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Prosodic structures of different Japanese dialects and the universality of the syllable

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1. Introduction

The syllable is considered one of the basic elements in phonological theories. It is the basic unit of mental organization of speech sequences, and it is also one of the most important elements in any attempt of phonological analysis. It is thus no wonder that the problems underlying the notion of syllable are seldom addressed.

There are two hypotheses in syllable theory, namely universality and exhaustivity (Hyman 1990, as cited in Cho & King 2003). While the universality of the syllable requires all languages to have syllables, the exhaustivity only requires all languages with syllables to parse segments according to syllables. While most of the phonologists do not even bother questioning these two hypotheses about syllables, some have raised controversial claims on these matters. Among the most interesting is the claim by Hyman (1983, 1985) that Gokana, a Niger-Congo language of Nigeria, does not have syllables as a way of organizing segments. Instead, the mora alone suffices to be the basic building block of Gokana phonology. The work of Hyman goes largely unnoticed (Hayward 1997, as cited in Hyman 2011), and later Hyman (2011) revises his claim and proposed that syllables could be playing a role in Gokana according to some overlooked and possibly ambiguous evidence. Yet the matter of the universality of the syllable seemed to be never settled, as later Labrune (2012) and Satō (2013) raise the question whether Standard Japanese has syllables or not. They conclude in their analyses that Standard Japanese does not require the syllable in its phonology, and the mora is the only prosodic constituent Japanese needs. This is indeed a very strong claim, and it is natural to think of how unwelcoming this claim is to the field of phonology, which is largely syllable-based after Chomsky and Halle (1968)'s SPE (*the Sound Pattern of English*), during which the syllable was downplayed but later revived as an important concept in phonology.

The exhaustivity, on the other hand, is more attended by phonologists, since languages such as Nuxálk (Bella Coola), Tashlhiyt Berber, Semai, Ōgami Ryukyuan (Pellard 2011) and Khmer have phonotactics that seem to violate the Sonority Sequencing Principle (SSP), which requires a sonority rise in between peripheral segments and the syllable peak (Cho & King 2003). Syllable peak normally consists of vowel, which has highest sonority, while consonants normally reside before or after the syllable peak as they have lower sonority. This is illustrated in the following

example in (1).

(1) *Vowelless sentence in Nuxálk* (Nater 1984, as cited in Bagemihl 1991: 627)
xɬp̓x̣ʷɬtɬpɬɬs kʷc̓
[xɬpʼχʷɬtʰɬpʰɬːskʷʰt͡sʼ]
'Then he had had in his possession a bunchberry plant.'

Nuxálk is considered to be problematic in syllable analysis. From (1), the whole sentence is vowelless, and SSP cannot be applied properly. There are numerous attempts on analysis, with some consider the language to be allowing the complete lack of syllables (Newman 1947; Bagemihl 1991), and some consider each segment to be a syllable (Hockett 1955). Cho & King (2003) question Bagemihl (1991)'s analysis and suggested the notion *semisyllable* can be employed to satisfy the exhaustivity of the syllable. In their work, they show that if a language employs the syllable then it can always be analyzed as exhausting the use of the syllable, regardless how seemingly the syllable structures defy common phonological principles like SSP (Sonority Sequencing Principle) and ES (Exhaustive Syllabification). Although they speak of "a universal prosodic structure" which always requires the syllable (Cho & King 2003: 187-188), the first hypothesis, which is the universality of the syllable, remains largely unattended in their work. This thesis will not deal with further issues in the exhaustivity of syllables, and it is only briefly mentioned so to stress the difference between the two hypotheses about the syllable. These two notions are related, but should be separated in analysis since they are dealing with different aspects. The syllable can be universal yet unexhausted, or it can be exhausted in every language that employs it while some languages can lack it as a constituent in prosodic structures.

In this thesis, the question of the universality of the syllable will be addressed. Four different Japanese dialects will be looked into to see their different way of treating the syllable and the mora as their prosodic constituents. While Standard Japanese (Tokyo Japanese) is described as problematic in whether it is a syllabic dialect or moraic dialect, the Osaka and Aomori[1] varieties are described as being moraic and syllabic respectively (Hirayama *et al*. 1993; Satō 2002;

1 It is mistakenly referred to as Aomori dialect in Labrune (2012: 114), which can refer to several different dialects in the Aomori Prefecture.

Labrune 2002, as cited in Labrune 2012: 141). From the several varieties spoken in the Aomori Prefecture I choose Hirosaki, a Tsugaru dialect. The Kagoshima dialect is chosen to be the fourth dialect in this thesis, and it is also said to be syllabic (Shibatani 1990).

I will first give an overview of prosodic structures and constituents in §2. Then the four Japanese dialects will be introduced in §3, followed by a brief description of Japanese phonology and dialectal variations in §4. In §5, more detailed description regarding the prosodic structures of these dialects will be given. In particular, the claim of Standard Japanese being a syllableless language will be reexamined. In §6, I will address the issue further by using Optimality Theory to formalize the prosodic patterns of these varieties. It will become clear that the syllable is in fact not universal but rather exemplified as a result of constraint ranking. This thesis ends with a discussion of the universality of the syllable in §7.

2. Overview of prosodic hierarchy and constituents

2.1. Prosodic hierarchy

Within the model of prosodic phonology originally proposed by Selkirk (1980), phonological grammar consists of layers of different prosodic units which are grouped under the prosodic hierarchy. Further studies of prosodic phonology such as the work by McCarthy & Prince (1986) have gained insights on what the prosodic constituents are. The common view of prosodic hierarchy consists of the following constituents shown in (2) (Ito & Mester 1992; Fery & van de Vijver 2003; Satō 2013):

(2) *Prosodic hierarchy*

Prosodic word $(PWd)^2$ (ω) > Foot (φ) > Syllable (σ) > Mora (μ)

Note that it is not the exhaustive hierarchy. There are other layers above the prosodic word which are however irrelevant to our discussion (Selkirk 1996).

2 Prosodic word is also called phonological word by some. The difference is not relevant to our discussion, but see Pentland & Laughren (2005).

According to Strict Layering Hypothesis (SLH) (Selkirk 1984), each unit of the prosodic hierarchy must immediately dominate a unit at the lower level. It is suggested that the prosodic structure of a language need not be strictly exhaustive (Cho & King 2003; Ito & Mester 1992, 2012). Although they admit that the strict layering is still largely unchallenged, Ito & Mester (2013) also mention that SLH can be reduced to violable constraints, such that the strict ordering of layers can be theoretically violated[3]. For instance, a mora can be dominated directly by a foot without an intervening syllable layer. I propose further that some Japanese dialects lack the theoretical evidence of syllable and thus can be considered to be without a syllable layer in their prosodic structures. Of course, this is a more radical claim than that the mora need not to be exhaustively dominated by the syllable. Syllables in those dialects are considered to be completely lacking and this questions the universality of syllables across languages.

Just as pointed out by Satō (2013), the prosodic hierarchy is not accepted among all linguists. I will not try to investigate the universality of prosodic hierarchy, which could be a separate study than the universality of prosodic constituents.

In some studies (Kubozono 2012: 1408; Uwano 2012: 1425), the term *prosodic structure* is used to refer to the accentual system of a particular language. This is not surprising, given the fact that seldom anyone questions the existence of prosodic constituents, and many do not care about the prosodic hierarchy and prosodic structure either (Satō 2013). In this thesis, I will use *prosodic system* to refer to the accentual system or tonal system, and the term *prosodic structure* to the hierarchical structure of prosodic constituents as Selkirk (1980) did. Prosodic structure can include different constituents across languages, according to my view, due to the lack of a layer. For example, Tokyo Japanese would be an example of lacking a syllable layer. The term *prosodic hierarchy* refers to the ordering of different prosodic constituents. *Prosodic constituents* or *prosodic units* in turn refer to the units within the hierarchy, i.e. the prosodic word, the foot, the syllable and the morae.

2.2. Mora

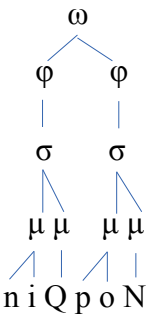
Although the mora has been accepted to be a unit in prosodic hierarchy, the concept of mora

3 In their context, it is only the recursion which was made possible, and they do not discuss the lack of a layer.

itself is actually ambiguous. Otaka (2008) mentions that the term *mora* has both phonetic and phonological meanings. The former is a regular timing unit controlling isochrony, and the later is a structural constituent which meets the need to account for syllable weight depending phenomena. In other words, the concept of phonological mora, which is also the aspect of mora that we are concerned, largely comes from the differences of syllable weight in some languages. For instance, if a language distinguishes between three syllable weights, then the syllable containing one mora is called a 'light syllable', that containing two morae is called a 'heavy syllable', and that of three morae a 'superheavy syllable'. It does not mean that the mora is only a weight bearing unit. Instead, the mora can function just like the other basic prosodic constituent, the syllable, by acting as the tone-bearing or accent-bearing unit in a prosodic system.

Phonological studies in Tokyo Japanese have traditionally relied on the mora, and the distinction between the mora and the syllable is clear (Shibatani 1990; Otaka 2008; Labrune 2012). In traditional definition of the syllable, the Japanese word *nippon* 'Japan' consists of 2 syllables and 4 morae. The conception of mora as the most important phonological unit in Japanese is so wide spread that the Japanese syllabary is also largely based on mora. (3) below shows the mora and the syllable as the prosodic units in Japanese. Otaka (2008) argues that onset is preferably attached to a mora since they together form a unit of isochrony, i.e. phonetic length of one mora.

(3) *Prosodic structure of the Japanese word* nippon *in syllable analysis*



In Japanese, a mora is the prosodic unit behind the following elements shown in (4) (Satō 2013). Within these, (4a) is also called a regular mora, and the others are called special morae (Labrune 2012: 115-116).

(4) *Segments having the mora*

a. A simple vowel which is optionally preceded by a consonant and glide, (C(j))V

b. The first half of a geminate consonant, also analysed as a separate phoneme /Q/

c. The moraic nasal, also analysed as a separate phoneme /N/

d. The second half of a long vowel, also analysed as a separate phoneme /R/

e. The diphthongal /i/ after a vowel, sometimes also analysed as a separate phoneme /ɹ/

2.3. Syllable

The syllable is the most commonly used unit to organize speech. Some languages clearly involve the syllable, such as Sinitic languages and Korean (Duanmu 2008). It is considered to be the most basic and invariably universal prosodic constituent.

The syllable consists of several components, namely onset, nucleus, coda and rhyme. Which type of segment can occur at certain places of a syllable is generally determined by SSP. The nucleus is the most sonorous part of a syllable, and since vowels are considered to be the most sonorous, they often occupy the role of syllable nucleus. The onset is the segments before the nucleus and the coda is the segments after. Within a syllable the sonority peak occurs at the nucleus. The rhyme consists of a nucleus and an optional coda and it is commonly used in poetic rhyme. SSP is adhered in different degrees by different languages. While there exist obvious violations as previously mentioned, languages such as Thai and Italian strictly follow SSP. For example, in both languages glides and liquids cannot appear before onset plosives and fricatives, but only after. In Japanese, too, a glide can only appear as the onset, or between the initial consonant and the nucleus, but never before other consonants.

As mentioned before, the syllable and the mora are different units in Japanese, yet they are closely related. In a syllable analysis, Japanese has six types of syllable structure: V, CV, CjV, VC, CVC and CjVC (Kubozono 1995 as cited in Otaka 2008). All onsets are non-weight bearing, meaning that they do not contribute to any separate mora. The vowel of the nucleus can be short or long in the first three cases, and when the vowel is long the syllable is considered to be heavy, with two morae. All possible consonant codas, i.e., /N/ and marginally /Q/, bear the

weight of one mora, and as a result of the restriction of superheavy syllables the later three structures cannot have long vowels.

2.4. Foot

The foot is a group of syllables which is used to indicate the fundamental unit of linguistic rhythm, with one syllable bearing the main stress (Otaka 2008). While it is most commonly attributed to languages with stress, such as English, the use of the foot in Japanese, a stressless language, mainly related to other behavior such as word truncation. Poser (1990) mentions also the rhythmic properties of Japanese foot, but the most important evidence of the foot is still foot-based morphology. This is also echoed by Ito (1990) and Ito & Mester (1992), who mention that the foot is generally bimoraic according to various word formation processes and truncation, despite the fact that in SLH the foot immediately dominates the syllable. Examples from Poser (1990, as cited in Otaka 2008: 13) and Ito (1990, as cited in Otaka 2008: 14) are given in (5).

(5) *Foot-based word formation*

hypocoristic name formation: /emi/ → /emi-tjaN/

kinship name formation: /o-toR-saN/ or /toR-saN/ 'father'

Geisha client name formation: /hoNda/ → /o-hoR-saN/

rustic girl's name formation: /yukiko/ → /o-yuki-saN/

word truncations 1: /maikurohoN/ → /maiko/ but */mai/ 'microphone'

word truncations 2: /saNdoitti/ → /saNdo/ but */saN/ 'sandwich'

word truncations 3: /demoNsutoreRsjoN/ → /demo/ but */demoN/ 'demonstration'

The above examples clearly show the preference of the bimoraic foot in Japanese. However, the examples /maiko/ and /saNdo/ show a different pattern, which poses problem to the assumption of the bimoraic foot. Ito (1990) provides some further restrictions to explain the case. She argues that truncated bimoraic words cannot consist of a heavy syllable, thus */saN/. She also claims that a word must consist of at least one foot, which in essence follows the SLH. Although there are cases of trimoraic or penta-moraic words which cannot be exhaustively

divided into feet, and thus poses problems to SLH. In addition, there are other languages like Cantonese (Yip 1992) which reportedly also have problem with bimoraic feet. The foot is, after all, not as widely accepted and (seemingly) unproblematic as a universal constituent as the syllable does.

3. Japanese dialects

The four dialects which will be covered in this thesis are Tokyo, Osaka, Tsugaru (Hirosaki) and Kagoshima Japanese. Fig. 1 below shows the approximate areas these dialects are spoken.

Fig. 1. Locations of selected Japanese dialects (modified from http://map.google.com/)

Shibatani (1990) distinguishes two main groups of Japanese dialects according to two ways of

distinction. One way is the West-East distinction and the other is the Central-Peripheral distinction. In the former, dialects are divided into the Western dialects and the Eastern dialects, with the Kyusyu dialects being a subset of the Western dialects. The Central-Peripheral distinction is worth looking into, since it is largely based on the historical development of Japanese. In this distinction, dialects of the Tohoku region and the Kyushu regions are considered to be peripheral, which preserve historical residue features of Japanese. Of the four dialects considered, the Kagoshima and Tsugaru dialects are grouped under the Peripheral dialects and they, as readers will soon see, have prosodic structures remarkably different from other Japanese dialects such that they rely heavily on the syllable. In contrast, the Osaka and Tokyo dialects are Central dialects, although they are opposing in the West-East distinction.

Tokyo is a large area and there are two different dialects spoken there, one is Yamanote and the other one is Shitamachi. The Tokyo dialect here refers to the former which is spoken in the Yamanote area in Tokyo, the capital of Japan and also the basis of Standard Japanese. The Osaka dialect is a member of the Kansai dialects, which had significant importance throughout Japanese history. At present the Osaka dialect is the second most important dialect in Japan after Tokyo Japanese, partly due to the fact that Osaka is now the second largest city in Japan. The Osaka and Kyoto dialects are also quite similar to each other such that they are sometimes grouped together as Kyoto-Osaka (Igarashi 2007). The Tsugaru dialect is a member of the Tohoku dialects, which are only a geographical category characterizing the dialects spoken in the Northeastern Japan. The Hirosaki dialect often represents the whole Tsugaru dialect family since Hirosaki is located central in the Tsugaru area (Kobayashi 1970: ii). The Kagoshima dialect, also called Satsugu, is a group of similar dialects spoken in southern Kagoshima Prefecture, Southwestern Japan. Within these four dialects, Tsugaru and Kagoshima Japanese are characterized as the syllabic dialects[4] which extensively use syllables. They are also located in peripheral Japan, in contrast to the Central dialects, Tokyo and Osaka Japanese. As such, they are also notably difficult for speakers of the standard language to understand.

The dialectal differences of the prosodic systems in Japanese are large. For example, one can discover a vastly different pitch-accent pattern across cities located near to each other. This is the case of the Miyakonojo dialect and the Kagoshima dialect, both spoken in Kyusyu. The former

4 Some, especially those from Japanese linguistic tradition, call them syllabeme dialects (シラビーム方言).

has a one-pattern pitch accent system while the later has a two-pattern system.

Dialectal differences regarding the degree of involvement of the syllable and the mora were also noted in other dialects. Shibatani (1990) mentions that some other Japanese dialects, including the Takajocho dialect, have large involvement of syllables and they divide the word *mikan* /mikaN/ 'Citrus unshiu' into *mi* and *kan* instead of *mi*, *ka*, and *n* as Tokyo Japanese does. Further evidence comes from the way the dialect assigns pitch-accent. The final syllable /roN/ of the word *kokoron* /kokoroN/ 'of heart' receives an H tone, showing that the mora does not play a role in pitch accent assignment in this dialect. In contrast, Osaka Japanese is reported to use the mora as its prosodic unit in its pitch-accent system. For instance, the same word given above is parsed into /,ko,ko,ro,N,/, where /,/ denotes moraic boundaries (Breteler 2013), in Osaka Japanese, and the moraic nasal /N/ receives a high pitch.

4. Japanese phonology

4.1. Vowel and consonant inventory

According to Shibatani (1990), Standard (Tokyo) Japanese has the following phonemes, as shown in Table 1 and 2.

Table 1. Japanese vowel phonemes

	Front	Back
High	i	u
	e	o
Low	a	
Moraic lengthening vowel: R		

Table 2. Japanese consonant phonemes

	Labial	Alveolar	Postalveolar /palatal	Velar	Glottal
Voiceless plosive	p	t		k	
Voiced plosive	b	d		g	
Voiceless fricative		s			h
Voiced fricative		z			
Rhotic			r		
Nasal	m	n			
Glide	w		j		
Underspecified moraic consonant				N	Q

4.2. Special segments /Q/, /N/ and /R/

Besides the five basic vowels, there is also a length distinction for the vowels. Long vowel counterparts are the same vowels of two morae. The second part of a long vowel carries one mora and is expressed as /R/, a separate vowel lengthening phoneme, in the present study, following Kindaichi (1950), Otaka (2008) and Labrune (2012 & 2012b). For example, /suR/ 'number' is realized as [suu]. There is only a minimal transition between vowels in spectrograph, and thus diphthong does not exist in Japanese, although sometimes a separate vowel within morpheme boundary is incorrectly referred to as diphthongal (Labrune 2012b). In an example like /aoi/ 'blue' the three vowels are separate monophthongs, each contains one mora.

The phonetic values of the underspecified moraic consonants /N/ and /Q/ depend largely on the environment. In particular, the "geminate" consonant /Q/ is described as phonologically a mora, though quite often analyzed underlyingly as a glottal stop. The reason why /Q/ is treated as a moraic phoneme instead of just gemination of the following consonant is because it is phonetically a mora, and that a sequence like /Qta/ [tta] has the time length of two morae instead of one (Otaka 2009). The two moraic consonants are underspecified for their place feature, and thus the exact pronunciation of them rely on the following consonant (Labrune 2012b). In other words, the place feature of the following consonant will assimilate that of the moraic consonants.

The three special phonemes /Q/, /N/ and /R/ are argued to be the result of extensive borrowing of Chinese loanwords between the ninth and eleventh century (Hamada 1952, Komatsu 1981, as cited in Labrune 2012b). Since Middle Chinese during that time had a lot of heavy syllables, the borrowing of Chinese words introduced new moraic consonants to compensate the then weak prosodic weight of Japanese syllables. Labrune (2012b) also argues that these special segments come from lenition of a CV sequence, extensive strengthening and adaptation of foreign sounds.

These three special phonemes are worth discussing as they are largely related to the moraic analysis of Standard Japanese. As Labrune (2012b) points out, they have quite some distinct features separating them from other consonants. First, they are moraic, in contrast to other consonant phonemes which are without prosodic weight. Second, they are underspecified, and either the preceding (in the case of /R/) or the following (in the case of /Q/, /N/) segment is required for the exact phonetic realization. Third, according to the principle of Non-accentuation

to Deficit Mora (NADM) suggested by Labrune (2012b: 168), these moraic phonemes cannot bear accent. Thus we have examples like /roNdoN+kai/ 'London club'→ /roN**do**Nkai/ but */roNdo**N**kai/[5], despite the fact that the accent in compound falls on the antepenultimate mora. However, we will see, as Labrune (2012b) also makes clearly, exception exists and they pose difficulty to the syllabic analysis of Standard Japanese.

Also, one interesting phenomenon of these special phonemes and the non-initial /i/, is that they can occur interchangeably. Thus /sjoRbeN/ 'pissing' can also be pronounced as /sjoNbeN/ (Jōo 1977, as cited in Labrune 2012b). In earlier writing of Japanese syllabary the four sounds /Q/, /N/, /R/ and /i/ are frequently confused with each other (Labrune 2012b). Because of the above facts, some people propose the fourth special moraic segment /ɹ/, which is supposed to be a separate phoneme from vocalic /i/ (Jōo 1977, as cited in Labrune 2012b). However, since they do not form contrasting pairs, the present thesis does not follow this proposal.

Although crosslinguistically the equivalent of the moraic nasal is often categorized as a syllabic nasal, such as /m/ and /ŋ/ found in Cantonese, there are enough motivations to not consider this in Standard Japanese. First, the behavior of /N/ is very similar to the other special morae such as /Q/, which cannot be treated as syllabic. Second, a moraic nasal does not behave like a syllable in accentuation. In traditional syllable analysis, the moraic nasal is treated as a coda of the preceding vowel which acted as the nucleus. Third, it is always preceded by a vowel, which means it is invariably treated as a coda in syllable analysis. Note that both *moraic nasal* and *syllabic nasal* can be used to describe the same nasal phoneme. However, although the nasal /N/ is undeniably moraic, its syllabic nature is questionable and a sequence like /kaN/ would be treated as a single syllable even in a syllable analysis of Standard Japanese.

4.3. Glides /j/ and /w/

The palatal glide /j/ is said to be a result of Chinese loanword influence and thus mainly appears in Sino-Japanese loanwords (Labrune 2012b). The glide can be combined with any consonants except /j/ and /w/ to form a phonetically palatalized consonant. However, the glide cannot appear before the vowels /e/ and /i/. The glide does not contribute to prosodic weight, so a

5 Boldface morae represent accentuation.

syllable /kja/ 'mimetic scream' will only have one mora.

The glide /w/ only appears as an onset before /a/ in Tokyo Japanese. It does not behave like /j/ since it cannot appear medially between a consonant and a vowel. Same as /j/, the glide /w/ does not contribute to prosodic weight.

Examples of the two glides /j/ and /w/ are given in (6).

(6) *Examples of the glides /j/ and /w/ in Tokyo Japanese*

/kjuR/	'nine'
/sjuR/	'week'
/zjo/	'woman'
/tjosja/	'author'
/wa/	'topic particle'
/watasi/	'first person singular pronoun (formal)'

4.4. Dialectal variations

In some dialects such as Kagoshima Japanese, /N/ can appear at word initial position, as seen in the examples /NNma/ 'horse' and /NN/ 'you (archaic)'. /Q/ can also appear at word final position after vowel deletion, as in the examples /kuQ/ 'mouth' /miQ/ 'water' and /esaQ/ 'greeting' (cf. Standard /kuti/, /mizu/ and /aisatu/ 'id.') (Matsumori & Onishi 2012: 328). The final /Q/ is realized phonetically as an unreleased [t], or assimilated to the following consonant of another morpheme (Shibatani 1990: 208; Matsumori & Onishi 2012: 328). In Standard Japanese /Q/ can also appear before a pause, in which case it is realized as a glottal stop, but only under limited conditions such as interjections. One such example is /areQ/ [aɾeʔ] 'oh!' (Labrune 2012b).

The special mora does not show autonomy in the syllabic dialects as in the moraic dialects, i.e., it is parsed with preceding segments as a unit instead of being a unit itself. Kagoshima Japanese is syllabic, which means parsing and the prosodic system employ the whole syllable as a unit. /N/ in this case would be simply an underspecified nasal which can either appear in the coda or initially. In other words, /N/ can behave both as the nucleus and coda, as in /NN/ 'you (archaic)' and /kaN/ 'paper'.

In Tsugaru Japanese, all intervocalic voiced plosives are prenasalized phonetically, while voiceless plosives are realized as voiced between vowels. The vowels /i/ and /u/ are neutralized, and as a result the four phonemes /du/, /zu/, /di/ and /zi/ are undistinguished. This is different from the Standard dialect, which makes distinction between the two sets /du~zu/ and /di~zi/ and the Kagoshima dialect, which distinguishes between all the four. The Tsugaru dialect is thus often referred to as /zuRzuRben/ 'zu-zu-dialect', because this dialect neutralizes the high vowels /i/ and /u/, which gives speakers of the standard language a feeling of laziness and slurring (Shibatani 1990: 204).

The glide /w/ can appear in between a velar and /a/ in the Kagoshima and Tsugaru dialects, while in most other dialects, including the Tokyo and Osaka dialects, /w/ only appears as an onset before /a/. Examples from Kagoshima are /kwazi/ 'fire accident' (cf. Kagoshima /kazi/ 'housework') and /kwaNziN/ 'beggar' (Shibatani 1990). Examples from Tsugaru are /gwaNzitu/ 'New Year's day' and /sjoRgwaR/ 'raw ginger'. This glide is a residue of an older form of Japanese, which obtained the glide through borrowing of Chinese loanwords having the form /kwa/. Thus there exists the spelling *kwannon* for the word /kaNnoN/ 'Bodhisattva' even in contexts using Standard Japanese (Matsumori & Onishi 2012: 331, Shibatani 1990: 203).

5. Prosodic structures and systems of the Japanese dialects

5.1. An overview of pitch-accent systems

In contrast to other East Asian languages such as Mandarin Chinese and Thai, which have extensive tone systems, Japanese in general uses pitch accent. Pitch accent is a kind of tone, and it occurs only when it is introduced by accent, so it is different from the lexical tones in tonal systems, which are lexically specified for each syllable. Hattori (1973) and McCawley (1968) analyze pitch accent as the surface result of the assignment of lexical accent within a word. In Tokyo Japanese, the different pitch-accent patterns are the result of the placement of the lexical accent on a syllable, which marks a pitch downfall. Although pitch accent can only be assigned within the lexical word, the downfall of pitch can happen in the prosodic word rather than just the lexical word, so when discussing pitch-accent systems a following grammatical particle is

also considered to illustrate the downfall happening after the accented final syllable (Igarashi 2007). In certain dialects such as Kagoshima Japanese, the addition of grammatical particles may also alter the placement of tone (Kubozono 2012), as will be illustrated in example (7) of §5.2.1. below.

While the notion that Japanese accent analysis can adequately describe the prosodic system is so widespread, some, such as Clark (1987), claim that a tone analysis would be better for Tokyo Japanese. While in the present study the accent analysis is followed, variations across dialects suggest some dialects, such as Kagoshima Japanese, employ a more direct tonal assignment and thus a tone analysis would indeed be a better alternative than an accent analysis in these cases. Another example is Osaka Japanese, which has both pitch accent system and register tone system. In this thesis, Osaka, Tokyo and Hirosaki Japanese are considered pitch-accent dialects, while Kagoshima Japanese is considered a tonal dialect.

It is worth noting that the distinction between a stress-accent and a pitch-accent system is not always obvious and in fact, some Japanese dialects may show stress-accent characteristics instead, according to the general features of stress-accent languages listed by Uwano (2012: 1416). Since some Japanese pitch-accent system, for instance the one of Kagoshima dialect, has very few tone variation and syllable as the prosodic unit, we may conclude then, that they are in fact employing a prosodic system closer to the other side of the stress-accent and pitch-accent continuum.

Uwano (2012) also writes about the typology of Japanese pitch-accent systems. The characteristic of the pitch-accent system in Tokyo Japanese is that the accented unit marks the falling pitch and is thus called the falling accent, while that of Hirosaki Japanese is the ascending accent. Uwano (2012) explains the ascending accent as raising the pitch of the accent bearing unit. There is also a third kind of accent, the raising accent, as mentioned by Uwano (2012). However, we are not concerned with this kind of accent, since none of the dialects of our concern employs it. As such, the internal diversity of the Japanese prosodic systems is large, even among pitch-accent systems. A rough summary of the variance of prosodic systems across Japanese dialects will be illustrated in the next section.

5.2. Prosodic systems across dialects

Igarashi (2007), Kubozono (2012) and Uwano (2012) recently give a good summary of various pitch-accent systems across Japanese dialects. In their analyses, Japanese dialects can be roughly divided into multi-pattern systems, *N*-pattern systems and accentless system. In multiple systems, the number of possible patterns varies with the word length. Dialects with *N*-pattern systems follow a fixed number of possible patterns ranging from 1[6] to 4 (Kubozono 2012). Dialects with accentless system do not have any accent. The most famous of these dialects are found in Northeastern Japan, most notably in Fukushima Prefecture (Kubozono 2012).

Within the abovementioned categorization, Tokyo Japanese is a dialect of multi-pattern system accent and is without tonal register. The number of patterns of Tokyo Japanese follows the (n+1) rule in which n means the number of syllables. This means there are 3 patterns for disyllabic words, and 4 for trisyllabic words. Osaka Japanese is of multi-pattern system with two tonal registers (high-level H and rising LH). The number of patterns of Osaka Japanese, and Kansai Japanese in general which includes other dialects such as Kyoto and Nara Japanese, is ($2n$+1), which means there are 5 patterns for bimoraic words and 7 for trimoraic words, although this is only the maximum theoretical possibility and practically not all of the possibilities are exploited. The two tonal registers contrast with each other by the tone of the initial mora of a word. Kagoshima Japanese has a 2-pattern system, which is only distinguished by the position of the high tone. Hirosaki Japanese also has (n+1) accent patterns as Tokyo Japanese does (Kobayashi 1970: 8-9). Thus disyllabic words have 3 patterns and trisyllabic words 4. However, while Tokyo and Osaka Japanese both employ the lowering accent, Hirosaki Japanese employs the accending accent instead.

McCawley (1968, 1978 as cited in Kubozono 2012) distinguishes two notions when discussing the prosodic systems of Japanese, namely *the tone/accent bearing unit* and *the unit of counting*. The former is describing a unit of prominence peak, while the later is the measurement of the phonological distance from the edge of a word. These notions are used by following studies to describe Japanese dialects. This typology will be referred to later.

I will examine various types of prosodic systems in the dialects I have chosen for this thesis. Special focus will be given to Tokyo Japanese and the controversial claim of it lacking the

6 The distinction between 1-pattern and accentless system is controversial, see Igawashi (2007: 12-15).

syllable will be reexamined. This is not to say that the natures of the prosodic constituents in the other dialects are clear, for example, that Osaka Japanese is really a moraic dialect. Since these dialects are more or less assumed to be so by many authors, and they are relatively uncontroversial as their prosodic systems show to be, the reexamination of the prosodic constituents of these dialects will be put aside and the dialect most controversial of this matter, Tokyo Japanese, will be discussed in detail. In the examples I give or quote, the clitic particles /ga/ 'nominative particle (=NOM)' or /kara/ 'from' are added to the word to fully illustrate the accentual patterns (Igarashi 2007: 4).

5.2.1. Kagoshima Japanese

In this section, I will first address the prosodic system of Kagoshima Japanese, which is noted for its unintelligibility for speakers of Standard Japanese, and the simple patterns of its prosodic system. Kubozono (2012) puts forth the typology of McCawley (1978) and claims that Kagoshima is a syllable counting syllable language. Various ways of representing the patterns are possible, and I choose the tonal analysis instead of the accentual analysis (Kubozono 2012). The following examples in (7) are given by Kubozono (2012) and Shibatani (1990). Boldface represents the accented syllable. The acute tonal marking /ˊ/ represents high tone H in the examples. The circumflex tonal marking /ˆ/ represents the tonal contour HL. The sign /=/ represents the connection of a clitic (Bickel *et al.* 2008). The dots /./ mark the syllable boundaries. I adopt the notation of Breteler (2013), using commas /,/ to represent the mora boundaries. The two types of tonal patterns in Kagoshima Japanese are shown explicitly in (8).

(7) *Examples showing the syllable as the tone bearing unit in Kagoshima Japanese*

Pattern	Characters	Underlying form	Gloss
Type A	ワシントン	/.wa.**síN**.toN./	'Washington'
Type A	ＹＭＣＡ	/.wai.e.mu.**síR**[7].ei./	'YMCA'
Type B	にわとり	/.ni.wa.to.**rí**./	'chicken'

7 I follow the analysis of long vowel in Standard Japanese here, but alternatives can be seen in other literature, e.g. /síi/ (Kubozono 2012).

Type B	にわとい	/.ni.wa.**tói**./	'chicken' (colloquial)
Type B	きょうだい	/.kjoR.**dái**./	'siblings'
Type B	きょうで	/.kjoR.**dé**./	'siblings' (colloquial)
Type A	とお	/.**tôR**./	'ten'
Type A	とおから	/.toR.=.**ká**.ra./	'from ten'
Type B	とう	/.**tóR**./	'tower'
Type B	とうから	/.toR.=.ka.**rá**./	'from tower'
Type A	き	/.**kî**./	'spirit'
Type B	き	/.**kí**./	'tree'

(8) *Prosodic system of Kagoshima Japanese*

Type A: (L)nHL

(σ … σ)n σ σ
| | | |
(L … L)n H L

Type B: (L)nH

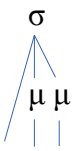
(σ … σ)n σ
| | |
(L … L)n H

The tonal contrast can be divided into two patterns. Type A pattern has the unmarked high tone falling on the penultimate syllable, while type B pattern has the high tone falling on the last syllable.

In these examples, the extra mora of the moraic nasal /N/, long vowel /R/ and final /i/ do not seem to contribute to tone bearing. Instead, the whole syllable acts as the tone bearing unit (henceforth TBU) in (7). If mora is the TBU, then the tonal pattern of the second word should be /,wa,i,e,mu,si,R,**é**,i,/. Also, the morae within these moraic segments do not have any importance, so there is no reason to consider them as moraic segments in their own right, and we can treat them just as codas of the syllable. However, their phonemic representations do not change because they are still underspecified segments. It is also possible to treat /R/ as the

second part of a long vowel, thus eliminating the phoneme /R/ and introducing long vowel counterparts to the vowels. The final /i/ is parsed as belonging to the same syllable as /e/, and thus should be represented by either /j/ or diphthongal /i/. It would be the only diphthong present in Kagoshima Japanese if the later approach is taken, since it is only /i/ that can follow another vowel within a syllable. It is better to treat it as a glide coda, so to make it parallel in role to other special segments /Q/ and /N/. These new analyses are possible and are shown below in (9), but in this thesis I will stick to the general way of describing Standard Japanese, which means the representations for the four special segments will be retained, for the sake of clarity when comparing dialects.

(9) *Heavy syllable structures of Kagoshima Japanese*[8]

a. /CVN/	b. /CVQ/	c. /CV:/	d. /CVj/
			
h o N 'book'	k u Q 'mouth'	k o: 'river; well'	t o j 'bird'

For monosyllabic words, the contrast is made through an internal contour within the syllable. Kubozono (2012) suggests that this means the underlying tone of Kagoshima Japanese is a melody H-L, which is realized as a contour tone in monosyllabic words, and as a series of tones in longer words. Shibatani (1990) mentions in an accent approach that the contour is the marked pattern and that type A pattern, which carries the contour, is the accented pattern which is more phonological prominent, while type B pattern is the accentless pattern. This means that the tone assignment is related to both the lexical tone in the lexical word and the structure of the whole prosodic word. The assignment of tones on all the syllables is a result of tonal spreading. This is also evidenced by the examples including the clitic /kara/, which makes the prosodic word longer and consequently alters the tonal pattern. Tonal spreading is thus a prominent phenomenon in Kagoshima Japanese, and it is also crosslinguistically discovered in various tonal

8 Otaka (2008) discussed whether onset should be linked to the nuclear mora. It is preferable to attach the onset to mora in Tokyo Japanese since the phonetic length of the onset and nucleus together is controlled by isochrony of the length of one mora, but in Kagoshima it is unknown if such intra-mora compensation effect exists.

languages such as Shanghainese (Duanmu 2008).

To conclude, it is no doubt that the syllable does play a large role in Kagoshima Japanese, and the mora is not required at least in its prosodic system.

5.2.2. Osaka Japanese

Examples showing the mora as the accent bearing unit in Osaka Japanese are listed in (10). The prosodic system of Osaka Japanese is shown below in (11). Examples are taken from Uwano (2012) and Shibatani (1990: 181-183). They are used as examples for Kyoto Japanese in Uwano (2012), but they can also be considered examples for Osaka Japanese, since the two dialects are so similar to each other in terms of pitch-accent systems. The accent assignment shown below involves only the mora, and as such it is described as a mora-counting mora language based on the typology of McCawley (1968). The two tonal registers are marked as H for the high tone, and LH for the low-rising tone.

(10) *Examples showing the mora as the accent bearing unit in Osaka Japanese*

Tone/Accent	Characters	Underlying form	Surface tone	Gloss
LH/Accentless	しんぶん	/,si,N,bu,N,/	LLLH	'newspaper'
H/Accented-2	ほんなら	/,ho,**N**,na,ra,/ but */.**hoN**.na.ra./	HHLL	'if that's true'
LH/Accented-2	まいど	/,ma,**i**,do,/ but */.**mai**.do./	LHL	'commercial greeting'
H/Accented-2	しゃあない	/,sja,**R**,na,i,/ but */.**sjaR**.nai./	HHLL	'cannot be helped'

(11) *Prosodic systems of Osaka Japanese*

a. Monomoraic:

Tone/Accent	Characters	Underlying form	Surface tone	Gloss
H/Accentless	とが	/,to,=,ga,/	HH	'door=NOM'
H/Accented	はが	/,**ha**,=,ga,/	HL	'leaf=NOM'
LH/Accentless	てが	/,te,=,ga,/	LH	'hand=NOM'

b. Bimoraic:

Tone/Accent	Characters	Underlying form	Surface tone	Gloss
H/Accentless	かぜが	/,ka,ze,=,ga,/	HHH	'wind=NOM'
H/Accented-1	おとが	/,**o**,to,=,ga,/	HLL	'sound=NOM'
LH/Accentless	ふねが	/,hu,ne,=,ga,/	LLH	'ship=NOM'
LH/Accented-2	とかが	/,to,**ka**,=,ga,/	LHL	'lizard=NOM'

c. Trimoraic:

Tone/Accent	Characters	Underlying form	Surface tone	Gloss
H/Accentless	みやこが	/,mi,ya,ko,=,ga,/	HHHH	'capital=NOM'
H/Accented-1	いのちが	/,**i**,no,ti,=,ga,/	HLLL	'life=NOM'
H/Accented-2	あたまが	/,a,**ta**,ma,=,ga,/	HHLL	'head=NOM'
LH/Accentless	すずめが	/,su,zu,me,=,ga,/	LLLH	'sparrow=NOM'
LH/Accented-2	おもなが	/,o,**mo**,na,=,ga,/	LHLL	'oval-face=NOM'
LH/Accented-3	のっぽが	/,no,Q,**po**,=,ga,/	LLHL	'tall person=NOM'

d. Tetramoraic:

Tone/Accent	Characters	Underlying form	Surface tone	Gloss
H/Accentless	にわとりが	/,ni,wa,to,ri,=,ga,/	HHHHH	'chicken=NOM'
H/Accented-1	あさがおが	/,**a**,sa,ga,o,=,ga,/	HLLLL	'morning glory=NOM'
H/Accented-2	あみものが	/,a,**mi**,mo,no,=,ga,/	HHLLL	'knitting=NOM'
H/Accented-3	かねもちが	/,ka,ne,**mo**,ti,=,ga,/	HHHLL	'rich=NOM'
LH/Accentless	あとあしが	/,a,to,a,si,=,ga,/	LLLLH	'hind leg=NOM'
LH/Accented-2	きのぼりが	/,ki,**no**,bo,ri,=,ga,/	LHLLL	'tree-climbing=NOM'
LH/Accented-3	まつたけが	/,ma,tu,**ta**,ke,=,ga,/	LLHLL	'matsutake=NOM'

In Osaka and general Kansai Japanese, there are two tonal registers which are marked by the initial pitch height of the initial mora. The high tone register is followed by a level pitch while the low tone register is followed by a rising pitch (Uwano 2012). So, in unaccented words such as /miyako=ga/ and /suzume=ga/ above, which have H tone and LH tone respectively, all the morae of the former are assigned H tones, i.e. HHHH, and the later are assigned the spreading LH melody, i.e. LLLH. The accent works in a different way by assigning a high pitch-accent to the accent bearing unit, and then lowering the pitch following it. The accent assignment overrides the tonal assignments coming from the register tone specification. So in /atama=ga/,

the accent falling on /ta/ lowers the pitches of all the following morae, despite the fact that they receive high tones from the specified H tone register.

Uwano (2012) also mentions that there are constraints on the patterns that can occur. First, the final mora of a high tone register word cannot bear accent. Second, the first mora of a low tone register word cannot bear accent. Third, no words of more than three morae can have accent assigned on the final mora. It should be clear from the above examples that only the mora is important in the prosodic system of Osaka Japanese.

5.2.3. Hirosaki Japanese

Although linguistic studies on Tsugaru Japanese are relatively scarce, there are descriptions regarding the pitch-accent system of Hirosaki Japanese, which is a member of Tsugaru Japanese. Kobayashi (1970: 7) describes it as a syllable-counting syllable language, stating that the syllable plays a large role in the prosodic system of this dialect. Nevertheless, the dialect employs a pitch-accent system very similar to that of Tokyo Japanese in a "mirror-image way" (Uwano 2012: 1427). Examples showing the syllable as the accent bearing unit in Hirosaki Japanese are listed in (12). An overview of the prosodic system is given in (13). Examples are from Kobayashi (1970) and Uwano (2012). The clitics /ga/ 'nominative particle (=NOM)' and /dage/[9] 'only' are used to illustrate the effect of phrasal length to the surface tone. Note that all the words below are treated as full phrases.

(12) *Examples showing the syllable as the accent bearing unit in Hirosaki Japanese*

Accent	Characters	Underlying form	Surface tone	Gloss
Accented	ばんが	/.**baN**.=.ga./	HL	'guard=NOM'
Accented-1	さいぶ	/.**sai**.bu./	HL	'detail'
Accented	てんが	/.**teN**.=.ga./	HL	'point=NOM'
Accented-4	カスタネット	/.ka.su.ta.**neQ**.to./	LLLHL	'castanet'
Accented-3	アルコール	/.a.ru.**koR**.ru./	LLHL	'alcohol'

9 It is だけ /dake/ in Standard Japanese.

(13) *Prosodic systems of Hirosaki Japanese*

a. Monosyllabic:

Accent	Characters	Underlying form	Surface tone	Gloss
Accentless	はが	/.ha.=.ga./	LH	'leaf=NOM'
Accented	きが	/.**ki**.=.ga./	HL	'tree=NOM'

b. Disyllabic:

Accent	Characters	Underlying form	Surface tone	Gloss
Accentless	みずが	/.mi.du.=.ga./	LLH	'leaf=NOM'
Accented-1	はなが	/.**ha**.na.=.ga./	HHL	'tree=NOM'
Accented-2	やまが	/.ya.**ma**.=.ga./	LHL	'mountain=NOM'

c. Trisyllabic:

Accent	Characters	Underlying form	Surface tone	Gloss
Accentless	さくらが	/.sa.ku.ra.=.ga./	LLLH	'cherry tree=NOM'
Accentless	さくらだけ	/.sa.ku.ra.=.da.ge./	LLLLH	'only cherry tree'
Accented-1	ほたるが	/.**ho**.ta.ru.=.ga./	HHHL	'firefly=NOM'
Accented-2	いのちが	/.i.**no**.ti.=.ga./	LHHL	'life=NOM'
Accented-2	いのちだけ	/.i.**no**.ti.=.da.ge./	LHHHL	'only life'
Accented-3	あたまが	/.a.ta.**ma**.=.ga./	LLHL	'head=NOM'

Note that in cases of foreign loans, e.g. the last two examples in (12), the general rule of accent assignment is on the penultimate syllable. Thus the whole syllable including a special mora receives accent.

The accent in Hirosaki Japanese works in a way different from that of Tokyo and Osaka Japanese. While the later are characterized by a lowering accent which lowers the pitches of the following morae, Hirosaki Japanese employs the ascending accent, which raises the pitch of the accent-bearing unit to H. Then, all the syllables following the accent-bearing syllable also receive the pitch-accent H.

The examples /sakura=ga/ and /sakura=dage/ show why the accentless class cannot be considered raising the pitch of the following particle, and that the pattern (L)nH must come from phrase-level operating prosody. Also, from the accented examples /inoti=ga/ and /inoti=dage/, we know that the lowering of the final syllable comes from the phrasal prosody. It is possible to generalize them into one constraint, that the phrase final syllable must have a different tone from the preceding syllables. This overrides the pitch accent assigned on the phrasal final syllable, so we have the example /hotaru=ga/, which has an L tone of the final syllable despite the fact that the ascending accent falls on the first syllable and affects all the following syllables.

5.2.4. Tokyo Japanese

Uwano (2006) mentions briefly that the prosodic unit of Tokyo Japanese based on mora, contrary to the mainstream thought. Kubozono (2012) also claims that Tokyo Japanese has both the syllable and the mora. He follows the way of McCawley (1968), analyzing Tokyo Japanese as a mora-counting syllable language. Based on the typology proposed by McCawley, Tokyo Japanese uses the mora to count the phonological distance of a word, but the tone assignment seems to involve the syllable. Kubozono (2012) gives examples of loanwords, in which accents fall on the antepenultimate mora. Since accents cannot fall on special mora, they have to be moved to the preceding mora. However, Labrune (2012: 125) gives examples that allow such. Both types of examples are given in (14) to illustrate the controversy of the TBU in Tokyo Japanese, followed by an overview of the prosodic system in (15). The accented unit is given in boldface. Boundaries are not marked in (15) because of the controversial nature of the TBU.

(14) *Examples showing the mora/syllable as the tone bearing unit in Tokyo Japanese*

a. Mora

Characters	Underlying form	Gloss
おばあさんっこ	/obaRsa**N**Qko/	'child raised by grandma'
チェーンてん	/tje**R**NteN/	'chain store'
こうえんしか	/koRe**N**=sika/	'only the park'
	but */koR**e**N=sika/	

b. Syllable

Characters	Underlying form	Gloss
きょうと	/**kjo**Rto/	'Kyoto'
にほん	/ni**ho**N/	'Japan'
アップル	/**a**Qpuru/	'Apple (company)'
コンパス	/**ko**Npasu/	'compass'

(15) *Prosodic system of Tokyo Japanese*

a. Monomoraic:

Accent	Characters	Underlying form	Surface tone	Gloss
Accentless	ひが	/hi=ga/	LH	'sunshine=NOM'
Accented	ひが	/**hi**=ga/	HL	'fire=NOM'

b. Bimoraic:

Accent	Characters	Underlying form	Surface tone	Gloss
Accentless	あめが	/ame=ga/	LHH	'candy=NOM'
Accented-1	あめが	/**a**me=ga/	HLL	'rain=NOM'
Accented-2	はなが	/ha**na**=ga/	LHL	'flower=NOM'

c. Trimoraic:

Accent	Characters	Underlying form	Surface tone	Gloss
Accentless	さかなが	/sakana=ga/	LHHH	'fish=NOM'
Accented-1	いのちが	/**i**noti=ga/	HLLL	'life=NOM'
Accented-2	こころが	/ko**ko**ro=ga/	LHLL	'heart=NOM'
Accented-3	おとこが	/oto**ko**=ga/	LHHL	'man=NOM'

The examples of the accentual patterns are from Kubozono (2012). He mentions that the distinction between accented or accentless patterns is of fundamental importance in word distinction as this counts for 90% of the contrasting pairs, and the difference in accented syllable is of secondary importance. It is worth noting that the most common accented segment is the

antepenultimate mora. This also where the accent lies for loanwords.

Uwano (2012) mentions that apart from a lowering accent, which accounts for the patterns H(L)n, there also exists a phrase tone, which assigns surface tones L(H)n to the phrasal unit containing the word. The phrase tone only affects segments within words which are not assigned accent. Thus, those words without an accent, e.g. /ame=ga/ still have the surface tones L(H)n.

The problem of whether the syllable is involved in the Tokyo Japanese prosodic system remains highly controversial. Labrune (2012) mentions that unlike the other dialects which uncontroversially belongs to either the realm of syllabic or moraic dialect, Tokyo Japanese remains unsettled in this matter. In the following section, the question will be addressed in more detail.

5.3. The syllable/mora controversy of Tokyo Japanese

As it is mentioned before, there is controversy on the prosodic structure of Tokyo Japanese. Although writing about another language, Gokana, a Nilo-Saharan language which is also suspected to be lacking the syllable, Hyman (2011) mentions that the discussion of the universality of the syllable is fostered by the contribution to prove the existence or absence of the syllable in Japanese. In particular there are positive opinions by Kubozono (1999, 2003) and negative ones by Steriade (2009), for example. While some, such as Kubozono (2012), Shibatani (1990), among others, remain faithful to the syllable analysis, i.e. Japanese has the syllable and employs it, recently there is a revival of the traditional mora analysis, with some of the advocates claiming that Japanese does not have the syllable (Labrune 2012; Satō 2013). It is a controversial claim because it challenges the power of the syllable, which is thought to be universal among all languages. While similar claims are also made for other Japanese dialects, I will only focus on Tokyo Japanese in this section.

To look into detail whether Tokyo Japanese has the syllable or not, we should first know what provides evidence for the syllable. Hyman (2011) gives a useful summary of the usual properties evidencing the existence of the syllable. They are listed below in (16). These will serve as criteria for our discussion and will be examined for Japanese.

(16) *Properties which provide evidence for the syllable*

a. Distributional constraints conditioned by syllable structure

b. Phonological rules conditioned by syllable structure

c. Morphological rules or allomorphy conditioned by syllable structure

d. Prosodies or word-stress targeting the syllable as a feature-bearing unit

e. Prosodic grouping of syllables into higher order constituents, e.g. the foot (Hyman 2011)

5.3.1. Distributional constraints

In this section, distributional constraints will be shown as not requiring the syllable.

As mentioned before, the phonotactics of Tokyo Japanese are often described by means of the syllable, so that it is often said that the syllable of Tokyo Japanese can consist of V(M), CV(M), CjV(M), where M is any of the special morae N, Q and R. It is also possible to describe the above sequences as a single mora when they are without M, or a sequence of a full mora followed by a special mora when M is included, without making any reference to the syllable (Labrune 2012b). It is also possible to consider final /i/ as a special mora, but it does not contrast the vowel /i/ in distribution, so it suffices to consider the final /i/ just as V[10].

There are some distributional constraints regarding consonants that seem to refer to the syllable. First, usually only /p, t, k, s/ can appear after /Q/, marginal cases of other consonants appearing are also recorded, i.e. /b, d, g, z, r, h/, although they tend to be altered to other possible consonants (Labrune 2012b). Second, the glide /w/ can only appear before /a/, and the glide /j/ cannot appear before high vowels /i/ and /e/. Third, special morae /N, Q, R/ cannot appear initially as the syllable onset, /Q/ generally must be followed by consonants, and they all cannot appear in their own right and must follow a vowel, i.e., they cannot act as a separate syllable.

The concepts *onset*, *nucleus* and *coda* do not have to be involved to explain the distribution of special morae, since alternative explanations are possible. Labrune (2012) discusses feature

10 Judging from the syllabic dialects, it is possible instead to consider the final /i/ a diphthongal /i/ or a glide /j/. More phonetic and phonological studies on the nature of the final /i/ are needed.

specification of deficient morae. /R/ is underspecified for all features except [-cons], which specifies it as vocalic, and must obtain further feature specification from a preceding vowel. /Q/ and /N/ are similar in that they are both underspecified apart from [+cons], but are separated by the nasal specification [+nas] on /N/. Thus, /N/ can appear without any consonant following it, while /Q/ cannot. They both have to obtain feature specification from the following consonants, so they cannot appear before a vowel, i.e., as the onset of a syllable. The three special morae cannot appear in their own right because they are deficient, and they must follow a proper vowel, which is also a full mora.

Sequences of the special morae /R, N, Q/ are traditionally forbidden, but are nonetheless recorded in recent studies (Shirooka 2012; Labrune 2012). Even if we consider sequences of special morae, we do not need the notion of syllable to describe their distribution. That is, the distribution pattern in general is minimally a mora (V) and maximally a mora followed by one or two special morae (VM/VMM).

Ito & Mester (1995) also discuss some distributional constraints of Japanese, and claim that there are several syllable-related constraints, which actually can be revised without involving the syllable. First, In native and Sino-Japanese words, /p/ can never appear alone, and it must follow either /N/ or /Q/, as in the examples /niQpoN/ 'Japan' and /kaNpai/ 'cheers'. It is clearly only related to moraic consonants /N/ and /Q/, but not the syllable. Second, in native Yamato[11] and mimetic words, consonants following /N/ cannot be voiceless, e.g.. /toNbo/ 'dragonfly' and /kaNde/ 'chewing'. There is no need to involve the syllable in this case either.

5.3.2. Phonological rules

There are many phonological rules in Tokyo Japanese, however, none of them rely on the syllable. Common rules such as vowel devoicing happening between two voiceless consonants or at word boundary after a voiceless consonant does not need any involvement of the syllable, nor do other rules such as palatalization need it. Smith (1980) studies the phonological rules and processes of Japanese, some of which are claimed to involve the syllable. In what he calls

11 Yamato is the endonym of ethnic Japanese (excluding Ainu and Ryukyuan) and also the name of the native stratum of Japanese lexicon.

“syllabicity reversal”, words like /atui/ [atsui] 'hot' will become [ats^{w}ii] in hypoarticulated speech. The rule he states involves the reversal of syllabicity and the lengthening of the last syllable [i]. However, if we take a moraic analysis, we can say instead that it is a case of mora insertion (of [i]) in order to conserve morae, after the loss of the mora [u] due to gliding. As Smith also mentions, vowel shortening often also happens, such that the additional mora is lost, i.e., [atsui] → [ats^{w}ii] → [ats^{w}wi].

5.3.3. Morphological rules and allomorphy

Japanese is a suffixing agglutinative language, meaning that morphemes are put after each other to form new words and sentences. There are also some prefixes, but most of the affixes in Japanese are suffixes.

Japanese verbal morphology is complex, and is often divided into two groups of verbs, called *godan* and *ichidan* verbs, according to the inflectional paradigms. Shibatani (1990: 222) gives the examples of /sin-/ 'to die' and /mi-/ 'to look at' as examples of *godan* and *ichidan* verbs respectively. The former is also called consonant-stem and the later vowel-stem verbs. There are also some verbs displaying allomorphy, such as /aw-/ 'to meet', which becomes /a-u/ in conclusive, which is formed by adding /u/, and /aw-a+nai/ in negative formation, which is formed by suffixing the irrealis /aw-a/ with the negative copula /nai/. In this case, /aw-/ alternates with /a-/. Verbal allomorphy apparently does not rely on the syllable nor the mora. Another example of allomorphy is commonly known as *onbin*, which refers to the sound change of stem consonant other than /s/, when it is followed by the past auxiliary /ta/ and the conjunctive particle /te/. First of all, velars elide as in /kak-i+ta/ 'write-PAST' → /kaita/. Verbs with the consonant stems /b, m, n/ have the whole mora altered into the moraic nasal /N/ and at the same time makes the following consonant voiced, e.g., /tob-i+ta/ 'fly-PAST' → /toNda/; /nom-i+ta/ 'drink-PAST' → /noNda/. The cause of *onbin* is actually historical change, but synchronically it can be accounted well by mora compensation and the constraint preventing voiceless consonant after moraic /N/ mentioned in §5.3.1. The syllable is thus not needed for *onbin*.

Sequential voicing, or *rendaku*, is the voicing process of the initial consonant of the non-initial component of a compound word. Kubozono (2005) discusses some of the constraints

governing the process. Lyman's Law is among the most important ones, and it blocks voicing if the non-initial component of the compound word already has a voiced obstruent. The syllable is clearly not relevant to account for this process. Kubozono later gave another constraint, which is, however, related to the mora. The constraint works specifically on compounds with the suffix /hoN/, and says that *rendaku* happens if the compound word consists of more than four morae. This is reflected in the examples /,e,ro,+,ho,N,/ 'erotic book' and /,ma,N,ga,+,bo,N,/ 'comic book'.

Kubozono (2005) also mentions that contraction occurs in some Sino-Japanese compound words. Examples are shown in (17).

(17) *Morphological contractions in Sino-Japanese compounds*

a. /gaQkai/ 'academic society' ← /gaku+kai/ 'learning+society'
   /buQsi/ 'sculptor of Buddhist images' ← /butu+si/ 'Buddha+teacher'

b. /gakubu/ 'faculty' but */gaQbu/ ← /gaku+bu/ 'learning+part'
   /buturi/ 'physics' but */buQri/ ← /butu+ri/ 'substance+law'

c. /daibutusi/ 'sculptor of big Buddhist images' ← /[dai+butu]+si/ '[big+Buddha]+teacher'
   /siNgakuka/ 'department of theology' ← /[siN+gaku]+ka/ '[god, learning]+department'

d. /daibuQsi/ 'great sculptor of Buddhist images' ← /dai+[butu+si]/ 'big+[Buddha+teacher]'
   /siNgaQka/ 'a new department' ← /siN+[gaku+ka]/ 'new+[learning+department]'

The examples (17a) and (17b) show the workings of a constraint, which says that contraction occurs if the second part of the compound has a voiceless consonant. (17c) and (17d) show a difference, in which /butu+si/ exhibits contraction while /daibutu+si/ does not. The constraint here is that contraction occurs only when the domain consists of up to four morae. Thus the examples /daibutu+si/ and /siNgaku+ka/, which have 5 morae, cannot undergo contraction. This is again a case of mora-involved morphology.

Concerning the effect of 'four mora domain', Kubozono (2005) lists more examples, including the alternation of initial /p/ and /h/ of non-initial morpheme following a moraic nasal /N/. The constraint is that morpheme-initial /p/ will turn into /h/ if it is after a moraic nasal /N/, in a word domain of more than four morae. Examples are /maNneNhitu/ 'fountain pen' ← /[maN+neN]+pitu/ '[one thousand+year]+pen' but /eNpitu/ 'pencil' ← /eN+pitu/ 'lead+pen'. This

shows that the mora has more involvement than the syllable regarding compounds.

Ito (1990) mentions an interesting case of prosodic requirement of morphological processes such as loanword truncation. In her account, the minimal prosodic requirements of those processes involve 1) bimoraicity of prosodic stem and 2) disyllabicity of prosodic word. This is particularly interesting because it echoes the mixed prosodic property of Japanese, such that it is a language which relies on both the syllable and the mora, i.e., a "mora-counting syllable language" (McCawley 1968; Shibatani 1990). However, the involvement of the syllable in the second constraint can be eliminated by using the notion *deficient mora* suggested by Labrune (2012: 141), where a heavy syllable is just a sequence of a full mora followed by a deficient mora. The concept of deficient mora also applies to other cases besides loanword truncation in which the distinction between heavy syllable and light syllable seems to be relevant. In her account, these deficient morae are responsible for many processes which are allegedly related to the syllable.

5.3.4. Prosodic system

In the examples given in (14) in §5.2.4., it seems that in Tokyo Japanese, the accent downstep happens between two morae if the accented syllable contains a special mora (/Q, N, R, i/), and the special mora cannot bear the accent at all. This is why Tokyo Japanese has been described as a mora-counting syllable language, as the accent assignment relies on the syllable and the downstep relies on the counting of the mora. Kubozono (2012: 1404) concludes that for loanwords "accent falls on the syllable containing the antepenultimate mora". This is especially true if we only look at the examples (14b), since it is always the first part of the syllable which receives the accent. However, this is argued by Labrune (2012) as a strange and inappropriate definition for accent, since it is not only the counting, but also the accenting unit which involves the mora. As we can see in the examples (14a) provided by Labrune (2012), in some cases, for example those involving sequences of special morae, accent placement can happen on the special mora which is at the second part of the syllable and this raises the question whether the syllable is needed at all to describe the pitch-accent system of Tokyo Japanese, since if both parts of a "heavy syllable" can be accented, then why do we not describe the accent assignment by mora

instead? Of course, sequences of special morae are rather special and are also thought to be quite new in Japanese, however, they also appear in abundance in informal speech and writing alike (Shirooka 2012). How does one parse these patterns, e.g. CVNQCV, remains a question. For now, I will consider them as a string of two special morae following one full mora without referring to the syllable. In other words, this is just a new type of phonotactics emerges recently. Traditionally proponents of the syllable analysis have given the constraint *disallow superheavy syllables* to prove the need to make reference to the syllable (Labrune 2012). However, the introduction of strings of one head mora and two special morae means that the traditional constraint of disallowing superheavy syllables is either irrelevant (if we accept that the syllable do not exist in Japanese) or violated. It would be neater to propose this constraint is just irrelevant in Tokyo Japanese.

5.3.5. Prosodic grouping

Prosodic grouping of the higher units i.e. the foot does not need to involve the syllable. As Otaka (2008) points out, there is enough evidence, such as Japanese foot-based word formation, showing that the foot in Japanese consists of two morae, rather than syllables.

The claim is echoed later by Labrune (2012), who also provides evidence of morphological truncations from Poser (1990) for bimoraic feet. Ito (1990) and Ito & Mester (1992) mention that the foot in Japanese also corresponds to the minimal word unit, when discussing prosodic minimality, and the truncated minimal word can always be mapped onto two morae. They explain the cases of trimoraic words by stressing the minimality of the constraint of bimoraic feet for a minimal prosodic word, such that the addition of an extra mora to the minimal word is possible.

Labrune (2012) also mentions the apparent mismatch between the syllable boundaries and feet. In the example she gives, /roriRta+koNpureQkusu/ 'Lolita complex', the word would be shortened to /rorikoN/ in truncated form, which consists of four morae. This corresponds to two bimoraic feet, but cannot be accounted for with syllable-based feet. If syllables are required for feet, then it would be /roriRkon/, instead of /rorikon/. The foot does not seem to depend on the syllable at all in Tokyo Japanese. While SLH states that a higher ranked prosodic constituent

must dominate the immediately lower ranked constituent, the foot in Japanese seems to be a violation. If the syllable analysis is followed, then that the foot consists of the mora but not the syllable violates SLH. If the mora analysis is followed, then the foot consists of the immediately lower ranked constituent, which is the mora. SLH is still violated since the syllable is excluded. Both analyses are possible, and the syllable analysis is not a better choice in this case.

5.3.6. Further evidence

Apart from the five criteria suggested by Hyman, there seems to be further evidence for the mora analysis. For example, metrics provides evidence for the mora but not for the syllable. Tokyo Japanese employs the mora as the metric unit in poetry and singing (Poser 1990; Labrune 2012; Satō 2013). Traditional Japanese Haiku are also written according to mora restrictions. Thus the first verse has 5 morae, the second 7 morae, and the third 5 morae.

One characteristic of Japanese songs immediately recognizable by foreigners would be the exact matching of each mora with musical notes. For example, when singing the verse /yoakenobaNni/ 'in the night of dawn'[12], Tokyo Japanese will pronunce the moraic nasal /N/ in /baN/ as a separate note. In contrast, the Tsugaru dialect employs syllable instead in singing, such that /baN/ is a single unit, although lengthening effect of /Q/ and /R/ still exist (observation[13], June 17, 2014), and the same verse will be sung without giving the moraic /N/ a separate note. This is a strong evidence pointing to the unparalleled importance of the mora. However, we cannot deny the possibility that it is actually the writing system, which relies heavily on morae, causing poetry and singing to employ the mora as the sole metric unit. However, in dialects such as Tsugaru Japanese, the way of singing still corresponds to syllables, even when they write the lyrics in Standard Japanese orthography.

Some psycholinguistic studies suggest that the mora has a prominent importance of parsing by native speakers of Tokyo Japanese[14] (Otake *et al*. 1993; Kureta *et al*. 2006 and Verdonschot 2011, as cited in Labrune 2012). Nagano-Madsen (1990) also does experiments to show that

12 This verse is from a traditional child song called かごめかごめ *Kagome Kagome*.

13 https://www.youtube.com/watch?v=rMrbJSvUKEA

14 However, see Matsuzaki (1996) for an opposite conclusion.

mora is the TBU of both Tokyo and Osaka Japanese.

5.3.7. Conclusion

Does the lack of involvement of the syllable in phonology induces that the language lacks syllable? One perhaps would like to preserve the universality of the syllable and says that this is not the case. As Hyman (2011) says, it is logically impossible to prove that the syllable do not exist in a certain language. However, if the syllable is not needed in the phonology of a language, then why should we include it? Universality is neat and it shows the underlying cognitive or biological features shared by all human, so every typologist aims at finding universals. but as phonological typology develops, more examples are found that contradict various previous universals. For instance, Hyman (2008) mentions a newly falsified universal i.e. *every languages have coronal consonants*. The universal is falsifed by a newly discovered language which shows the otherwise. Tokyo and Osaka Japanese are exactly the cases which do not need the involvement of the syllable, and a "universal" like the syllable should not be universal anymore if evidence shows up as against it.

Also, as mentioned before, there is another language claimed by Hyman (1983, 1985) to be a possible candidate of syllableless language. Although evidence is ambiguous as also mentioned by Hyman (2011), Gokana is still a possible candidate which does not care about the syllable. It is understandably difficult to accept Japanese as a peculiar example without the syllable among world languages, but what if there are more languages claimed to be syllableless?

It should be noted that there is no reason to assume the mora must be present and that SLH must be met. Unlike the syllable, which has always played a central role in phonology, the mora can be less important in languages which do not care about syllable weight. Selkirk (1986) actually states that the mora is the only unit that can be absent in the prosodic hierarchy. There are also other prosodic constituents which are problematic if considered to be universal, such as the foot and even the phonological word (Bickel 2013: 3-4). The fact that neither the mora and the foot might be universal actually strengthens the claim that the syllable is not universal, since the three are all prosodic constituents and there is no *a priori* reason that the syllable is more special than the other prosodic constituents. In the following section, I will examine whether

Japanese syllabic dialects have morae.

5.4. Do syllabic dialects have morae?

Although we discussed the case (though briefly) that the moraic dialects like Osaka and Tokyo Japanese do not seem to have the syllable, can we make the reverse statement for the syllabic dialects like Kagoshima and Tsugaru (Hirosaki) Japanese?

It is reported by Matsumori & Onishi (2012) that at least in some varieties of Kagoshima Japanese, a syllable gets lengthened to compensate the deletion of a final mora. For example, the word /isi/ 'stone' becomes [i:ʃ], both of which consist of two morae, despite the difference of the number of syllables. Words of only one mora always get lengthened phonetically, such that /hi/ 'fire' is realized as [hi:]. While the first case could be a general phenomenon of syllable lengthening, or a result of mora conservation, the latter can only be accounted for by assuming the mora in the prosodic structure of Kagoshima Japanese.

While /N/ in Tsugaru Japanese acts often as a syllable coda and a heavy syllable with /N/ has the same time length as syllables without it, /R/ and /Q/ have a much more prominent effect in lengthening the syllable. This could be due to the fact that /R/ and /Q/ are phonetically a vowel lengthening segment and a geminate consonant respectively. To account for length distinction of vowels, whether or not /R/ is employed, the mora must be introduced.

The above being said, it does not mean that all Japanese dialects, or human language in general need to have the mora. In the last section, it is argued that languages care less about syllable weight can be considered without the mora. It seems that Japanese dialects generally care much about the mora.

6. Formalization of the dialects

The formalization consists of three parts. The first part (§6.1.) is about the phonotactics and parsing of the dialects. It is relevant because the dialects differ in their phonotactics and the way they parse. A single parsing algorithm for all dialects is impossible without considering the effect of phonotactics on segmental sequences, which are the inputs of parsing. The second part (§6.2.)

is about the prosodic systems of these dialects, which in turn leads to the third part (§6.3.), the prosodic structures of the dialects.

6.1. Optimality Theory in Prosodic phonology

In §6.2, the model of formalization will be Bidirectional Phonology and Phonetics (henceforth BiPhon) proposed by Boersma (2007, 2011). It is best to illustrate phonotactic and parsing constraints in the form of perceptual-based phonological adaption of speech inputs which do not follow native phonotactics, and OT BiPhon is indeed perceptual-based. Since perception and production employ the same set of constraints in BiPhon, native inputs already follow the phonotactics since they are produced, thus they are not good candidates for showing the effects of the constraints. Instead, non-native inputs which do not follow the phonotactics must be used. The constraints involved in the perception of non-native speech inputs are assumed to be the same as native phonotactic constraints, since perception of any input is based on the same native constraints. When perceiving auditory forms, phonotactic constraints come into play in the form of structural constraints, which operate at phonological surface form, and cue constraints, which operate between phonetic form and phonological surface form.

Stratal OT will be used in §6.3, to illustrate the different processes of accent and phrasal tone assignment, which happen at different strata of the prosodic hierarchy. This OT model is developed from the tradition of Lexical Phonology, and is most used for modeling morphophonological processes through derivations in different strata (Bermúdez-Otero 1999; Kiparsky 2000). Three strata are considered in Stratal OT, namely stem, word and phrase. Each stratum has its own set of constraints. The operation goes from the stem stratum through the word stratum to the phrase stratum, with each output of the previous stratum becoming the input of the next stratum. Following Breteler (2013), stem stratum is not necessary and can be skipped, and it is hereby considered not to be involved in prosodic systems. For example, while pitch-accent is assigned at the prosodic word stratum, phrasal tone is assigned at the phrase stratum. The two strata do not interact with each other, i.e., the two sets of constraints governing the two strata do not compete with each other. Showing the processes in different stratum better illustrates the effect of the different set of constraints. Note that when stratification is irrelevant

such as in the case of Kagoshima Japanese, Stratal OT is applied similar to the way of traditional OT, as only one prosodic word stratum is involved.

6.2. Phonotactics

I am not going to give a complete picture of Japanese phonotactics by formalization. Instead, examples of formalization will be given only when they are related to parsing, the syllable, the mora and special mora. Tokyo Japanese will be taken as the center of interest in the following section, and the other dialects will be discussed in §6.2.2.

6.2.1. Tokyo Japanese

Assuming the mora is the unit for parsing, the segment sequencing of Japanese may be written as (C)(j)V(M[15]) for a bimoraic sequence, or as (C)(j)V for a full mora. Special morae cannot appear at word-initial position. In other words, S can only appear after V. They also cannot appear in sequence. Thus, we have the constraints ***#S** and ***SS**. The former prevents special morae from appearing initially. The later prevents sequences of special morae.

All dialects of Japanese disallow consonant clusters except when the second part of a biconsonantal cluster is the glide /j/. Although Cj is a consonant cluster, it is also the lowest ranked in terms of structural complexity. Vennemann (2012) discusses the degrees of structural complexities of consonant clusters along a quality scale. Double plosives are among the most complex and most uncommon across languages. In contrast, a plosive followed by a semi-vowel or a glide are the simplest and also most common across languages. Vennemann gives Korean as an example of only allowing this simplest consonant cluster. Japanese behaves in the same way.

The hypothetical foreign word [hjɑːns] is taken as the input for illustration. Since all the consonant clusters along the complexity scale can be considered as controlled by corresponding constraints, we can thus propose a structural constraint ***CC** as a general condensed constraint for all the consonant clusters along the line excluding the ***Cj** constraint, such that the cluster Cj does not violate ***CC**. Since there are dialects which allow Cw sequence, there is also the

15 Recall that M stands for the special mora.

constraint *Cw, which is irrelevant in the illustration. Thus the constraint ***CC** is required to ensure no output phonological form with consonant cluster is allowed. When the input consists of consonant clusters, vowel epenthesis is preferred to vowel deletion. So the cue constraints **[n]$_{aud}$ NOT / /$_s$**, **[s]$_{aud}$ NOT / /$_s$** and **[j]$_{aud}$ NOT / /$_s$**, which ensure the input consonants are perceived in the output, are required. Moraless consonants cannot be attached to the right of a vowel or a special mora, so we have the constraints ***,VC,** and ***,SC,**. The cue constraint **[nC]$_{aud}$ NOT /nuC/$_s$** is needed to ensure the coda [n] is preferred to be perceived as moraic /N/ instead of the epenthetic /nu/. The cue constraint **[V:]$_{aud}$ NOT /V/$_s$** is needed to ensure long vowel is not perceived as a single vowel without a following /R/. In terms of parsing, only two constraints are needed. While **UNIT-MORA** ensures parsing is based on the mora but not otherwise, **UNIT-SYL** does the reverse. Kager (1999: 95) gives the constraints ONSET and NOCODA for syllabification. However, Japanese violates these constraints, such that the sequence CVNV is parsed as CV.N.V instead of CV.NV. This points to the fact that N cannot be taken as a normal consonant, and this in turn shows that constraints based on syllables are violated. Thus, the two constraints **UNIT-MORA** and **UNIT-SYL** are needed to specify the prosodic constituent comes into play, without assuming the role of syllabification.

The most important difference in ranking between the constraints is the low ranking of **UNIT-SYL**, which reflects that Tokyo Japanese prefers the mora as the unit of parsing, instead of the syllable. The constraint ***Cj** is ranked on a lower level than **[j]$_{aud}$ NOT / /$_s$**, showing that perceiving /j/ is more important than preventing consonant cluster Cj. The Japanese adaptation of the English name *Hans* [hɑ:ns] is /haNsu/, in which /N/ is perceived but not /R/. The cue constraint **[V:]$_{aud}$ NOT /V/$_s$** is ranked lower than **[n]$_{aud}$ NOT / /$_s$**, such that perceiving /N/ is preferred over perceiving /R/. The ranking of all constraints is shown below in (18). The perception of the hypothetical example [hjɑ:ns] is shown below in Tableau 1.

(18) *Constraint ranking of phonotactic constraints in Tokyo Japanese*

{UNIT-MORA ; *CC ; [n]$_{aud}$ NOT / /$_s$; [s]$_{aud}$ NOT / /$_s$;
[j]$_{aud}$ NOT / /$_s$; *SS ; *,SC, ; *,VC, ; [NC]$_{AUD}$ NOT /NUC/$_s$}

≫

{*Cj ; [V:]$_{aud}$ NOT /V/$_s$; UNIT-SYL}

Tableau 1. Perception of the hypothetical foreign word /hjɑ:ns/, showing phonotactics in Tokyo Japanese

$[hjɑ:ns]_{aud}$	Unit-Mora	*CC	$[n]_{aud}$ not / /$_s$	$[s]_{aud}$ not / /$_s$	$[j]_{aud}$ not / /$_s$	*SS	*,SC,	*,VC,	$[nC]_{aud}$ not /nuC/$_s$	*Cj	$[V:]_{aud}$ not /V/$_s$	Unit-Syl
/.hjaN.su./	*!									*	*	
/.haN.su./	*!				*						*	
☞ /,hja,N,su,/										*	*	*
/,ha,N,su,/					*!						*	*
/,hja,N,/				*!						*	*	*
/,hja,Ns,/							*!			*	*	*
/,hja,su,/			*!							*	*	*
/,hja,nu,su,/									*!	*	*	*
/,hja,R,N,su,/						*!				*		*
/,hja,R,su,/			*!							*		*
/,hjan,su,/		*!						*		*	*	*

6.2.2. Dialectal variations

One obvious variation across the dialects is the relative ranking of **UNIT-MORA** and **UNIT-SYL**. While Tokyo Japanese and Osaka Japanese prefers the mora as the unit of parsing, Kagoshima and Hirosaki Japanese prefer the syllable, and accordingly **UNIT-SYL** is ranked on a higher level than **UNIT-MORA**. Also, the constraint ***.VC.** is required to prevent consonant coda from appearing, since the previous constraint ***,VC,** is no longer relevant. The same goes for ***.SC.**., which prevents sequence of special mora and consonant from appearing within syllable boundaries. Note that a coda consisting of a special morae is acceptable. The identical input as in the previous tableau will be perceived as the following in syllabic dialects, as shown in Tableau 2. There are actually more differences across dialects as mentioned in §4.4., but they are not relevant to our discussion regarding prosodic constituent.

Tableau 2. Perception of the hypothetical foreign word /hɑːns/, showing phonotactics in syllabic dialects

[hjɑːns]$_{aud}$	Unit-Syl	*CC	[n]$_{aud}$ not / /$_s$	[s]$_{aud}$ not / /$_s$	[j]$_{aud}$ not / /$_s$	*SS	*.SC.	*.VC.	[nC]$_{aud}$ not /nuC/$_s$	*Cj	[Vː]$_{aud}$ not /V/$_s$	Unit-Mora
/,hja,N,su,/	*!									*	*	
/,ha,N,su,/	*!				*						*	
☞ /.hjaN.su./										*	*	*
/.haN.su./					*!						*	*
/.hjaN./				*!						*	*	*
/.hjaNs./							*!			*	*	*
/.hja.su./			*!							*	*	*
/.hja.nu.su./									*!	*	*	*
/.hjaRN.su./						*!				*		*
/.hjaR.su./			*!							*		*
/.hjan.su./		*!						*		*	*	*

6.3. Prosodic systems

While the prosodic system of Kagoshima has been formalized by Breteler (2013), the formalizations of dialects of other accentual types are less studied. The present study provides the formalizations of the four dialects have been mentioned. Stratal OT is used in this part, and all the processing happen in the prosodic word stratum in Kagoshima Japanese, and between the prosodic word stratum and the phrase stratum in the other three dialects. Although strictly speaking, accent assignment should happen between the lexical representation and the phonological surface representation, the processes have to go through all the strata before the tones are realized on the surface. The representations involved in the strata are considered intermediate stages before the phonological surface representation containing all the tones is realized and they are all marked by the slashes / / representing the phonological surface representation.

Some general constraints that appear repeatedly are introduced here. Constraints which are relevant to tone or pitch-accent assignment are discussed first. First, the pair of constraints

TONE-SYL and **TONE-MORA** are proposed here. **TONE-SYL** ensures all the syllables and only syllables are assigned tone. **TONE-MORA** is the reverse, which ensures all the morae and only morae are assigned tone. Each violation mark is assigned when each of the concerned unit does not receive tone. The rankings of these two constraints determine the involvement of the syllable and mora in the prosodic system. The constraints **UNIT-SYL** and **UNIT-MORA** are violated even by words that have no accent but parse the word in the other way. For all the concerned dialects, **UNIT-SYL** must be ranked on the same level with **TONE-SYL**. The same holds for **UNIT-MORA** and **TONE-MORA**. These four constraints all work in the same stratum in the same intermediate phonological surface representation. The rankings of these four constraints are shown in (19).

(19) *General constraint ranking*

{TONE-SYL ; UNIT-SYL}

{TONE-MORA ; UNIT-MORA}

The constraints **MELODY-R** and **MELODY-L** are proposed here to ensure that the input tonal melody has to be located at the rightmost or leftmost boundary of the word, and it does not matter whether the tonal melody is assigned as different tones on different syllables or a contour on one syllable.

The constraint ***CONTOUR** prevents internal contour in the TBU regardless what the TBU is, which is also mentioned by Yip (2002), and as SYL-TO-TONE/μ-TO-TONE in Breteler (2013: 18).

Concerning accent assignment, the constraints **ACCENT-FALL** and **ACCENT-ASCEND** are required for the accent assignment of the three pitch-accent dialects to follow the characteristics of their accent type, and a violation mark is assigned if the assigned pitch-accent does not follow the falling or ascend accent, respectively. If the accent is an ascending one, the accented TBU bears H pitch-accent, and every TBU after the accented one must also bear H pitch-accent. For a falling accent, the accented TBU bears H pitch-accent, while all the following ones bear L pitch-accents.

The constraint ***ALIENTONE** militates against any tone not resulting from the H tone of the accented mora from appearing by assigning one violation mark to each alien tone. The constraint **FAITH-ACCENT** (Breteler 2013: 20) ensures faithfulness of accent assignment to the lexical

specified position by assigning violation marks for the distance of the accented mora and the specified mora. If accent is not specified in the surface output, one violation mark is assigned.

The constraint **SPREAD-LEFT** (Breteler 2013: 22) ensures the leftmost tone spreads to all the following TBU by assigning violation marks for every TBU not associated with the tone of the leftmost TBU. In contrast, the constraint ***SPREAD-LEFT** (Breteler 2013: 22) prevents spreading of the leftmost tone.

There are also constraints concerning alignment of certain tones (Breteler 2013: 16). The constraint **ALIGN-R(H)** ensures that the rightmost TBU is assigned only an H tone by assigning a violation mark, if an L tone is assigned instead. The constraint **ALIGN-L(PH, L)** ensures that the leftmost TBU of a phrase is assigned only an L tone. The constraint **ALIGN-R(PH, C)** ensures the rightmost TBU of a phrase is assigned a tone different from the previous one, which also means an obligatory contour melody at the rightmost edge of the phrase. For example, when the input pitch-accents are HHHH for an initially accented word, the output will become HHHL after implementing the contour melody.

The constraint **MAX-TONE** (Breteler 2013: 15) operates in the phrasal level to ensure all the input pitch-accents are kept in the output by assigning one violation mark for each missing input tone in the output. The constraint ***MULTI-ASSO** is always required to prevent multiple association of tones to a single mora. Each violation mark is assigned for each mora that is associated to multiple tones. The constraint ***MIXTBU** militates against assigning phrasal tones on a TBU different from that of accent assignment. This prevents assigning tone on the other TBU when the default TBU has already been assigned pitch-accent. The constraint **PHRASALTONE** works on the phrasal level to ensure that phrasal tone is assigned to no matter what TBU.

In the following formalizations, the input representation is the prosodic word in the phonological form, which has not yet been given any surface tone value. The tone in the input represents the lexically specified tone of the word. The mora and syllable boundaries /,/ and /./ in the output mark the boundaries of the TBU. They are not specified in the input since the input is underspecified for the choice of TBU. H and L denote high tone and low tone respectively. the sign /'/ marks the output accented mora, while **boldface** represents the lexically specified accent. The bracketed tones (H) and (L) represent alien tones which are not from lexical specification,

the understroked tones H and L represent register tones in Osaka Japanese, and the outlined tones ℍ and 𝕃 represent phrasal tones in Hirosaki and Tokyo Japanese.

6.3.1. Kagoshima Japanese

The analysis by Breteler (2013) provides useful insight on the OT analysis of *N*-pattern prosodic systems. I will try to give an alternative account here. The main difference lies in the choices of constraints.

As illustrated before, the tonal pattern in this dialect is simple as having only 2 patterns. The TBU is the syllable, but since tonal patterns change when the prosodic word becomes longer with the addition of clitics, the tonal assignment is affected by the prosodic word.

We first need the tones to be assigned to all the syllables, as there are no syllables in the language without tone. Also, syllables must be the TBU. Since Kagoshima Japanese does not use mora as prosodic unit, we can say that **TONE-MORA** is ranked low, while **TONE-SYL** is ranked high. This ranking is shown in (20).

(20) *Interim constraint ranking*

TONE-SYL ≫TONE-MORA

Observing from the type A words, e.g. /.toR.=.ká.ra./, the assignment of tone first put the contour melody HL at the rightmost edge of the prosodic word, then all other syllables on the left will be assigned the L tone. The constraint **MELODY-R** is thus needed. Judging from the avoidance of contour except in monosyllabic type A words, i.e. /.kî./, the constraint ***CONTOUR** is also required. These two constraints interact with each other, so that tonal faithfulness and banning of contour compete with each other. In the case of monosyllabic words, we can see that tonal faithfulness is preferred to banning contour. So instead of only mapping the obligatory H tone, the input HL tone is preserved. In words containing more than one syllable, the problem does not exist because tonal faithfulness can be satisfied by mapping the HL melody across two syllables. Note that there is no restriction on how many syllables the tone map on, so the melody HL can mapped on two or more syllables. Thus we have the following ranking (21).

(21) *Interim constraint ranking*

MELODY-R ≫*CONTOUR

To prevent the monosyllable from epenthesis as a mean to relieve the contour tone, the constraint ***/.□./** is added, which militates against the output from having epenthetic syllable. Just as **TONE-SYL**, it is never violated, so it must be high-ranked. Since all prosodic words must contain one and only one H tone, we have the constraint **ONEH**. It means that obligatory high tone must occur only once in the word. This is also mentioned by Hyman (2009), and is represented by Breteler (2013: 20-21) as the two constraints OBLIGATORINESS(H) and CULMINATIVITY(H). It is never violated and thus a high-ranked constraint. These two constraints, ***/.□./** and **ONEH**, do not compete with others, so they are on the same level with **TONE-SYL**. The constraint **MELODY-R** can also be put on the same level as it does not compete with the other constraints. Thus we have the full constraint ranking as in (22).

(22) *Constraint ranking of Kagoshima Japanese*

{TONE-SYL ; */.□./ ; ONEH ; MELODY-R} ≫*CONTOUR ≫TONE-MORA

Syllable boundaries are marked to better represent the correspondence between syllables and tones. However, it does not mean the TBU cannot be the mora, as shown by one of the possible candidates, in which there are two tones within one of the syllables. Also, it does not mean parsing necessarily happens before tone assignment.

The following Tableaux 3-6 show the tone assignments of the type-A prosodic words /toR=kara/, /ki/ and the type-B prosodic words /niwatoi/, /ki/.

Tableau 3. H Tone assignment of the type-B prosodic word /niwatoi/ in Kagoshima Japanese

/niwatoi/ H	Tone-Syl	*/.□./	OneH	Melody-R	*Contour	Tone-Mora
☞σ σ σ | | | /.ni.wa.toi./ | | | L L H						****
σ σ σ | | | /.ni.wa.toi./ | H	*!*					****
σ σ σ | | | /.ni.wa.toi./ | | | L H H			*!			****
μ μ μ μ | | | | /,ni,wa,to,i,/ | | | | L L L H	*!**					
σ σ σ | | | /.ni.wa.toi./	*!**		*	*		****
σ σ σ | | | /.ni.wa.toi./ | | | L H L				*!		****

Tableau 4. HL Tone assignment of the type-A prosodic word /toR=kara/ in Kagoshima Japanese

/toRkara/ HL	Tone-Syl	*/.□./	OneH	Melody-R	*Contour	Tone-Mora
☞ σ σ σ | | | /.toR.ka.ra./ | | | L H L						****
σ σ σ | | | /.toR.ka.ra./ | | H L	*!					****
σ σ σ | | | /.toR.ka.ra./ | | | H H L			*!			****
σ σ σ | | | /.toR.ka.ra./ | | | L L HL					*!	****
σ σ σ | | | /.toR.ka.ra./	*!**		*	*		****
σ σ σ | | | /.toR.ka.ra./ | | | L L H				*!		****
μμ μ μ || | | /,to,R,ka,ra,/ | | | | LL H L	*!**					

Tableau 5. H Tone assignment of the type-B monomoraic prosodic word /ki/ in Kagoshima Japanese

/ki/ H	Tone-Syl	*/.□./	OneH	Melody-R	*Contour	Tone-Mora
☞ σ | /.ki./ | H						*
σ | /.ki./ | L			*!	*		*
σ | /,ki,/ ⟋| LH					*!	*
μ | /,ki,/ | H	*!					

Tableau 6. HL Tone assignment of the type-A monomoraic prosodic word /ki/ in Kagoshima Japanese

/ki/ HL	Tone-Syl	*/.□./	OneH	Melody-R	*Contour	Tone-Mora
☞ σ | /.ki./ ⟋| HL					*	*
σ | /.ki./ | H				*!		*
σ σ | | /.□.ki./ | | H L		*!				*
μ | /,ki,/ ⟋| HL	*!				*	

As shown in the tableaux, the only lexically specified tone is either H or HL. The other surface tones are the result of a general tone assignment process, which does not necessarily happen during word level processing. In fact, it is possible that the surface L tones are the result of a more superficial process happening during phrase level or above in the prosodic hierarchy. I will not go into detail here.

6.3.2. Osaka Japanese

Osaka Japanese is special in that it makes use of tonal registers as well as pitch accent, thus it should not be surprising that it involves constraints concerning both tonal and pitch-accent systems. Examples and overview of the prosodic system are given in §5.2.3.

Accent assignment, which happens in the prosodic word stratum, is considered first. First of all, it is clear that Osaka Japanese uses the mora as the TBU. Thus constraint **TONE-MORA** is ranked higher than **TONE-SYL**. **UNIT-MORA** is also needed.

The accent of Osaka Japanese behaves like most other Japanese dialects, i.e., a falling accent, meaning that the accented mora has an H tone, and the following morae have L tones. The pitch-accents assigned are never overridden by other factors. The constraint **ACCENT-FALL** is thus needed. For faithfulness of tone assignment, the constraints ***ALIENTONE** and **FAITH-ACCENT** are also required. They do not interact and thus are on the same level. These are not too different from the Hirosaki dialect, and we have the conclusive ranking as in (23).

(23) *Constraint ranking of accent assignment in Osaka Japanese*

{FAITH-ACCENT ; ACCENT-FALL ; *ALIENTONE} ≫
{TONE-MORA ; UNIT-MORA} ≫TONE-SYL

Register tones are assigned in a stratum higher than prosodic word stratum. The tonal registers of Osaka Japanese appear to affect the leftmost mora by assigning a melody to it, which spreads to all following morae before the accented one. If the lexically specified register is H, then the melody H will spread. The melody L will spread if the register is L instead, and if the word does not have accent then the final mora is assigned an H tone. The constraints **MELODY-L**

and **SPREAD-LEFT** are also needed for spreading of the leftmost input tone. Since the final mora always has an H tone for accentless words, the constraint **ALIGN-R(H)** is needed. It is higher in ranking than **SPREAD-LEFT** since spreading should not affect the final mora. When the rightmost mora already has a tone it cannot be affected, and so the constraint **MAX-TONE** is required and ranked higher than **ALIGN-R(H)** and **MELODY-L**, both of which cannot override the preservation of input pitch accents. It is possible to satisfy the constraints **MAX-TONE**, **ALIGN-R(H)** and **MELODY-L** together by associating the concerned mora to both the input pitch accent and the tone to be assigned, which would be H for the rightmost mora. Another way is to assign the register tone on the corresponding syllable when the mora has got a pitch-accent. The constraints ***MULTI-ASSO** and ***MIXTBU** are required to prevent these. These two constraints are ranked as high as **MAX-TONE**. The constraint **TONE-MORA** is needed here since the mora is the TBU in Osaka Japanese, and it should be highest ranked. Thus, we have the conclusive constraint ranking in (24).

(24) *Constraint ranking of register tone assignment in Osaka Japanese*

{TONE-MORA ; *MULTI-ASSO ; MAX-TONE ; *MIXTBU} ≫
{MELODY-L ; ALIGN-R(H)} ≫SPREAD-LEFT

The constraints on the patterns of lexical accent specification mentioned in §5.2.3 are possibly due to lexical restriction, i.e., the constraint *no words of more than three morae can have accent assigned on the final mora*, or it could be that the surface results of accent assignment are neutralized with other accent specification, i.e. the constraints *the final mora of high tone register word cannot bear accent* and *the first mora of low tone register word cannot bear accent*. The first case is indistinguishable from an H/accentless pattern, and the later case from a H/accented-1 pattern. They are not relevant to our discussion and are thus not included.

In the following Tableaux 7-10, the examples /suzume=ga/ 'tall person=NOM' and /noQ**po**=ga/ 'sparrow=NOM' are chosen.

Tableau 7. Pitch-accent assignment of the L/accented-3 prosodic word /noQ**po**=ga/ in Osaka Japanese

/noQ**po**ga/	Faith-Accent	Accent-Fall	*AlienTone	Tone-Mora	Unit-Mora	Tone-Syl
☞ μ μ μ μ | | | | /,no,Q,'po,ga,/ | | H L				**		***
μ μ μ μ | | | | /,'no,Q,po,ga,/ | ⌊ H L	*!*					***
μ μ μ μ | | | | /,no,Q,'po,ga,/ | | L H		*!		**		***
μ μ μ μ | | | | /,no,Q,'po,ga,/ ⌊ | | (L) H L			*!*			***
σ σ σ | | | /.noQ.'po.ga./ | | H L				***!*	*	*

Tableau 8. Register tone assignment of the L/accented-3 prosodic word /noQ**po**=ga/ in Osaka Japanese

μ μ μ μ /,no,Q,'po,ga,/ H L L	Tone-Mora	*Multi-Asso	Max-Tone	*MixTBU	Melody-L	Align-R(H)	Spread-Left
☞ μ μ μ μ /,no,Q,'po,ga,/ L H L						*	**
μ μ μ μ /,no,Q,'po,ga,/ L H L		*!*				*	
μ μ μ μ /,no,Q,'po,ga,/ L H			*!*				*
μ μ μ μ σ [16]/,no,Q,'po,ga,/ L H L H				*!			**
μ μ μ μ /,no,Q,'po,ga,/ H H L					*	*!	**
σ μ μ /.noQ.'po.ga./ L H L	*!*			*		*	***

16 The TBU with a dotted line is associated with the tone with also a dotted line.

Tableau 9. Pitch-accent assignment of the L/accentless prosodic word /suzume=ga/ in Osaka Japanese

/suzumega/	Faith-Accent	Accent-Fall	*AlienTone	Tone-Mora	Unit-Mora	Tone-Syl
☞ μ μ μ μ | | | | /,su,zu,me,ga,/				****		****
μ μ μ μ | | | | /,'su,zu,me,ga,/ | ⟋ H L	*!					****
μ μ μ μ | | | | /,'su,zu,me,ga,/ | ⟋ L H	*!	*				****
μ μ μ μ | | | | /,su,zu,me,ga,/ | ⟋ (H) (L)			*!***			****
σ σ σ σ | | | | /,su,zu,me,ga,/				****	*!	****

Tableau 10. Register tone assignment of the L/accentless prosodic word /suzume=ga/ in Osaka Japanese

μ μ μ μ | | | | /,su,zu,me,ga,/ L	Tone-Mora	*Multi-Asso	Max-Tone	*MixTBU	Melody-L	Align-R(H)	Spread-Left
☞ μ μ μ μ | | | | /,su,zu,me,ga,/ L H							*
μ μ μ μ | | | | /,su,zu,me,ga,/ L H		*!					
μ μ μ μ σ | | | | /,su,zu,me,ga,/ L H				*!			
μ μ μ μ | | | | /,su,zu,me,ga,/ H H					*!		*
μ μ μ μ | | | | /,su,zu,me,ga,/ L						*!	
σ σ σ σ | | | | /,su,zu,me,ga,/ L H	*!***						*

Tonal registers in Osaka Japanese behave similarly to phrasal tones in the Tokyo and Hirosaki dialects in that they all provide tones for all TBUs without pitch accents after accent assignment. They are all of less importance than pitch accent as they cannot override pitch accents already assigned, except in the Hirosaki dialect the rightmost syllable is always affected. The only difference is that tones in Osaka have more variation. Tonal registers in Osaka Japanese are treated in a different layer from pitch accent, just like phrasal tones differ from pitch accents in the Hirosaki and Tokyo dialects. This is not to say, however, that tonal registers in the Osaka

dialect are phrasal tones. They could instead be at the layer between prosodic word and phrase in the prosodic hierarchy. Thus, It is best to consider two strata in Osaka Japanese, one the level for pitch-accent assignment and the other one for tone assignment.

6.3.3. Hirosaki Japanese

Accent assignment in the prosodic word stratum is discussed first. Hirosaki Japanese uses a different type of accent, as well as employing a different TBU from Osaka and Tokyo Japanese. Some of the constraints are already mentioned in §5.2.3, and it is stressed here again that word level accent and phrase level tones are both considered to account for the surface tones. Words in Hirosaki Japanese either do or do not have lexically specification for accent, and those having lexical accent will be assigned an ascending accent during accent assignment. All the TBUs, including the accented unit, are assigned H tones, which are the result of tone spreading from the accented unit. Accordingly, the constraint **ACCENT-ASCEND** is needed here. The constraints ***ALIENTONE** and **FAITH-ACCENT** are also needed and are on the same level.

In Hirosaki Japanese, **TONE-SYL** is ranked higher than the mora counterpart to make sure syllable is preferred. However, judging from the fact that words can actually lack accent, they both must be low-ranked compared to other constraints. The constraint **UNIT-SYL** is required again. Hence we have the conclusive ranking in (25).

(25) *Constraint ranking of accent assignment in Hirosaki Japanese*

{FAITH-ACCENT ; ACCENT-ASCEND; *ALIENTONE} ≫
{TONE-SYL ; UNIT-SYL} ≫TONE-MORA

In phrasal tone assignment in the phrase stratum, every syllable which does not have tone or pitch accent yet will be assigned an L tone. This happens to all the syllables of an accentless word, and all syllables before the accented syllable of an accented word. This is considered as an instance of spreading of an L phrasal tone or melody from the leftmost syllable. Thus we need the constraint **ALIGN-L(PH, L)**. The constraint **SPREAD-LEFT** is also needed to ensure spreading of the leftmost tone.

Recall that the final unit of every phrase has its tone different from the previous one, and since this happens to phrasal tones of accentless words too, the process must operate on a level at least higher than prosodic words. For our purpose, I assume the process happens at the same level as phrasal tone assignment. The constraint **ALIGN-R(PH, C)** is used to ensure the rightmost syllable is assigned a tone different from the previous syllable. This is ranked the highest.

Phrasal tone never overrides pitch accent, and so the constraint **MAX-TONE** is needed to ensure that the input tones are kept in the output. Same as Osaka Japanese, the constraints ***MULTI-ASSO** and ***MIXTBU** are required. However, they are ranked higher than **MAX-TONE** because it is not acceptable to link both the rightmost phrasal contour and the input tone with the syllable in order to keep the input tone of the rightmost syllable and satisfy **MAX-TONE**. In other words, preserving the input tone should not be prioritized over preventing multiple association, when the constraint **ALIGN-R(PH, C)** ensures every rightmost syllable must have its input tone, if any, changed.

The constraint **TONE-SYL** does the same job as the accent stratum counterpart does, and it does not matter whether the syllables have phrasal tone or pitch accent, as long as they carry tone in the output. It is necessary since all the syllables must carry tones by the time the phrasal level prosodic operation is finished, and is accordingly placed in the highest layer. The constraint **PHRASALTONE** works together with the constraint ***MIXTBU** to ensure that a phrasal tone can only be assigned on a syllable, if it has to be assigned. If all syllables are already assigned pitch-accent, then they will not play any role. Only those syllables left behind after accent assignment obtain phrasal tones. Thus the constraint ranking of phrasal tone assignment in Hirosaki Japanese looks as follows in (26).

(26) *Constraint ranking of phrasal tone assignment in Hirosaki Japanese*

{TONE-SYL ; ALIGN-R(PH, C) ; *MULTI-ASSO ; *MIXTBU} ≫
MAX-TONE ≫{ALIGN-L(PH, L) ; SPREAD-LEFT} ≫PHRASALTONE

In the following Tableaux 11-14, the examples /sakura=ga/ 'cherry tree=NOM' and /aru**koR**ru=ga/ 'alcohol=NOM' are chosen. They are both considered to be phrases in the formalization.

Tableau 11. Pitch-accent assignment of the accentless prosodic word /sakura=ga/ in Hirosaki Japanese

/sakuraga/	Faith-Accent	Accent-Ascend	*AlienTone	Tone-Syl	Unit-Syl	Tone-Mora
☞ σ σ σ σ | | | | /.sa.ku.ra.ga./				****		****
σ σ σ σ | | | | /.sa.'ku.ra.ga./ H (H)[17]	*!		*	*		****
σ σ σ σ | | | | /.sa.'ku.ra.ga./ L H	*!	*		*		****
σ σ σ σ | | | | /.sa.ku.ra.ga./ (H)			*!	***		****
σ σ σ σ | | | | /.'sa.ku.ra.ga./ H	*!					****
μ μ μ μ | | | | /,sa,ku,ra,ga,/				****	*!	****

17 This output candidate also violates a high-ranked constraint *CROSSLINE, which prevents lines from crossing, but the constraint is not important to the present study so it is not included.

Tableau 12. Phrasal tone assignment of the accentless prosodic word /sakura=ga/ in Hirosaki Japanese

σ σ σ σ | | | | /.sa.ku.ra.ga./	Tone-Syl	Align-R(Ph, C)	*Multi-Asso	*MixTBU	Max-Tone	Align-L(Ph, L)	Spread-Left	PhrasalTone
☞ σ σ σ σ | | | | /.sa.ku.ra.ga./ \ | 𝕃 𝕙							*	
σ σ σ σ | | | | /.sa.ku.ra.ga./ \ | 𝕃 𝕙			*!					
σ σ σ σ | | | | /.sa.ku.ra.ga./	*!***	*				*		****
σ σ σ σ | | | | /.sa.ku.ra.ga./ \ | 𝕙 𝕃						*	*!	
μ μ μ μ | | | | /,sa,ku,ra,ga,/ \ | 𝕃 𝕙	*!***						*	
σ σ σ μ | | | | /.sa.ku.ra.ga./ \ | 𝕃 𝕙	*!			*			*	

Tableau 13. Pitch-accent assignment of the accented-3 prosodic word /aru**koR**ru=ga/ in Hirosaki Japanese

/aru**koR**ruga/	Faith-Accent	Accent-Ascend	*AlienTone	Tone-Syl	Unit-Syl	Tone-Mora
☞ σ σ σ σ σ | | | | | /.a.ru.'koR.ru.ga./ H				**		******
σ σ σ σ σ | | | | | /.'a.ru.koR.ru.ga./ H	*!*					******
σ σ σ σ σ | | | | | /.a.ru.'koR.ru.ga./ H L		*!		**		******
σ σ σ σ σ | | | | | /.a.ru.'koR.ru.ga./ (H)(H) H			*!*			******
μ μ μ μ μ μ | | | | | | /,a,ru,'ko,R,ru,ga,/ H				**!***	*	

Tableau 14. Phrasal tone assignment of the accented-3 prosodic word /aru'koRru=ga/ in Hirosaki Japanese

σ σ σ σ σ | | | | | /.a.ru.'koR.ru.ga./ H	Tone-Syl	Align-R(Ph, C)	*Multi-Asso	*MixTBU	Max-Tone	Align-L(Ph, L)	Spread-Left	PhrasalTone
☞ σ σ σ σ σ | | | | | /.a.ru.'koR.ru.ga./ L H L					*		***	**
σ σ σ σ σ | | | | | /.a.ru.'koR.ru.ga./ L H L			*!				***	**
σ σ σ σ σ | | | | | /.a.ru.'koR.ru.ga./ L H		*!					***	***
σ σ σ σ σ μ | | | | | /.a.ru.'koR.ru.ga./ L H L				*!			***	**
σ σ σ σ σ | | | | | /.a.ru.'koR.ru.ga./ H L					**!*	*	*	
σ σ σ σ σ | | | | | /.a.ru.'koR.ru.ga./ L H L					*		****!	

6.3.4. Tokyo Japanese

As mentioned in §5.2.4, surface tone assignment in Tokyo Japanese involves both the word level accent and the phrase level tones. In this section, both will be considered. In accent assignment in the prosodic word stratum, the position lexically specified with accent will have a falling accent assigned at that position, and the surface tone for the falling accent is minimally only an H assigned on the accented unit, if the accented unit is the rightmost unit and no clitic follows the lexical word, and maximally with an additional L assigned for all other conditions, in

which case the L spreads to all following units (Igarashi 2007). The first mora receiving accent thus has a H pitch accent, and the rest have L pitch accents. Thus, the constraint **ACCENT-FALL** is required. It is the highest ranked since no exception can be found. The constraint ***ALIENTONE** is needed again too. They do not interact and are at the same ranking.

The constraint **TONE-MORA** is low-ranked because words can have no accent at all. Similar to the other dialects allowing accentless words, the constraint **UNIT-MORA** is needed. The constraint **TONE-SYL** is ranked even lower than its moraic counterpart, but the difference of ranking is not really large such that Tokyo Japanese is ambiguous in its accent bearing unit. Hence we have the order in (27).

(27) *Interim constraint ranking*

{ACCENT-FALL ; *ALIENTONE} ≫{TONE-MORA ; UNIT-MORA} ≫ TONE-SYL

It is more important to assign the accent according to the lexical specification than filling pitch-accent-less morae by altering the accented mora, thus the constraint **FAITH-ACCENT** is again ranked higher than **TONE-MORA**. Although most of the time the faithfulness of accent position in the output is observed, there are cases in which the accent has to be moved to the preceding mora. In such cases, the constraint ***MOVE-RIGHT** ensures the accent only moves to the left if it has to move. This constraint is not competing with other constraints, and is put in the same layer as other high-ranked constraints since it is never violated. The constraint ***ACCENT-SPMORA** is needed to account for that special morae cannot bear accent. It is possible to split this constraint into four constraints concerning the four different special morae, which are posited differently in the mora hierarchy according to Labrune (2012: 141). The difference of rankings of these four constraints reflects the mora hierarchy, which may in turn account for the fact that /N/ is sometimes assigned accent, while /Q/ can be never accented. For our purpose, only one constraint is used. Then we have the ranking in (28).

(28) *interim constraint ranking*

*ACCENT-SPMORA ≫FAITH-ACCENT ≫TONE-MORA

And the conclusive ranking in accent assignment can be written as (29):

(29) *Constraint ranking of accent assignment in Tokyo Japanese*

{ACCENT-FALL ; *MOVE-RIGHT ; *ALIENTONE ; *ACCENT-SPMORA} ≫
FAITH-ACCENT ≫{TONE-MORA ; UNIT-MORA} ≫ TONE-SYL

In phrasal tone assignment in the phrase stratum, the leftmost morae are assigned the LH melody, and the H tone spreads to all the following morae which do not have pitch accents. The constraints **ALIGN-L(PH, L)** and ***SPREAD-LEFT** are thus required to prevent all morae after the first one from receiving L tones by assigning a violation mark for each mora receiving an L tone except the first one. The constraints ***MULTI-ASSO**, **MAX-TONE** and ***MIXTBU** are again required and are the highest ranked constraints.

The constraint **TONE-MORA** is important and highest ranked, since all the morae in the phrase must have tones. The constraint **PHRASALTONE** is ranked low, because the phrasal tone is secondary to the pitch accent, and if the first mora of a word is assigned the accent and thus has pitch accents for all the subsequent morae, the phrasal tone will not have any role. It is also impossible for a phrasal tone to be assigned on a different TBU, i.e., the syllable, when all the morae have already got pitch accent, since the constraint ***MIXTBU** already prevents this. Also, the preservation of preexisting tones is more important than implementing phrasal tones. Thus the ranking of phrasal tone assignment in Tokyo Japanese looks as in (30).

(30) *Constraint ranking of phrasal tone assignment in Tokyo Japanese*

{TONE-MORA ; *MULTI-ASSO ; MAX-TONE ; *MIXTBU} ≫
{ALIGN-L(PH, L) ; *SPREAD-LEFT} ≫PHRASALTONE

In the following Tableaux 15-18, the examples /ko**ko**ro=ga/ 'heart=NOM' and /a**Q**puru=ga/ 'Apple=NOM' are chosen. They are both considered to be phrases in the formalization. Also, note that in the second example the lexical accent falls on the special mora /Q/, since accent falls on the penultimate mora of loanword. This example shows how the accent moves from the special mora to the preceding mora.

Tableau 15. Pitch-accent assignment of the accented-2 prosodic word /ko**ko**ro=ga/ in Tokyo Japanese

/ko**ko**roga/	Accent-Fall	*Move-R	*AlienTone	*Accent-SpMora	Faith-Accent	Tone-Mora	Unit-Mora	Tone-Syl
☞ μ μ μ μ | | | | /,ko,'ko,ro,ga,/ | ⟋ H L						*		****
μ μ μ μ | | | | /,ko,'ko,ro,ga,/ | | | H L (L)			*!			*		
μ μ μ μ | | | | /,ko,'ko,ro,ga,/ | ⟋ L H	*!					*		****
μ μ μ μ | | | | /,ko,ko,'ro,ga,/ | | H L		*!			*	**		****
μ μ μ μ | | | | /,ko,'ko,ro,ga,/ | ⟋ H L					*!			****
σ σ σ σ | | | | /.ko.'ko.ro.ga./ | ⟋ H L						**!**	*	

Tableau 16. Phrasal tone assignment of the accented-2 prosodic word /ko'koro=ga/ in Tokyo Japanese

μ μ μ μ /,ko,'ko,ro,ga,/ H L	Tone-Mora	*Multi-Asso	Max-Tone	*MixTBU	Align-L(Ph, L)	*Spread-Left	PhrasalTone
☞ μ μ μ μ /,ko,'ko,ro,ga,/ L H L							***
μ μ μ μ /,ko,'ko,ro,ga,/ L H L			*!				**
μ μ μ μ /,ko,'ko,ro,ga,/ H L	*!				*		****
μ μ μ μ /,ko,'ko,ro,ga,/ L H			*!*				
μ μ μ μ /,ko,'ko,ro,ga,/ L			*!*			***	
μ μ μ μ /,ko,'ko,ro,ga,/ L H L		*!**	*			***	
σ μ μ μ /.ko.',ko,ro,ga,/ L H L	*!			*			***

Tableau 17. Pitch-accent assignment of the accented-2 prosodic word /a**Q**puru=ga/ in Tokyo Japanese

/a**Q**puruga/	Accent-Fall	*Move-R	*AlienTone	*Accent-SpMora	Faith-Accent	Tone-Mora	Unit-Mora	Tone-Syl
μ μ μ μ μ | | | | | /,a,'Q,pu,ru,ga,/ | | H L				*!		*		****
μ μ μ μ μ | | | | | /,a,Q,'pu,ru,ga,/ | | H L		*!			*	**		****
☞ μ μ μ μ μ | | | | | /,'a,Q,pu,ru,ga,/ | | H L					*			****
μ μ μ μ μ | | | | | /,'a,Q,pu,ru,ga,/ | | L H	*!				*			****
σ σ σ σ | | | | /.'aQ.pu.ru.ga./ | | H L					*	*!****	*!	
μ μ μ μ μ | | | | | /,a,'Q,pu,ru,ga,/ | | (H)(L)	*!		**		*	*		****

Tableau 18. Phrasal tone assignment of the accented-2 prosodic word /'aQpuru=ga/ in Tokyo Japanese

	Tone-Mora	*Multi-Asso	Max-Tone	*MixTBU	Align-L(Ph, L)	*Spread-Left	PhrasalTone
μ μ μ μ μ /,'a,Q,pu,ru,ga,/ H L							
☞ μ μ μ μ μ /,'a,Q,pu,ru,ga,/ H L					*		*****
μ μ μ μ μ /,'a,Q,pu,ru,ga,/ L H			*!****				
μ μ μ μ μ /,'a,Q,pu,ru,ga,/ L L			*!				****
μ μ μ μ μ /,'a,Q,pu,ru,ga,/ H L			*!****		*		
μ μ μ μ μ /,'a,Q,pu,ru,ga,/ H L			*!		*		****
σ σ σ σ /.'aQ.pu.ru.ga./ H L				*!	*		

6.3.5. Differences of constraint rankings

The differences of the prosodic systems of the four dialects and the preferences of the syllable and the mora as the TBU are results of different constraint rankings. This section serves as a summary and comparison of the constraint rankings of the four dialects.

(31) *Comparison of the constraint rankings of the four dialects*

Kagoshima

{TONE-SYL ; */.□./ ; ONEH ; MELODY-R} ≫*CONTOUR ≫TONE-MORA

Osaka

a) Accent assignment:

{FAITH-ACCENT ; ACCENT-FALL ; *ALIENTONE} ≫
{TONE-MORA ; UNIT-MORA} ≫TONE-SYL

b) Register tone assignment:

{TONE-MORA ; *MULTI-ASSO ; MAX-TONE ; *MIXTBU} ≫
{MELODY-L ; ALIGN-R(H)} ≫SPREAD-LEFT

Hirosaki

a) Accent assignment:

{FAITH-ACCENT ; ACCENT-ASCEND ; *ALIENTONE} ≫
{TONE-SYL ; UNIT-SYL} ≫TONE-MORA

b) Phrasal tone assignment:

{TONE-SYL ; ALIGN-R(PH, C) ; *MULTI-ASSO ; *MIXTBU} ≫
MAX-TONE ≫{ALIGN-L(PH, L) ; SPREAD-LEFT} ≫PHRASALTONE

Tokyo

a) Accent assignment:

{ACCENT-FALL ; *MOVE-RIGHT ; *ALIENTONE ; *ACCENT-SPMORA} ≫
FAITH-ACCENT ≫{TONE-MORA ; UNIT-MORA} ≫ TONE-SYL

b) Phrasal tone assignment:

{TONE-MORA ; *MULTI-ASSO ; MAX-TONE ; *MIXTBU} ≫
{ALIGN-L(PH, L) ; *SPREAD-LEFT} ≫PHRASALTONE

Kagoshima Japanese differs the most from the other dialects, reflecting the fact that it is an N-pattern dialect which employs tone instead of pitch accent.

The two syllabic dialects Kagoshima and Hirosaki Japanese have the constraint **TONE-SYL** ranked higher than **TONE-MORA**. In contrast, Tokyo and Osaka Japanese show the reverse.

The constraint **FAITH-ACCENT** is ranked lower in Tokyo Japanese than in the other dialects. This is because faithfulness of accent assignment is not always observed in Tokyo Japanese, since the accent has to be moved to the left when the lexically specified accent falls on a special mora. In the other dialects, such a process does not happen.

While the constraint **MAX-TONE** is ranked on the same level as ***MULTI-ASSO** and ***MIXTBU** in the other dialects, it is ranked lower than the other two in Hirosaki Japanese. The reason is that in the process of phrasal tone assignment, the tone value of the rightmost pitch-accent has to be reversed. Keeping input tone thus has less importance than the other two constraints.

6.4. Prosodic structures

In this section, the prosodic structures of the moraic and syllabic Japanese dialects are discussed and formalized. It has already been mentioned that SLH can be taken as a violable constraint. In fact, it is possible to construct a tableau with constraints governing the ordering of the prosodic constituents of the prosodic structure. The constraints **WORD>FOOT**, **FOOT>SYLLABLE** and **SYLLABLE>MORA** all represent the immediate ordering between two prosodic constituents. Thus a constraint like **WORD>FOOT** requires the foot to be immediately dominated by the prosodic word. For example, if in a prosodic structure the foot is skipped or goes below the syllable, then SLH is violated and violation marks are assigned accordingly. The constraint **FOOT>MORA** is low ranked in SLH, since it implies either immediate domination of the syllable by the foot is not necessary, or the intermediate constituent, the syllable, is missing. The same goes for the constraint **WORD>SYLLABLE**. SLH is thus just the straight ordering of the constraints as shown in (32).

(32) *SLH shown as a set of constraints*

{WORD>FOOT ; FOOT>SYLLABLE ; SYLLABLE>MORA} ≫
{FOOT>MORA; WORD>SYLLABLE}

If this ranking is altered, then the prosodic structure will be different from what SLH states. This is exactly the case happening in the moraic dialects of Japanese, in which **FOOT>MORA** is ranked on a higher level than **FOOT>SYLLABLE**, reflecting the fact that the syllable layer is lacking in moraic Japanese.

Two other constraints are included in the formalization for a complete illustration. The constraints **BASE-MORA** and **BASE-SYL** serve to ensure the lowest ranked prosodic constituent is the mora and the syllable respectively. In Tokyo and Osaka Japanese, the only difference between the ranking of the constraints in (32) and the above two constraints is that **FOOT>MORA** and **BASE-MORA** are ranked on a higher level than all other constraints. In Hirosaki and Kagoshima Japanese, SLH is followed instead, such that the syllable layer is immediately in between the foot layer and the mora layer. In both types of dialects, **BASE-MORA** is ranked on a higher level than **BASE-SYL**, such that the mora is required and is the lowest ranked prosodic constituent in both types of dialects, as already discussed in §5.4. Note that while the syllabic dialects use the syllable in their prosodic systems, in their prosodic structures the mora is still the base.

The word *nippon* 'Japan' is taken as an example to illustrate the variation of prosodic structures across dialects. The formalization is shown as Tableaux 19 and 20.

Tableau 19. Prosodic structure of the moraic dialects with /niQpon/ as the example

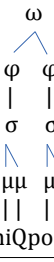
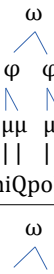
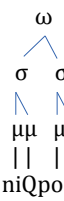
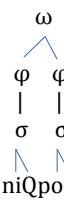
niQpoN	Foot>Mora	Base-Mora	Word>Foot	Foot>Syllable	Syllable>Mora	Word>Syllable	Base-Syl
	*!						
				*	*		
	*!		*	*		*	
	*!	*			*		*

Tableau 20. Prosodic structure of the syllabic dialects with /niQpon/ as the example

niQpoN	Base-Mora	Word>Foot	Foot>Syllable	Syllable>Mora	Foot>Mora	Word>Syllable	Base-Syl
ω φ φ | | σ σ μμ μ μ || | | ☞niQpoN					*		*
ω φ φ μμ μ μ || | | niQpoN			*!	*			*
ω σ σ μμ μ μ || | | niQpoN		*!	*		*	*	*
ω φ φ | | σ σ niQpoN	*!			*	*		

7. The universality of the syllable, and prosodic constituents in general

The syllable has always been mentioned or involved in various phonological analysis in various languages. It is no doubt that the syllable is much preferred in most languages, by the fact that a language which has been traditionally described as moraic, like Japanese, is also commonly analyzed by the syllable reflects the fact that the syllable is a well-established concept in phonological theories such that every one in the field employs this unit without questioning the existence of it in specific languages. Just like the syllable, which has been shown as not being a universal constituent, what we call absolute universals could also be just "much preferred by most languages". In fact, concerning absolute universals, Hyman (2008) discusses a

case of a phonological absolute universal being falsified by new typological evidence. Labrune (2012) also mentions that absolute universals could be fewer than we generally think. Regarding the violable nature of universals, it is hard to not think of OT, which is a framework formalizing mainly (but not limited to) phonology based on the ranking of violable constraints (Prince & Smolensky 2008). The notion of violable constraints is, in my opinion, something insightful to the study of typology. As the study of various languages reveals that the variety languages exhibit is larger than we imagined, for example in the case of Pirahã, which is typologically peculiar[18], it is possible that many proposed universals are actually the surface result of generally high-ranked constraints. However, these constraints are violable, so it is logically possible to find counterexamples to every proposed absolute universals, although there could be other absolute constraints such as cognitive constraints preventing counterexamples from appearing. If we are to accept that OT constraints are what underlie universals, then the notion of absolute universal should also be revised. In other words, the syllable, however universally adopted as it might seem, should be considered just a surface result of a crosslinguistically general preference of constraint ranking. It is perhaps meaningless to discuss whether or not certain prosodic constituent is universal. Instead, we can only speak of whether a language "care a lot about" a certain prosodic constituent, like what Hyman (2011: 114) said.

This being said, it does not mean absolute universal does not exist at all. Bickel (2013) discussed absolute and statistical universal, and claimed that they are not only reflecting the number of languages which display the feature, but are instead much more complicated concept related to theoretical aspects of linguistics. In other words, true absolute universals should only be those displaying fundamental human cognitive features which are fundamentally without any exception, instead of universals such as "all languages have plosives", which although is absolute based on observation, can be theoretically violated. Just as Bickel (2013: 11) stated explicitly, if further evidences of the existence of the syllable as a fundamental property within human cognitive system can be found, then it should be taken as a true absolute universal. Until that day comes, there are more evidence pointing the syllable as being just a preferred prosodic constituent, instead of being a universal. The same also goes for the other proposed absolute universals. True universals can only be those which can be correlated with psychological and

18 Pirahã is special in that it is claimed to be without recursion (Everett 2005).

biological evidences.

8. Discussion

8.1. Diachronic prosodic structural change of Japanese

It is worth mentioning that Japanese at an earlier stage seemed to be different in terms of isochrony, thus pointing to a prosodic structure different from contemporary Japanese. Diachronic development of the prosodic structure may provide explanation on the difference between the syllabic and the moraic dialects. Although it is impossible to fully cover the diachronic aspect, I will try to briefly explain the difference in diachronic point of view.

Old Japanese was a language of (C)(G)V structures (Frellesvig 2010: 39). Chinese characters were used to write Japanese and this early form of Kana is known as Mayogana. Although influence from China during that period was evident, it was not comparable to latter periods during which Chinese closed syllables were introduced into the native Japanese phonology. Japanese had a large inventory of Chinese loanwords starting from the period of Early Middle Japanese,. Middle Chinese and other dialects which formed the Sino-Japanese lexical stratum of borrowing have the syllable structure of (C)V(C), and this was borrowed into Japanese along with loanwords. According to historical resources such as *Vocabvlario da Lingoa de Iapam* (Japanese–Portuguese Dictionary) and *Arte da Lingoa de Iapam* (Grammar of the Japanese language) which was published during the period by Jesuits missionaries (Irwin & Narrog 2012), Late Middle Japanese had closed syllables with codas /t/[19], /m/ or /n/. Although Japanese kana appeared during Old Japanese period in the form of Mayogana, it is not until later peiod that the syllabaries ん and ン are chosen to represent the moraic /N/ (Yamaguchi 2010). This is an evidence that earlier form of Japanese did not have a moraic /N/.

As for prosodic change, Japanese has been described as syllable-timed language before the period of Early Middle Japanese, and each syllable corresponds to one mora. Strictly speaking, mora should have played no role during this stage of Japanese, since syllable weight was not important and every syllable was light. By the time of Early Middle Japanese the isochrony had

19 See Irwin & Narrog (2012: 250) for a discussion on the introduction of plosive coda.

changed to mora-timed with the introduction of closed-syllables, long vowels and long consonants. It can be argued that the discrepancy between the distribution of the syllable and the mora started from this period. The distribution of the mora followed the traditional pattern of open syllables, but syllable structure had changed to a more complex one which allows closed syllable and long vowels, all of which can be considered as including an additional mora.

If we follow the analysis of Labrune (2012), then we can argue that it was during this period of historical development that the language gradually lost the importance of the syllable, as the introduction of new syllable structures provided the mora a larger role, and eventually the syllable was lost from the prosodic structure. In some other dialects (e.g. Kagoshima dialect) the importance of the syllable was retained, such that the prosodic structure of /iN/ is analyzed as one syllable and two morae. Nasukawa (2008) also discusses the diachronic development of /nu/ to /N/, which shows the discrepancy between syllable and mora. Although it may not be the only explanation of the development of /N/, it shows a complete syllable changes to a moraic consonant which consists of the weight of one syllable, but is a syllable coda in the syllabic dialects instead of a syllabic consonant. In other words, while the syllable is elided into a syllable coda, the weight of the syllable, i.e., the mora is kept.

To conclude, the difference between the syllabic dialect and the moraic dialects comes from the discrepancy between the scope of the syllable and the mora, which in turns comes from historical development of the dialects.

One thing readers should keep in mind is the definition of the standard dialect was different from now. Standard Japanese in modern terms refers to the Tokyo dialect, yet before the Edo period, during which the seat of government was changed to be Edo (modern day Tokyo), the official dialect corresponded to the Kansai dialect. The standard dialect was based on Tokyo dialect starting from Early Modern Japanese. Shibatani (1990) mentions the time of the shift of the standard language happened around the end of the eighteenth century. As usual in diachronic analysis, the language described are very often the continuation of only one variety. Yet in cases like Japanese, even the development from one period to the other cannot be strictly said to be a strict continuation of the same variety, as there are other factors such as the change of the seat of government, which can contribute a lot to the differences of the language in different periods, owing to the fact that these different geographical locations must already have dialectal

variations.

8.2. Influences from orthography

As a language with a rich literal tradition, it should not be surprising that the writing system of Japanese is related to the prosodic structure. Gnanadesikan (2011) mentions that writing systems provide good evidence for the underlying structure. This is the case for all the languages which use syllabary to represent syllables, and even for Japanese, in which case a mora-based characters is used instead of syllable-based characters. Japanese characters have long history, dating from the time when Japanese still consisted of strict open syllable structure, and no distinction was made to vowel length. During that time, Japanese characters represented the syllabic nature of the language and so was a syllabary. When special moraic appeared, the writing system also adopt to the new structure by using some existing syllabary to represent the morae. From that time on, the writing system was not based on syllable anymore (Smith 1980). It is difficult to argue whether the orthographical representation of mora came before the change of prosodic structure or *vice versa*. The only thing we can be sure is that they are interrelated.

Apart from possible diachronic influence, the Japanese writing system also has its effect in the Japanese prosodic structure during developmental stage. Kobayashi *et al*. (2010) do an experiment which shows the largely mora-based writing system have an effect on the speech segmentation unit. Before acquiring *kana* literacy, children may segment speech according to syllables, contrary to what adult does. However, we do have speakers of the syllabic dialects such as the Kagoshima dialect, who have full access to the standard *kana* writing system, but the segmentation unit of who remain syllabic. Also, Ota (2001) does experiments and shows that the mora still plays a large role during early prosodic development. Moreover, even the orthography of Japanese does play a role in shifting the prosodic unit of Japanese from the syllable to the mora and thereby eliminating the role of the syllable in Japanese, it is merely a developmental phenomenon exhibited by children and should not contribute to the description of grammar in adult. Interestingly, Demuth (1995) mentions also that the early developmental stages of prosodic structure consist of mainly core syllables CV. As it is a grammar change through developmental stages, the conclusion that the syllable does not play a role in Japanese does not

need to be revised.

9. Conclusion

In this thesis, I have given an overview of the variation of prosodic systems of four Japanese dialects, Tokyo, Osaka, Hirosaki and Kagoshima Japanese. I argue that instead of the common view, the syllable is not universal, and that Tokyo Japanese is a prime example of syllable-less language. In the formalization, I have formalized the phonotactics, prosodic systems, and the prosodic structures of all four Japanese dialects, with special focus on the competition between the role of the syllable and that of the mora. It is also argued in this thesis that linguistic universals like the syllable should be taken as violable constraints in an Optimalistic-Theoretic view, and thus absolute universals should not be considered truly absolute.

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