parameters approach to Universal Grammar.

Finally, we should mention another difference in phonological form between Japanese and Winnebago: the minimal word requirement, which is directly related to prosodic or metrical structure as an organizing principle (section 3.2.2.1). For example, there is no monomoraic word in English because the minimal word of this language is a foot (bimoraic), as in *lúck, pén, spá, péa,* and so on.[31] Monomoraic words are rare and limited to function words like *a* and *the*, both of which have no foot and hence are stressless. Conversely, when they are given stress in strong forms, they become bimoraic as in [éi] and [ðí:], respectively. Likewise, Tanaka (1997c) suggests that the parameters of the Minimality Condition for the two languages above are the ones given in (84) (for the definition of the Minimality Condition, see 2.6.3):

(84) Minimality Condition

a. Japanese: syllable (monomoraic)

b. Winnebago: foot (bimoraic)

To put it plainly, a word must contain at least one syllable in Japanese and one foot in Winnebago. The syllable is monomoraic because its basic form is CV, while the foot is bimoraic because its basic form is binary. As a consequence, monomoraic monosyllabic words are found in Japanese but not in Winnebago, as shown below:

(85) Minimal Word

a. Japanese

(*)	(*)		
(*)	(*)		
hí (ga) 'fire'	té (ga) 'hand'	ke (ga) 'hair'	či (ga) 'blood'
H L	H L	L H	L H

b. Winnebago

(*)	(*)	(*)	(*)
(*)	(*)	<(*)>(*)	<(*)>(*)
žíi 'yellow'	sgáa 'white'	hi wą́x 'to ask'	wa ǰé 'prepare'
HL	HL	L H	L H

Indeed, there are monomoraic bound morphemes in Winnebago, such as *ra* (definite marker), *nį* (negative marker), *ha* (first-person marker), and *ra* (second-person marker), but they are functional in nature and so have no accent by themselves. In contrast, recall that Japanese does have accentless words like the latter two examples in (85a) and the ones in (78b), which are provided with no metrical structure (i.e. foot) in spite of the fact that they are content words.

Interestingly enough, the presence of monomoraic content words and unaccented words only in Japanese is not a mere accident. Since the minimal size of a word is a syllable as in (84a), a word can be monomoraic and does not always have any feet. That is why even a content word can be of the CV size or accentless. In this respect, the Japanese language forms a happy contrast with Winnebago, where neither monomoraic nor accentless words are found on account of (84b).[32]

Notes to Chapter 3

[1] There is another reason why *h* is not observed in the C_1 position. As discussed in section 2.5.1, the clusters of *hw, hr,* and *hy* undergo glide fortition before Dorsey's Law if the word in question is a derived one, as in *pažók* (< /h-wažok/) 'I mash cf. HWE80: 130,' *tée* (< /h-ree/) 'I go S43: 79, M89: 150, M93: 123,' and *hačá* (< /ha-h-ya/) 'I see M79: 32, HWE80: 123.'

Exceptional cases are *hǫwé* (< /hwe/) 'swollen S43: 22' and *hęré* (< /hre/) 'to be S43: 10, 22,' to which glide fortition does not apply due to the Strict Cycle Constraint and instead Dorsey's Law seems to apply, even though *h* should be underspecified for [–voi] underlyingly. A similar exception is *hįnį́k* 'I am small S43: 64, 121,' which is an example of the hVnV sequence. Again, this sequence does not match to the environment of glide fortition and hence appears to undergo Dorsey's Law. However, Dorsey's Law is usually not observed in the hVSV context, as in *hiwą́x* 'to ask M89: 152,' *hirawáhazra* 'the license M79: 28,' *hirat'ét'e* 'you speak WE82: 316,' *hinų́k* 'woman S43: 42, 123,' and so on, which are even more dominant in number than the above cases.

[2] The definitions of 'dispersion' are different between Clements (1990) and Clements (1992). For convenience, I will adopt the latter revised version of the notion, since it is easier to understand and not misleading.

[3] Steriade (1990: 395) notes that besides Dorsey's Law, the output form *wąągną́ka*, derived from /wąąk-nąk-ga/, involves another rule which voices an obstruent before a sonorant, irrespective of morpheme boundaries (and the elision rule of *g* after *k* is also necessary). She assumes that the voicing rule is ordered <u>after</u> Dorsey's Law; thus, the derivation of *hiruką́nąną* from /hiruknąną/ is a typical case, according to her, where vowel insertion has bled the voicing rule. (i) illustrates this point as well as her assumption of

cyclic syllabification:

(i)

1st Cycle		
Syllabification	wąąk	hi . ru . kną . ną
DL	n.a.	hi . ru . ką . ną . ną
Voicing	n.a.	n.a.
2nd Cycle		
Syllabification	wąąk . nąk	–
DL	n.a. (heterosyllabic)	
Voicing	wąąg . nąk	–

This ordering is the opposite of Miner's (1981: 342, 1989: 150, 1993: 111–112) assumption: it is the voicing rule applying across morpheme boundaries that bleeds Dorsey's Law as in *wąągną́ka*, whereas its non-application allows Dorsey's Law to apply as in *hiruką́nąną*. That is why he incorporates the [–voi] value into the rule formulation in (2).

In either case, recall that my analysis is not bothered about the ordering of the two, since I do not adopt the voicing rule. See section 2.6.1.

[4] For details of the Strict Layer Hypothesis and the Extrametricality Condition, see sections 2.6.4 and 2.6.1, respectively.

[5] As demonstrated earlier, rule applications in (29) proceed in the order of syllabification, metrification, and Dorsey's Law. At this point, one might say that it is unclear why the voiceless obstruent remains stray until the application of Dorsey's Law or why vowel insertion does not apply immediately after syllabification. In other words, it might appear that a violation is repaired (i.e. a stray segment is rescued by epenthesis) as soon as it occurs. Concerning the problem, I assume that a repair strategy is a 'last

resort' whose operation is carried over till the end of the phonological level (in this case, of the lexical cyclic level). This is why the operation of Dorsey's Law is delayed after metrical structure construction.

[6] Note also that in this analysis, there would be no explicit motivation for the application of Dorsey's Law, because this form does not have any stray segments or constraint violations.

[7] For a complete list of the correspondences, see Miner (1979: 27).

[8] The fact that nasalization and *e/a* ablaut operate to the copied vowels implies that the two vowels in a Dorsey's Law sequence share not only place features (i.e. [±low], [±high], [±back]) but also manner features (i.e. [±nas]). That is, what is spread leftward is not the Place node as Alderete (1995) assumes but the Root node of the following vowel, which contains the whole features concerning the place and manner of articulation. See section 3.1.2 for Alderete's analysis of the copying phenomenon.

[9] Formally, the Linking Constraint is formulated as "association lines in structural descriptions are interpreted as exhaustive" (Hayes (1986: 331)).

[10] I do not deal here with words with less than three moras, such as *zíi* 'yellow, orange M89: 152, M93: 119, 120,' *sgáa* 'white M89: 152, M93: 117, 120,' *hiwą́x* 'to ask M89: 152,' *wažé* 'dress HWE80: 118, M89: 152' and so forth. The accent assignment of such words is discussed in section 3.2.4.1. The position of subsidiary accent is also accounted for in that section.

[11] Hayes (1995: 9) furthermore claims that stress is parasitic because stress is the linguistic manifestation of rhythm, which in turn is not tied to any particular physical realization; for example, he remarks, "one can detect and recognize the same rhythm irrespective of whether it is realized by (for example) drumbeats, musical notes, or speech."

I think that the reasoning holds true only if rhythm and stress constitute a one-to-one correspondence, that is, in stress-timed rhythm languages. However, rhythm can in principle correspond to any prosodic tier, forming a one-to-many correspondence: to moras in mora-timed rhythm languages, to syllables in syllable-timed rhythm languages, to feet in stress-timed rhythm languages, and so on.

Moreover, what Metrical Stress Theory has referred to as 'stress' is not limited to stress accent but includes pitch accent whose phonetic correlate is pitch to some extent. That is, it is true that both stress accent and rhythm are parasitic, at least in stress-timed rhythm languages, because stress accent is the linguistic manifestation of rhythm; however, this does not exclude the possibility that pitch accent is somewhat parasitic and thus involves phonetic resources other than pitch, since its chief physical correlate is indeed pitch but still shares more properties with stress accent than with true tone, as McCawley (1968) correctly observes. It then follows that metrical structure as an organizing principle is construed as representing both stress accent and pitch accent but that it is mapped to tonal structure representing pitch only in languages with pitch accent. See section 3.2.2.2.

[12] Dresher and Lahiri (1991) and Tanaka (1992b) attempt to make the same point explicitly on the basis of Old English phonology. The former work refer to the organizing property of metrical structure as 'metrical coherence.' The idea underlying the term originates in Hayes's (1982) paper, "Metrical Structure as the Organizing Principle of Yidin^y Phonology," which first framed the tenet in an explicit fashion.

[13] The arguments taken up here as cases sensitive to the height of a grid mark (none, secondary, primary, etc.) are treated differently by Hayes (1995).

They are treated as ways of determining whether the vowel concerned is stressed or stressless on tonal and segmental bases, since stress lacks its physical correlate (see section 3.2.2.1) and thus may be hard to detect even by native speakers. However, it seems to be uncontroversial that these cases also serve as arguments for metrical coherence, as will be stated below.

[14] Regarding this prediction, Hayes (1995: 83-84) notes that there are languages, though not common, which have the Syllabic Trochee and yet have the lengthening rule of stressed vowels. He attributes this apparent exceptional behavior to the fact that lengthening in such trochaic languages is typically phonetic in character, falling short of the duration given to true phonological long vowels, and that it is limited to the main-stressed syllable. In contrast, Iambic Lengthening leads to the full phonological length of vowels or consonants dominated by every foot.

[15] Here, "a sentence feature" means the intonational patterns of this language. According to Susman (1943: 39), there are mainly four intonational (i.e. pitch) patterns with grammatical meanings: 1) falling pitch, decreasing intensity (declarative); 2) rising pitch at the end, after a drop (interrogative); 3) slight fall at the end, with sustained or increased stress (imperative); and sustained or slightly rising pitch throughout (derisive). These patterns seem to be common to many other languages.

[16] Note that at this point, Miner (1979) does not incorporate a distinction between primary and subsidiary accents into the rule, as compared to Miner's (1989) generalization. See the discussion below.

[17] I will omit the cases of monosyllabic words (with two moras), for their location of accent is obvious.

[18] This optionality of secondary accent is accounted for by non-adjacent

clash movement, which is discussed in sections 2.3.3, 2.6.6, and 3.2.4.1 by invoking *wiirágu̯šgerà* 'the stars M79: 28' and *wiirágu̯šgèra* 'the stars HWE80: 117.'

[19] Here and below, I will give examples as syllabified in accordance with the syllabification principle I proposed in section 3.1.3.1. This way makes it easier to see the syllable weight configuration of relevant words.

[20] Importantly, this assumption on the metrical structure of Winnebago is made originally in Tanaka (1990).

[21] Quantity-sensitive, right-headed feet are called Iambs in Hayes's foot inventory. They allow either a light or heavy syllable to be in their head position, but a heavy syllable in their non-head position is banned.

Strong/Weak Local Parsing is the locality parameter of foot parsing. This parameter accounts for the variable nature of binarity/ternarity in bounded-stress systems, and is defined as in (ii) and can be illustrated as in (iii):

(ii) Strong/Weak Local Parsing

When a foot has been constructed, align the window for further parsing either at the next unfooted syllable or by skipping over /◡/, where possible. Hayes (1995: 308)

(iii) a. Strong

(* .)(* .)(* .)(* .)
◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ ...

b. Weak

(* .) (* .) (* .) (* .)
◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ ◡ ...

(iii) is a hypothetical parsing from left to right with trochees, in which (iiia) illustrates the strong local value for binary-stress languages and (iiib) the weak local value for ternary-stress languages.

[22] Note here and below that only long vowels and diphthongs count as heavy in Winnebago; a short vowel closed by a consonant (i.e. (C)VC)

constitutes a mere light syllable.

[23] In the case of (64a), (64c), (64d), and (64g), their correct outputs can be derived through either Strong or Weak Local Parsing. The examples given here are parsed strong-locally, since it is the unmarked value as noted in Hayes (1995: 308, 400). It is to be noted, however, that (64e) and (64f) can only be derived properly through the weak value.

[24] The Faithfulness Condition, originally proposed in Halle and Vergnaud (1987: 15-16), is a well-formedness condition on all stages of derivation, requiring that a bracketed structure has one and only one grid mark (i.e. the head) in its domain and a grid mark * is always enclosed by brackets. It is defined by Hayes (1995: 41, 380) in the following way:

(iv) The Faithfulness Condition

Grid marks must be in one-to-one correspondence with the domain of which they are heads.

[25] We also find sequences like [voiceless obstruents + voiceless stops] (e.g. *pč, čt, pk, ...*) at the surface (section 2.5.2), but I will omit them here since they are marginal and have only a quite limited distribution.

[26] Other rules after tone association involve cancellation of extrametricality and L-insertion, which together provide the forms below with full tone structures. But to simplify the discussion, I will omit the applications of the two rules. See section section 2.6.6 for the details of this level.

[27] The definition of foot quantity in terms of the number of moras is due to the fact that Winnebago is a mora-counting language. In the case of syllable counting languages, foot quantity is equivalent to the number of syllables, i.e. unarity vs. binarity. This difference results in a significant consequence; for example, the weight of $\overset{(*\quad .)}{\sigma\mu\ \sigma\mu}$ and $\overset{(*)}{\sigma\mu\mu}$ is equal in mora-counting

languages, but different in syllable-counting-languages. Note, however, that in languages where stress (accent)-bearing units are moras, foot quantity is equivalent to unarity vs. binarity and the number of moras at the same time, i.e. $\overset{(*}{\mu}\ \overset{.)}{\mu}$ vs. $\overset{(*)}{\mu}$, even though they are mora-counting.

[28] This situation is also construed as a violation of the Extrametricality Condition in section 2.6.1, because making the entire string extrametrical is a 'non-peripheral' application, or as that of Hayes's (1995: 58) Non-Exhaustivity Condition, which blocks extrametricality from applying exhaustively to the domain of a word. But I think it better to resort to the Strict Layer Hypothesis, owing to its generality.

[29] As stated in section 3.1.3.1, voiceless obstruents and sonorants are syllabified as heterosyllabic, so that the initial *k* in (74a) is floating and lacking its nucleus. Thus, due to the initial heterosyllabic *k*, the leftmost foot in (74a) is not made extrametrical at the stage before Dorsey's Law, because its non-initiality violates the 'peripherality' requirement of the Extrametricality Condition. This point was discussed in detail in section 3.1.3.2.6.

[30] Here, I assume, following Haraguchi (1991), that the basic tone melody of Japanese is HL, which is associated with the accented mora of a word. But the rule system in (79) as a whole is different from Haraguchi's in that it can account for tonal patterns of accentless words as well as of accented ones, as shown in (80). I think that this point is one of the advantages of my proposed system.

[31] In English, all segments in the rime count as moras, just like Japanese.

[32] However, we must await further research to examine whether these consequences from the Minimality Condition are always true for other languages. For instance, in the Osaka dialect of Japanese, content words can

be unaccented without any foot, although it is sure that their minimal size is a bimoraic foot: *tee (ga)* 'hand,' *kée (ga)* 'hair,' *čii (ga)* 'blood,' and so forth.
LL H HL L HH H

This case shows that an accentual or stress foot does not always agree with word minimality and that a distinct morphological foot sometimes defines it in some languages. The observations we have made above are based on Standard Japanese, of course.

Chapter 4

Conclusion: Theoretical Implications

I believe that the basic questions in (2a–c), which I posed in section 1.1, are now answered in an explicit and principled way by discussion in sections 2.1–2.6, 3.1, and 3.2, which are concerned with the topics on the architecture of the Lexicon, the synchronic and diachronic emergence of Dorsey's Law, and the solution of the ordering paradox, respectively. The reason that I take up these issues is that they have been controversial or even unexplored in the history of phonological theory and that they have also been essential in characterizing a particular grammar of Winnebago. In short, these three are significant issues in both theoretical and empirical respects, and to achieve the goal of elucidating them, I have described and explained various phonological phenomena of this language and have argued for a coherent and comprehensive model of its system in a unified theoretical framework which draws together the Level-Ordered Theory of Lexical Phonology, the Theory of Constraints and Repair Strategies, and Metrical Stress Theory. As a consequence, my specific claims, either empirical or conceptual, have given the following theoretical implications to the current theories concerned.

First, we knew so little about the Winnebago Lexicon before, as Miner (1993: 128) concludes his article with the remark that "[a] comprehensive lexical phonology remains to be worked out" for Winnebago. To take a step toward breaking through, I have presented the overall phonological system of its Lexicon with special reference to morphology and Universal Grammar, which are illustrated in figures 1 and 2 of section 1.2. Morphologically, this structure favors Borowsky's (1993) model of the Lexicon in which phonology precedes morphology on level 2 (section 2.1) and historically, it witnesses an upward change of rules (or constraints) such as the one as Kaisse (1993) and others suggest (section 3.1.4). This level-ordered composition of the Lexicon in my principles-and-parameters approach, in turn, has another implication to a non-derivational framework like Optimality Theory: at present, it seems to be rather difficult to construct a language-specific grammar in parallel fashion, because as we saw in sections 3.1.2 and 3.2.3.2, even a particular phenomenon (e.g. accent, syllabification, etc.) is hard to capture in Winnebago, where various phonological processes interact with each other. This is because the non-derivational framework aims mainly at developing a theory of Universal Grammar on the basis of language-specific or cross-linguistic phenomena rather than at constructing an overall phonological grammar of a particular language in relation to Universal Grammar.[1] Thus, I will await further research to recast the present model in a parallel-computational framework.

Second, we have seen that the architecture of the Lexicon consists of some language-specific rules and general constraints and that they sometimes interact with each other in two ways: by the effects of constraints in Universal Grammar, rule applications are blocked in some cases while they are triggered in others. For the latter type of effects, I have presented several arguments for the Theory of Constraints and Repair Strategies, where rule applications are not specified in a particular grammar (i.e. the Winnebago Lexicon) but follow automatically from Universal Grammar, as Paradis (1988: 71) remarks: "[a] Repair Strategy as opposed to a rule is an operation that applies to a phonological unit or structure in order to repair the violation of a structural or segmental phonological constraint of universal or language-particular type. It is context-free, the context being determined by the very constraint which justifies its application." (1) is a summary of the blocking and triggering effects on rules by constraints:

(1) a. Blocking of Rules

i) *e/a* Ablaut	⬅	Strict Cycle Constraint
ii) Glide Fortition	⬅	Strict Cycle Constraint
iii) Intervocalic *h*-Deletion	⬅	Strict Cycle Constraint
iv) Final-Consonant Extrametricality	⬅	Extrametricality Condition
v) Non-Initial Stem Shortening	⬅	Minimality Condition
vi) Coda & Onset Syllabification	⬅	Dispersion Principle
vii) Syllabification & Metrification	⬅	Maximality Condition
viii) Reduplication	⬅	Maximality Condition

b. Triggering of Repair Strategies

i) Insertion	⬅	Prosodic Headedness
ii) Insertion	⬅	Coda Condition
iii) Reconstruction	⬅	Strict Layer Hypothesis / Structure Preservation
iv) Deletion	⬅	Clash Avoidance Principle
v) Movement	⬅	Clash Avoidance Principle

As discussed in sections 3.1.3.1, 3.1.4, and 3.2.4.1, the phonology of Winnebago involves the following four types of repair strategies: insertion, reconstruction, deletion, and movement. Dorsey's Law and intrusive schwa contain V-insertion to remedy a violation of Prosodic Headedness and the Coda Condition, respectively, which are followed by leftward spreading in violation of Full Interpretation; the surface ordering paradox of accent assignment and Dorsey's Law is related to the reconstruction rule of metrical structure when either the Strict Layer Hypothesis or Structure Preservation is violated as a result of Dorsey's Law; and a violation of the Clash Avoidance Principle causes clash deletion or clash movement, depending on its seriousness defined by foot weight (the optionality of movement is determined by grid distance, or (non-)adjacency). All of these processes are cases for context-free repair strategies.

Finally, even more significant are implications on the Metrical Stress Theory, as we have adduced full evidence for the metrical structure and extrametricality of Winnebago. Combined with final-consonant extrametricality, (76) in section 3.2.4.2 is extended as in the following way:

(2) a. Metrical Structure

- i) Bracketed Grids

    Parasitic and abstract properties of stress

- ii) Foot Weight and Grid Distance

    Location of secondary accent

b. Initial-Foot Extrametricality

- i) Invisibility to the Effects of Constraints

    Paradox resolution

- ii) Invisibility to the End Rule: Left

    Location of primary accent

- iii) Invisibility to Tone Association

    Quantity-insensitivity of heavy syllables in word-initial position

c. Final Consonant Extrametricality

- i) Invisibility to Copying

    Surface infixal reduplicants as well as suffixal reduplicants

ii) Invisibility to Syllabification

Voicing neutralization of obstruents in word-final coda position

In any framework, stress or accent is assumed to be computed by metrical structure. In fact, many people think that metrical structure is simply a device for capturing the location of stress or accent in a particular language or in all languages. As a result, its precise nature has not been discussed in explicit terms, except for pioneering and outstanding studies on the Metrical Stress Theory. I have shown that the Metrical Stress Theory is one not only for explaining the computation of stress distribution but also for discovering an organizing principle of phonological systems themselves. The central claim of Metrical Stress Theory is that metrical structure functions as an organizing principle in the phonology of a particular language and even in the phonological component of Universal Grammar, as discussed extensively in section 3.2.2.1.

Note to Chapter 4

[1] Itô and Mester (1995a, 1995b, to appear) are sole exceptions, as far as I know, to this characterization in that they account for the phonological distinction among word classes in Japanese and propose its Lexicon model within the framework of Optimality Theory.

Appendix
Phonological Primitives and Word Index

1. Phonological Primitives

This section summarizes such phonological primitives as the phonemic inventory of consonants and vowels, the co-occurrence restrictions on consonant clusters and vowel sequences, the type of basic syllable templates, and the generalization of primary accent. Its aim is to help readers reexamine the essentials of Winnebago phonology from a wider perspective by referring to a variety of data given in section 2.

1.1. Phonemic Inventory (sections 2.5.1 and 2.5.3)

(1) Consonantal Inventory

Manner Features \ Place Features					[-gutt] [-cor] [+ant] Labial	[-gutt] [+cor] [+ant] Alveolar	[-gutt] [+cor] [-ant] Palato-Alveolar	[-gutt] [-cor] [-ant] Velar	[+gutt] [-cor] [-ant] Glottal
[-son]	[-cont]	[-nas]	Stop		p / b	t	č / ǰ	k / g	'
[-son]	[+cont]	[-nas]	Fricative			s / z	š / ž	x / ǧ	h
[+son]	[-cont]	[+nas]	Nasal		m	n			
[+son]	[+cont]	[-nas]	Glide		w	r	y		

(2) Vocalic Inventory

Height Features \ Depth Features		[-back]	[+back]
[+high]	[-low]	i / į	u / ų
[-high]	[-low]	e	o
[-high]	[+low]	a / ą	

1.2. Cooccurrence Restrictions (sections 2.5.2, 2.5.4, 3.2.3.1)

(3) Possible Consonant Clusters: C_1C_2

a. Tautosyllabic Clusters: Word-initial or Word-medial Position

C_1 voiceless obstruent + C_2 voiced stop: sg, šg, xg, šǰ, xǰ, kǰ, pǰ, čg, pg, etc.

+ C_2 voiceless fricative: ps, pš, ks, kš, ph, etc.

+ C_2 glottal stop: p', t', k', s', š', x', etc.

b. Heterosyllabic Clusters: Word-medial Position only

C_1 voiced obstruent + C_2 sonorant: br, gr, ǧr, zr, gn, ǰn, ǰw, etc.

(4) Possible Vowel Sequences: V_1V_2

V_1 \ V_2	i	e	u	o	a
a	ái	*	*	*	áa
o	ói	óe	*	óo	oá
u	úi	úe	úu	uó	uá
e	éi	ée	*	eó	eá
i	íi	ié	*	ió	iá

1.3. Syllable Structure (cf. section 3.1.3.1)

(5) Possible Syllable Types (V = vowel; C = consonant; and O = obstruent)

a. Onset: C, CC, (ϕ)

Nucleus: V, VV

Coda: ϕ, voiced O (word-medial), voiceless O (word-final)

b. Light: V, CV, CCV, VC, CVO, CCVO

Heavy: VV, CVV, CCVV, VVO, CVVO, CCVVO

c. The minimal word is a heavy syllable.

d. An onsetless syllable, in principle, does not seem to be acceptable but inserted by the glottal stop in onset position, although there are a few forms lacking the onset consonant like į́į 'to live M89: 151' and ų́ų 'to make M89: 151.' But they are thought of as rare cases where the lack of the glottal stop is crucial for distinguishing them from 'íi 'mouth S43: 123' and 'ų́ų 'to do S43: 17, 47,' respectively.

1.4. Accentual Position (section 3.2.3.1)

(6) Generalization for Primary Accent

In the case of words with more than two moras, primary accent falls on the syllable containing the third mora, except for words whose second mora is epenthetic.

2. Word Index

I give here lexical and postlexical items in alphabetical order, all of which appeared and were discussed in the text of the previous chapters. Note that the items are not transcribed by spellings just like English dictionaries but are listed in phonemic representation, where 1) the glottal stop ' does not count as an alphabet and 2) the nasalized vowels (į, ų, ą) and the crowned consonants (š, ž, č, ǰ, ǧ) are treated the same as their respective counterparts without the diacritics. Note also that 3) the distinction in lexical status (i.e. lexical items on the uni-domain level vs. postlexical items on the multi-domain level) is made in hyphenation and that 4) although within a single domain subsidiary accent is less prominent than primary or any other subsidiary accent preceding, due to the effect of down step, I transcribe all subsidiary accents with secondary one and do not use tertiary or quaternary one here.

The list, of course, reflects the important results of the discussion so far: all the items are syllabified and accented properly, and the positions of Dorsey's Law vowels are shown explicitly by underlines. In that sense, the data are somewhat revised and different from the ones indicated by the abbreviations of data sources. But needless to say, the chief purpose for organizing this index is 1) to gurantee the reliability and objectivity of the data sources and their English meanings, 2) to make it easier for readers to compare them with those analysed here, and 3) to encourage any further study on the phonology of Winnebago.

A

'áa	'to say S43: 48, H95: 350'
'aa bú	'blossom S43: 67, 125'
'áap	'leaf S43: 67, 125'
'áa – ǰi ré	'to start saying S43: 48'

B

ba gáa xge	'chicken S43: 35'
bo á ta	'I hit WE82: 317'
boi ksáp	'I come to M93: 119'
boo ką́	'to knock over M89: 152'
boo ką́ ga ǰą	'obviously knockdown M89: 152'
boo pé res	'to sober up M89: 154'
boo pų́ nųs	'to hit at random M89: 149'
boo rá ta	'you hit WE82: 317'
boo šíp ge	'because he shot it down S43: 64'
boo tá	'he hits WE82: 317'

Č

čáa	'deer S43: 29, M93: 117'
čáap	'related S43: 57'
čaa hái žą	'a deerskin S43: 29, 78'
čaa héi žą	'a deer horn S43: 78'
čée	'deer S43: 41'
čee bí	'to consume S43: 34, 56, 67'
čeeb wá hi	'he consumed something S43: 34'
čee hé	'deer horn, buffalo horn S43: 41, 56, 67'
čéek	'new S43: 25, 33, 35, M93: 123'
čéep	'finished S43: 56'
číi	'lodge, house, to live S43: 33, 36, HWE80: 130'
čii ną́ą gu	'home roads S43: 57, 123'
čii ną́k	'town M89: 152'
čioi ǰás	'tent M93: 121'
čį̱ wį́	'sound M89: 149'
čį̱ wį čį̱́ wį	'sound causing vibration M79: 26, M89: 149'
čóop	'four, four-legged S43: 59'
čoo wió mį nąk	'the leading-place S43: 29, 76'
čuu giá šą ną pgè	'kingbird cf. M81: 342'

E

'ée	'to say S43: 47, 122'
'ée	'this S43: 36, 63, 78'
'ee gí	'here S43: 36, 63, 76. 78'

'ee ǰá	'there S43: 36, 63, 76. 78'

G, Ǧ

géeš	'bow, arch S43: 120'
gi gi nį́ ną ga ǰą̀	'he should not have done it to him S43: 53, 136'
gi hú	'to swing M89: 149'
gi hu hú	'to wag its tail M89: 149'
gį́įx	'around S43: 71'
gi ką̱ ną ką̱́ nąp	'shiny M89: 155'
gi ką̱ ną ką̱́ ną pšą̱̀ ną	'it is shiny M89: 170'
gi pįé sge	'enjoyable S43: 66'
gi sa̱ wa nắk	'to calm down sitting M89: 150'
gi se̱ wé	'to calm down M89: 150'
gi šgái pǰą ne	'he will strike M93: 124'
gi šib šgų́ nį	'he must have fallen cf. M93: 124'
gi sú	'to husk M89: 149'
gi sų́	'upset M89: 149'
gúu	'to leave returning here M89: 151'
guuǰ s'á	'to shoot repeatedly cf. M93: 124'
guu ną́	'she came S43: 66'
gų́ųs	'to teach WE82: 310'
gųų sšą́ ną	'he teaches (declarative) or taught WE82: 309'

H

háa	'skin S43: 29, 61'
hąąb čék	'Monday cf. M93: 123'

hąą bó ka hì	'every day S43: 125'
hąąb rá	'the day, the light S43: 18, 40, 65'
háač	'I eat M93: 123'
háač – tée	'I go to eat cf. M93: 123'
hąą hé	'night S43: 58'
hąą hé wi	'moon S43: 58, 123'
hąą hió ka hi	'every night S43: 62'
háak	'rear part M89: 149'
hą́ąk	'woodchuck M89: 149'
haa kí tu ǰìk	'I pull taut HWE80: 118, 120, 126'
hą́ąp	'day S43: 40, 66, M93: 123'
haa pé	'I waited for him S43: 8, 11'
hąą pgú	'dawn S43: 56'
hąą p'į́	'good day cf. S43: 66'
haa pų́ ruč	'common elder M89: 154'
haa stį́	'strawberry S43: 65'
ha čá	'I see HWE80: 123'
ha čą kę́ re	'with difficulty M89: 154'
ha čį́į ǰa	'where S43: 36, WE82: 309'
ha čį́į ǰa – kų nų gá – nį́įp	'where did Kųnųga swim? WE82: 309'
ha go rée žą	'sometime in the future S43: 76'
ha go réi žą	'sometimes S43: 63, 67'
ha guá hi	'to go to get S43: 79'
ha gų́s	'I teach WE82: 309'
ha gų sšą́ ną	'I teach (declarative) or taught WE82: 309'

ha k̲e̲ we há šge	'six times perhaps S43: 135'
ha ǰá	'to see, he sees S43: 47, M79: 31, 32, HWE80: 123'
ha ǰą́ąk	'he (moving) saw S43: 10, 11, 47'
ha ǰa pį́	'good-looking S43: 122, 123'
ha ǰá – pį́į	'able to see S43: 122'
ha ki rú ǰik	'to pull taut, he pulls taut HWE80: 126'
ha̲ ną́ąč	'all S43: 67'
ha̲ ną́ą te 'e	'all this S43: 66'
ha nį́	'to have S43: 57, 67'
ha nį nį́ žùi šge	'if it rains on you S43: 48'
ha nį́p	'I swim WE82: 309, 310'
ha nį pšą́ ną	'I swim (declarative) or I swam WE82: 309, 310'
ha pée ną	'he was waiting for him S43: 12'
ha̲ ra čáb ra	'the taste M79: 28'
ha̲ ra gį́ nąį̀ če	'you will suffer for it S43: 49, 139'
ha̲ ra ką́ ra gi nąį̀	'you are going to fast for it S43: 49'
ha̲ ra kí šu̲ ru ǰìk	'you pull taut HWE80: 126'
ha̲ ra kí šu̲ ru ǰì kšą̲ nį̀	'you pull taut (declarative) or you pulled taut HWE80: 126'
ha̲ ra pé	'you waited for him S43: 10'
ha̲ ra pée ną	'you were waiting for him S43: 10, 12'
ha̲ ra pé ge	'because you waited for him S43: 10, 12'
ha̲ ra pé gį nį̀	'you waited for him already S43: 10'
ha ru wą́k	'eight S43: 11'
ha są ǰé ǰa	'on the far side M79: 28'
ha šǰá	'you see HWE80: 123'
hée	'horn S43: 41'

hee ną́ ga	'Heenąga (person name, second-born son) WE82: 308, 309'
hee ną́ ga – ha čį́į ǰa – nįįp	'where did Heenąga swim? WE82: 309'
hee pšį́	'to sneeze S43: 70'
he̲ ré	'to be, he is S43: 10, 22'
he riá ną ga	'he was and S43: 75'
hįą bó šip	'you and I shot him down S43: 28, 29'
hi 'aǰ rá	'the father S43: 78'
hi ča kó̲ ro	'friend closer than brother S43: 35
hi 'e nį́ že	'he did not find it S43: 28'
hi gái ra ną gà	'they said to him and S43: 53'
hi hag ré gi	'on top S43: 13, 60'
híi	'to do S43: 34, 56'
hį́į	'to suck S43: 34'
hii žúu go ki rù sge	'double-barreled shotgun cf. M79: 28, HWE80: 117, M81: 341'
hi ǰái ra	'more, bigger S43: 36, 63'
hi ko̲ ro hó	'to prepare, dress, he prepares S43: 35, 48, M79: 30, 39, HWE80: 128, M89: 155'
hi ko̲ róo ke	'great grandmother, female ancestor S43: 35'
hi ku̲ ru nį́	'tangled M89: 155'
hi ną́ą nąk	'we (sitting) slept S43: 11'
hį nį́k	'I am small S43: 64, 121'
hį nų gá	'Hįnųga (person name, first-born daughter) WE82: 308'
hi nų gúu ną	'the woman came cf. S43: 66'
hi nųg wá ček	'young woman, virgin S43: 42, 57'
hi nų́k	'woman S43: 42, 123'

hi nų́k – čáap	'one's own sister S43: 57'
hi pe̲ rés	'to know S43: 40, 71, M79: 26, M89: 154, M93: 111'
hi pe̲ rés – roo gų́	'he wanted to know cf. S43: 40'
hi pi rák	'belt M79: 28, M89: 152'
hi ra kó̲ ro hò	'you prepare, dress HWE80: 128'
hi ra kó̲ ro hò nį	'you don't prepare HV87: 31'
hi ra kó̲ ro hò nį rà	'the fact that you don't prepare H90: 149'
hi ra pé̲ rez nį ną̀ą ną	'you would not know S43: 53, 144'
hi ra t'á t'a šą̲̀ ną kšą̲̀ ną	'you are talking HWE80: 130, H85: 428'
hi ra t'é t'e	'you speak WE82: 316'
hi ra wá haz rà	'the license M79: 28'
hi ro kí ya pò̲ ro kšè	'he rolled them up S43: 29, 68'
hi ruá kų	'I used it S43: 74'
hi ru ką́ ną ną̀	'boss M81: 342, M93: 111–112'
hi ru pį́ nį	'to twist M89: 154, M93: 111'
hi šǰá	'face S43: 57'
hi šǰa sú	'eye S43: 57, M79: 28'
hi t'a t'áak	'he (lying) talked S43: 10, 11, 47'
hi t'a t'á – ǰi ré	'he started to talk S43: 74'
hi t'é	'to speak M79: 28'
hi t'eó ki rač	'to speak different languages S43: 67'
hi t'e t'é	'to speak, to speak repeatedly S43: 9, 10, 47, M89: 149, WE82: 316'
hi t'e t'ée ną	'speak (declarative), spoke, he spoke WE82: 316'
hi t'e t'éi re	'they speak M79: 29'

hi t'e t'é – ǰi ré	'he started to talk S43: 74'
hi wą́x	'to ask M89: 152'
hi žą́	'one S43: 29, 50, 67, 76, 78, 79, M79: 28'
hi žą kíi čą šgu nį̀	'nine M79: 25'
hi žą kíi čą šgu nįą̀ ną gà	'nine and M79: 25'
ho čį čį́ nįk	'boy HWE 80: 118'
ho gi híi žą	'one hundred S43: 36'
hoi xǰį́	'full S43: 78'
hoi kę́ we	'to enter M79: 27, M89: 167'
ho ǰi są́ ną	'recently M89: 154'
ho ka hí	'every S43: 79, 82, 125'
ho k'a̲ wa né ge	'so that he could come in L45: 6, Hg95: 156'
ho ki t'é	'to talk to, he speaks to HWE80: 121'
ho ki wá ro kè	'swing M79: 28'
ho ki wá haz rà	'the license M79: 28'
ho kǰa ké ya ǧèp	'wild plants S43: 29, 59, 67'
ho nį́p	'he swims in it WE82: 317'
hoo čą́k	'Winnebago M79: 27'
hoo čą́g ra	'the Winnebago M79: 27'
hoo 'ó 'o kè	'owl S43: 35'
ho ra kí t'e	'you talk to, you speak to HWE80: 121'
ho ra nį́p	'you swim in it WE82: 317'
ho̲ rók	'to be a member of, to join S43: 17, 106'
ho̲ rók – 'ų́ų	'to join S43: 17, 67'
ho ša̲ wa žá	'you are ill, sick HWE80: 125, M89: 155'

ho sgą́č	'playground M89: 152'
ho si̜ ni̜ rá	'in the cold S43: 143'
ho 'u̜ó ka hi	'whenever you do it S43: 79'
ho wa žá	'to be ill, sick HWE80: 125'
ho̱ wé	'swollen S43: 22'
húič	'butt end, foot of tree S43: 36, 71'
húu	'leg S43: 120'
húu	'to come S43: 67, 125'
huu géš	'bow-legged S43: 120'

I

í̜i̜	'to live M89: 151'
'íi	'mouth S43: 123'
'ii ní̜	'saliva S43: 123'

J̌

ǰáa	'frozen M93: 117'
ǰaa gú ra pi̜ą̀ ši̜ ni̜ gì	'whatever good things you have S43: 62'
ǰi ke̱ ré	'to become M79: 27, M89: 167'
ǰi ré	'to start S43: 48, 74, 108, 122'
ǰuu ǰúk	'tender M79: 29'

K

ką nák	'to marry M89: 149, M93: 124'
ką nąg sgé	'he may have married cf. M93: 124'
ka̱ ra čgą́	'to drink one's own M89: 151'

ka rái re	'they leave returning M79: 29, M89: 150'
k'ée	'to dig M93: 115'
ke ré	'to leave returning M79: 26, 27, 29, M89: 150, 167'
ke re ǰų́ sep	'Black Hawk M79: 30, M89: 154'
ke re ké reš	'colorful M79: 26'
ke re pą́ ną	'ten M79: 27, M89: 167'
ke riák	'he (moving) barked S43: 75'
kiás	'to flee in fear S43: 36'
kii zá	'fight M79: 31, H95: 356'
ki ri gí	'to come back'
ki ríi ną	'he returned H90: 149'
ki ri kí ris	'striped, spotted S43: 33, 67'
ki ri nį́į ną	'he did not return S43: 47'
kǰée	'revenge M93: 117'
ksáač	'stiff M93: 117'
kšée	'apple M93: 117'
kšíi	'S43: weak'
kų nų gá	'Kųnųga (person name, first-born son) WE82: 308, 309'
ku ru šíp	'to pull down one's own S43: 45, M89: 151'
k'ų́ų	'to make one's own M89: 151'

M

mą́ą	'earth S43: 36, 61, 79, M79: 28, M89: 149'
mąą čái re	'they cut a piece off M79: 29, M89: 150'
mąą čé	'to cut a piece off M89: 150'
mąą čói ǧop	'to have grizzly bear power S43: 79'

mąą nį́	'to walk S43: 33'
mąą nį́ nį	'to walk a little S43: 33'
mąą pę́ re	'to slice thin M89: 150'
mąą pá ra ną̀	'he could slice thin M89: 150'
mąą ráč	'to promise S43: 106, HWE80: 127'
mąą šą́ rač	'you promise S43: 106, HWE80: 127, M89: 154'
mąą táč	'I promise HWE80: 127'
mąį tá wu shì ra	'May Miner 81: 342'
mį ą́ nąk	'I sit HWE80: 130'
mį́įk	'to lie down WE82: 310'
mįį kšą́ ną	'he lay down WE82: 309'

N

ną́ą	'wood S43: 120'
nąą 'á	'to weigh HWE80: 121'
ną ą́ 'ą	'I weigh HWE80: 121'
nąą gú	'road S43: 59, 61'
nąą hái či	'bark house S43: 125'
ną́ąk	'to run S43: 71, WE82: 310'
nąą kšą́ ną	'he ran WE82: 309'
nąą ná 'ą	'you weigh HWE80: 121'
ną́ąp	'hand S43: 71'
nąą pą́ą	'basket S43: 120'
ną ą́ še	'I took him away S43: 73'
ną ą́ wą	'I sang S43: 8, 10, 12, 105'
nąą wą́ąk	'he (lying) sang S43: 10, 11'

nąą wą́ą ną	'he was singing S43: 10, 12'
nąą wą́ ge	'because he sang S43: 10'
nąį wá čgis	'saw (n) M93: 119'
nįe ǰá	'river WE82: 309'
nįe ǰá – nįį pšą́ ną	'he swam in the river WE82: 309'
nį́į	'water, liquid S43: 60, 123, M89: 149, 150'
nį́įp	'to swim WE82: 309, 310'
nįį pšą́ ną	'swim (declarative) or swam WE82: 309
nįį pšą́ ną	'he swims (declarative) or he swam WE82: 309'
nįį pšą́ ną gè	'because he swam cf. S43: 64'
nįį žú gùu	'rainy weather S43: 125'
nį kši kší nį kǰ́ą nèe ną	'it will not be weak for you S43: 41'
nįoi są́	'faded M93: 121'
nųųǧ rá	'the ear S43: 64, 121'
nųųg rí nį̀įk	'I am deaf S43: 64, 121'

P

pą́ą	'sack S43: 120'
pąą pą́č	'soft M79: 29'
p'ąą p'ą́č	'to give to the touch M93: 115'
paa šiá ǰèe ną	'I (standing) danced S43: 51'
pą ną́	'to smell S43: 123'
pą ną pį́	'sweat–smelling S43: 14, 123'
pą ną́ – pį́į	'able to have an odor S43: 14, 123'
pa̱ ra ǧų́ čge	'information M89: 154'
pa̱ rás	'flat, broad S43: 71, M79: 27, 29, 30, M89: 167'

pa̲ ra pá̲ ras	'wide M79: 29'
pa ší	'I dance S43: 46'
pa ši ną́k	'I dance sitting S43: 50'
pa žók	'I mash cf. HWE80: 130'
péeč	'fire S43: 25, M79: 31, M89: 150, M93: 123, 124'
peeǰ nį́	'whiskey M89: 150'
peeǰ wáč	'locomotive cf. M89: 150, M93: 123'
pį́į	'good, to be able S43: 66, 113'
po̲ ró	'spherical S43: 70'
po̲ ro pó̲ ro	'spherical M79: 26, M89: 155'
po̲ ro póo ro	'spherical M89: 154'
psíč	'to spray S43: 70'
psį́č	'to sway S43: 70'
psįį psį́č	'awkward M79: 29'
psįį psį́č	'small change M93: 117'
pšoo pšóč	'fine M93: 117'

R

raa bią́	'a beaver S43: 67'
raa gá ką ną šgè	'ant M81: 342'
ráap	'beaver S43: 67, HWE80: 130'
ra čgą́	'to drink M89: 149, 151'
ra čgą čgą́	'to drink repeatedly M89: 149'
ra ke̲ re kǰą́ ne	'you will return S43: 138'
ra ke̲ re kǰą́ ną hèe ną	'you will go home S43: 47'
ra nį́p	'you swim WE82: 309, 310'

ra nį pšą́ ną	'you swim (declarative) or you swam WE82: 309, 310'
rée	'to go M89: 151, M93: 113'
ree čá̲ wa	'navel S43: 35'
roo gų́	'to want S43: 40'
roo ké̲ we	'to dress, paint face S43: 13, M79: 30'
roo rá ke̲ wè	'you dressed him S43: 13'
ru gás	'to tear M89: 151'
ru pi̲ ríš	'curl M79: 27'
ru šíp	'to pull down S43: 45, M89: 151, M93: 113'
rúus	'to take S43: 71'
rúuš	'to drop S43: 71'
ru xu̲ ru ké	'because he earns it S43: 64'
ru xu̲ ru k'é	'he often earns it cf. S43: 65'

S, Š

saa nį́g ru ǰį̀p	'unbalanced S43: 125'
ša̲ rá	'bald S43: 33, M79: 29, M89: 149'
ša̲ ra šá̲ ra	'bald in spots S43: 13, 33, M79: 29, M89: 149'
ša̲ wa ší	'you dance M89: 151'
ša̲ wa žók	'you mash HWE80: 124, M89: 153'
ša̲ wa žó kǰį	'you mash hard M89: 154'
š'ée	'to leak, to drip S43: 71, M93: 115'
š'ee š'é	'to drip M79: 29'
se̲ réč	'long M79: 27'
še̲ rée	'you go cf. M89: 151'
sgáa	'white M89: 152, M93: 117, 120'

sgáač	'to play M79: 31, M93: 117'
sgaa sgáp	'sticky M79: 29'
šgúu	'you leave returning here M89: 151'
ši̯ ái̯ ge xǰi̯	'I am clumsy M93: 121'
síi	'leg, foot M89: 149, M93: 117, 119'
sí̯i̯	'liver M89: 149'
s'íi	'for a long time M93: 115'
š'í̯i̯	'you live M89: 151'
si̱ní̯	'cold M79: 29, M89: 149'
šǰáak	'warm M93: 117'
šǰée	'you die S43: 112, M89: 151'
šóo	'to spit S43: 71'
šóoč	'foggy S43: 71'
šo̱ róš	'deep M89: 153, M93: 112'
stoo hí	'gather M93: 117'
šu̱ ru gás	'you tear M89: 151'
šu̱ ru xé	'you ran after him S43: 9'
šu̱ ru xú̱ ruk	'you earn, you are able M79: 30, 33, M89: 154'
šu̱ ru xú̱ ru kìi sge	'if you succeed, if you reach there S43: 48'
súu	'seed S43: 57'
šu̯u̯ gí nu̯k	'female dog S43: 123'
šú̯u̯k	'dog S43: 42, 68, 123'
šu̯u̯ ké te	'horse S43: 42, 68'

T

taa ná̯	'I could go M89: 150'

taa nį́	'to put S43: 58'
taa nįó žu	'to offer tobacco S43: 58'
taa nį́ žu	'sugar M89: 152'
taa nį́ žu ra	'the sugar M89: 152'
t'ąą pgúu	'to jump down S43: 56,122'
t'ąą pǰą́ą re	'this one that jumped down S43: 42'
taa wú sǰià ną gà	'it was very dry S43: 65'
tée	'I go S43: 79, M89: 150, M93: 123'
t'ée	'to die M79: 28, M89: 151'
te 'é	'this S43: 47, 66'
tee ǰá na ǧo pgè	'pelican cf. M81: 342'
t'ee kǰą́ ne	'he would die S43: 48, 65, 137'
tu šíp	'I pull down S43: 45'
t'ų́ųp	'to put something long M93: 115'

U

'úič	'lower end S43: 36, 71'
ų́ų	'to make M89: 151'
'ų́ų	'to do S43: 17, 47'

W

wáa	'snow M89: 152'
wáač	'boat M89: 150'
wąą gá nį	'to be a man S43: 57, 125'
wąą gią́	'a man S43: 67, 79'
wąąg ną́ ka	'that man sitting M79: 27, M81: 342, M93: 111'

wą̨ą̨g wá šo šè	'brave man S43: 57'
wą́ąk	'man S43: 56, M79: 27, HWE80: 130, M81: 342, M93: 111'
waa kí t'e	'I speak to HWE80: 121'
wąą kšíg ną gù	'path (Indian Road) S43: 58'
wąą kší go 'įą̀ šį nį rà	'your life S43: 62'
wąą kší k'ı̨̀ı̨	'to live S43: 124'
waa nį́p	'I swim in it WE82: 317'
waa pó̲ ro hì	'snowball making M79: 30'
waa pó̲ ro pò̲ ro	'snowball M79: 30'
wáas	'breast S43: 34'
waa sgió ke̲ re	'waiter S43: 76'
wa á 'ų	'I do HWE80: 129'
waa zį́	'to suckle S43: 34'
waa zį́ zį	'to suckle a little at a time S43: 34'
wa čék	'something new, young S43: 35, 42, 112'
wai pé̲ re sgà	'linen M79: 28'
wa ǰé	'dress HWE80: 118, M89: 152'
wa ǧį ǧį́ gi šga p'ų̀į že rè	'baseball player M79: 25'
wa ǧį ǧį́ gi šga p'ų̀į že reà ną gà	'baseball player and M79: 25'
wa ki̲ rí	'insect, small animal S43: 59'
wa ki̲ rí – ǰóop	'lizard S43: 59.'
wa ki̲ ri kí̲ rik	'slippery elm M89: 155'
wa ki̲ ri pá̲ ras	'flat bug, cockroach M79: 30, HWE80: 131, M89: 155'
wa ki̲ ri pó̲ ro pò̲ ro	'spherical bug HWE80: 131, M89: 155'

wa mą nų́ ke	'thief M89: 149'
wa nį́k	'bird M89: 150'
wa nį gį́k	'little bird S43: 68, M89: 152'
wa nįg nį́k	'little bird M89: 150'
wa nįg nį́g ra	'the little bird M89: 150'
wa raǰ nįą́ ną ga	'you do not eat and S43: 53'
wa ra ré	'work ! M89: 150'
wa ré	'to work M89: 150'
wa re čá̲ wa	'twins S43: 35'
wa ruǰ rá	'the food S43: 59'
wa ruǰ róo žu	'dish of food S43: 59'
wa ší	'to dance S43: 46, M89: 151'
wa šiá hąąg wi	'they (moving) danced S43: 51'
wa šiák	'he was dancing S43: 47, 76'
wa ší – ki̲ ri gí	'to come back dancing S43: 58'
wa ši nąk	'to dance sitting S43: 50'
wa šo šé	'brave M79: 31, H95: 356'
wa sų̲ nų́	'to spit roast M79: 27, M89: 167'
wa 'ųą́ kše	'he (moving) did it S43: 72'
wa 'ų nąąg ra	'ones who do this, what they do, what they want S43: 50, 54, 142, 144'
wa xi̲ rí	'to squash M89: 152'
wa žái ǰa	'where it was wiped S43: 75, 109'
wa žók	'to mash HWE80: 124, 130'
wee čą́į ǰa	'where it was folded S43: 109'
wia ğé phùu	'sunrise S43: 17, 67'

wi hą gá 'Wihąga (person name, second-born daughter) WE82: 308'

wíi 'sun S43: 58'

wii rá gų šgè 'star S43: 58'

wii rá gų šge rà 'the stars M79: 28'

wii rá gų šgè ra 'HWE80: 117'

wii rá pę rèe ste 'you will learn this S43: 49, 65, 75'

wi ǰúk 'cat WE82: 313'

wi ǰug nį́k 'small cat WE82: 313'

wi ǰug wą́ąk 'male cat, male weasel S43: 57'

wioi ré 'west S43: 28, 124, M93: 121'

wioi ré giè re rà 'the west S43: 78'

woo gų́z ra nąg rè 'this creation S43: 48, 52, 142'

woo xé te hì 'to love S43: 35'

X

xaa pgé nįk 'rapidly S43: 67'

x'ée 'to drip (thin liquids) S43: 33, 71, M93: 115'

x'ee x'é 'to drop earnings S43: 33, 71'

xe té 'big S43: 22, 35, 42, 59, 68'

xgąą sák 'energetic M93: 117'

xgį́įk 'to draw out fluid S43: 70'

xǰaa ną́ ne 'yesterday M89: 152, M93: 117'

xo čgé 'gray S43: 58'

xo̱ ro ǰí ke 'hollow M89: 154'

Y

yaa k<u>ó</u> ro hò	'I prepare, dress HWE80: 128'
yaa t'é t'e	'I speak WE82: 316'

Z, Ž

zíi	'yellow, brown M89: 152, M93: 117, 119, 120'
žii gó ga nį xǰį 'eò ra wà š<u>a</u> ra wiè ge	
	'Don't ever go that way again! S43: 78'
žoo žók	'slippery M79: 29'

The above list lacks groups with such initials as *C, D, F, J, L, Q,* and *V,* simply because they are not included in the phonemic inventory of this language, as is clear from (1). Careful readers might also find that words beginning with *O* are not observed in this list, either, although (2) surely indicates that it is a phoneme. This seems to be an accidental gap, since *'o* can appear word-medially, as in *hoo 'ó 'o kè* 'owl S43: 35'; or for that matter, we can find only a few vowel-initial syllables or words, as compared to consonant-initial ones. This may be one of the examples showing the distorted distrubution in the segmental system or the general tendency to resist to an onsetless word or syllable (cf. (5d)). Moreover, among the consonant-initial syllables or words, there is also a clear asymmetry in word frequency: we often find *h*-initial and *w*-initial ones, while *y*-initial ones are quite rare even in other data sources. A productive case of *y*-initial words is the first-person, singular form of verbs which begin with *hi-* underlyingly, as in *yaa k<u>ó</u> ro hò* 'I prepare, dress HWE80: 128' (< /hi-<u>ha</u>-kroho/) and *yaa t'é t'e*

'I speak WE82: 316' (< /hi-ha-t'et'e/). Here, the first-person, singular marker is *-ha-*, as double underlines show, which functions as an infix and causes a phonological change with *hi-*, resulting in *yaa*. See section 2.6.5.

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