

Subsyllabic structures in Japanese child phonology: A preliminary study

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ABSTRACT. In many languages, we observe that children go through a developmental stage in which their utterances are limited to a certain prosodic maximum. In English, for example, there can be a developmental stage in which children's utterances are limited to a trochaic foot (e.g. *spaghetti* → [gɛ:.di]: Pater 1997). Ota (1999) points out that Japanese children go through a stage in which they show disyllabic maximum. This paper reports on a closer examination of Ota's (1999) data, and shows that within disyllabic forms, some syllable structures are more preferred over others; concretely, there may be preference toward Heavy-Light (HL) and Light-Light (LL) forms over Heavy-Heavy (HH) and Light-Heavy (LH) forms. The results show that subsyllabic structures play a non-trivial role in determining the outputs of child phonology in Japanese.

Keywords: syllables, syllable weight, markedness, child phonology, prosodic maximum, Japanese

1. Introduction

1.1. The goal of the study

In many languages, we observe a developmental stage in which children's utterances are limited to a certain prosodic maximum. Such a stage is documented in a number of languages including, but not limited to, Dutch (Fikkert 1994), English (Pater 1997; Smith 1973), German (Lleó 2002), Hebrew (Adam 2002), Sesotho (Demuth 1994), Spanish (Demuth 2001), and Japanese (Ota 1999). Most relevant to the current project is Ota (1999), which arguably offers the most extensive investigations on Japanese child phonology to date. Ota (1999) has shown, among other things, that in the development of Japanese phonology, there is a stage in which all of the outputs of children's utterances are limited to two syllables.

This study draws on this observation by Ota (1999) and shows that in addition to a disyllabic maximality requirement, preference to particular types of subsyllabic structure is observed. Specifically, the current investigation shows that there is a developmental stage in which two sequences of heavy syllables (henceforth HH) and a light syllable followed by a heavy syllable (LH) are dispreferred, whereas a heavy syllable with a light syllable (HL) and a sequence of two light syllables (LL) are favored.

This study thus shows that, despite the apparently dominant role of moras in the prosodic organization of Japanese (Katada 1990; Labrune 2012; Trubetzkoy 1939), a syllable also plays an important role as well—an issue that has been actively debated in the recent phonological literature on Japanese (Ito and Mester to appear; Kawahara 2012, 2016; Kubozono 1999, 2003; Starr and Shih 2014; Tanaka 2013).

1.2. Background

To the extent that children's language development follows a path from unmarked to marked structures (Jakobson 1941 *et seq.*), it is predicted that Japanese children go through a stage in which unmarked prosodic shapes are favored. For example, English children are known to exhibit a stage in which their productions conform to a trochaic foot, an unmarked prosodic structure in English (e.g. *spaghetti* can be pronounced as [gɛ:.di]: Pater 1997: 204; Pater and Paradis 1996). This sub-section reviews evidence that HL is unmarked, whereas LH is marked in Japanese phonology, which leads to the prediction that HL, but not LH, should be favored in the child phonology of Japanese.

One piece of evidence for the unmarkedness of HL comes from a word formation pattern in Japanese child directed speech (CDS), in which the templatic output is a heavy syllable followed by a light syllable (Kawahara 2001; Kubozono 2003). Some examples are shown in (1), in which a syllable boundary is denoted by a period. When the base stems are longer than one syllable, gemination (and concomitant coda nasalization for voiced geminates) takes place to make HL forms (the left column). When the original forms are monosyllabic, as in the forms in the right column, the base forms are repeated twice (i.e. reduplicated) with gemination.

(1) The formation of some CDS words

<u>Base</u>	<u>Output</u>		<u>Base</u>	<u>Output</u>	
/ta.tʃi/	→ [tat.tʃi]	‘stand up’	/ne/	→ [nen.ne]	‘sleep’
/o.ki/	→ [ok.ki]	‘get up’	/pii/	→ [pip.pi]	‘pee’
/o.bu.ri/	→ [om.bu]	‘piggy-back-ride’	/tʃuu/	→ [tʃut.tʃu]	‘kiss’
/da.ki/	→ [dak.ko]	‘hug’			

It has been shown cross-linguistically that such templatic word formation processes are based on unmarked structures (McCarthy and Prince 1995; Urbanczyk 1996): the word formation in (1) thus indicates that HL is prosodically unmarked in the phonology of Japanese. Moreover, there are several words that are specific to CDS in Japanese (“baby-talk words”), which take the HL form, as listed in (2). Corresponding adult forms are shown in *italic* below each CDS form, none of which are HL (see MacNeilage and Davis 2004 for discussion on the possible phonological simplicity of “baby-talk words”).

(2)	[om.mo] ‘outside’	[an.jo] ‘legs’	[kuk.ku] ‘shoes’
	<i>[so.to]</i>	<i>[a.ʃi]</i>	<i>[ku.tsu]</i>
	[en.tʃo] ‘to sit’	[buu.bu] ‘car’	[dak.ko] ‘a hug’
	<i>[su.wa.ru]</i>	<i>[ku.ru.ma]</i>	<i>[da.ku]</i>
	[ʒii.ʒi] ‘grandpa’	[baa.ba] ‘grandma’	[tʃit.tʃi] ‘pee’
	<i>[o.ʒii.san]</i>	<i>[o.baa.san]</i>	<i>[o.ʃik.ko]</i>
	[nii.ni] ‘brother’	[nee.ne] ‘sister’	[mam.ma] ‘food’
	<i>[o.nii.san]</i>	<i>[o.nee.san]</i>	<i>[go.han]</i>
	[mem.me] ‘No!’	[kok.ko] ‘chicken’	[tot.to] ‘bird’
	<i>[da.me]</i>	<i>[ni.wa.to.ri]</i>	<i>[to.ri]</i>

To the extent that HL forms are unmarked in Japanese phonology, especially in its CDS, then we should expect Japanese children to show preference toward HL forms.

In addition to the evidence presented in (1) and (2), *zuuja-go*—argot word formation used among Japanese musicians—shows preference toward HL (Poser 1990; Ito et al. 1996; Kubozono 2003; Tateishi 1989). Input forms of several prosodic compositions (L, LL, H, LH, HL) can be mapped onto HL, as shown in (3):

(3) *Zuuja-go* formation resulting in HL

<u>L → HL</u>		<u>LL → HL</u>	
/çi/ →	[ii.çi] ‘fire’	/ʒa.zu/ →	[zuu.ʒa] ‘jazz’
/me/ →	[ee.me] ‘eye’	/me.ʃi/ →	[ʃii.me] ‘rice’
/he/ →	[ee.he] ‘fart’	/no.mi/ →	[mii.no] ‘drinking’
<u>H → HL</u>		<u>LH → HL¹</u>	
/kii/ →	[ii.ki] ‘key’	/hu.men/ →	[meN.hu] ‘music score’

/tsuu/ →	[uu.tsu]	‘expert’	/ni.oi/ →	[oi.ni]	‘smell’
/pan/ →	[n:.pa]	‘bread’	/ma.zui/ →	[zui.ma]	‘tastes bad’

HL → HL

/doi.tsu/ →	[tsui.do]	‘Germany’
/dan.su/ →	[sun.da]	‘dance’

On the other hand, LH is known to be marked in Japanese phonology. Ito (1990), for example, observes that loanword truncation never results in LH; long loanwords can be truncated to HL (e.g. [mai.ku<re.foɴ>] ‘microphone’) and LL (e.g. [su.to<rai.ku>] ‘strike’), but never to LH (*[de.mon<su.to.ree.foɴ>], but [de.mo<n.su.to.ree.foɴ>]). Further, Kubozono (2003) points out there are sporadic cases of lengthening which can be understood as the avoidance of LH; e.g. /nⁱo+boo/ → [nⁱoo.boo] ‘wife’ and /so.oo/ → [soo.oo] ‘queen.’

Given that HL is unmarked and LH is marked in Japanese phonology, the prediction is that Japanese children should exhibit a developmental stage in which HL is favored. In fact, Hayashi et al. (1998) and Mazuka and Hayashi (1998) report a head-turn preference experiment with stimuli consisting of three syllable structures (HL, LH, LLL), which revealed that HL is the most preferred sequence. Aoyama (2000) observes that a child whose language he investigated pronounced the name [ne.ne] as [nen.ne], although he attributes this gemination to a general preference to geminates over singletons (cf. Ota 1999).

The goal of this paper is to examine this preference toward HL forms in an actual child’s production patterns. The investigation shows that indeed, the child shows preference for particular subsyllabic compositions. Although the conclusion remains tentative because it is based on the production data of one child, this paper adds to the growing body of literature showing that children favor unmarked prosodic structure (see papers cited in §1.1). The finding of this paper, in turn, supports the claim that subsyllabic structures play a non-negligible role in the markedness computation in Japanese phonology, despite the claim to classify Japanese as a moraic language (cf. Labrone 2012 vs. Kawahara 2016). The paper, although currently limited in scope, provides a step toward investigating the importance of syllables in Japanese phonology from the perspective of language acquisition.

The rest of this paper proceeds as follows. §2 illustrates the method of this study. §3 presents the results, which show that as predicted, HL is favored whereas LH is disfavored; the results in addition show that the child favors LL, while he disfavors HH. §4 briefly discusses the markedness of HH, HL, LL and LH in formal terms. The final section sums up.

2. Method

The data analyzed in this paper is the developmental data of one child, K (1;6~2;6), which was transcribed by Ota (1999). For the details of data collection, see Chapter 3 of Ota (1999). For all input-output mapping pairs, prosodic structures of the inputs and outputs were manually coded. Following the general assumption of the child phonology literature (Smith 1973: 133-148 and subsequent work), I assume that the input forms of child phonology are equivalent to corresponding adult forms. Output words that exhibit illicit consonantal clusters and non-nasal final consonant were excluded from the dataset, since it was not clear how such structures contributed to syllable weight. I also assume that given a sequence of two vowels, they formed a diphthong if and only if the first vowel was more sonorous than the second vowel. (While this assumption may be too simplistic, it does provide an objective and simple coding protocol: see Kubozono 2015 for a recent discussion on this issue). The developmental paths were analyzed with one-month incremental step. The data for 1;10, 1;11, 1;12 and 2;1, however, were collapsed into one stage, as there are too few data points in each of these

months. Repetitions of the same token were counted only once; e.g. when the original data says that the child utters a certain item three times in one setting, it was counted only once. Segmental changes are abstracted away from. When the child did not use a word of a particular prosodic form, the faithfulness percentage is replaced with zero.

3. Results

The results of this procedure revealed two points: (i) HL and LL are favored, and (ii) LH and HH are disfavored. First we are going to look at how often each type of prosodic input is mapped faithfully in terms of prosodic structure, and then more closely examine how each prosodic input forms are mapped.

3.1. Percentages of faithful mapping

The first evidence that the child favors HL, not LH, comes from the percentages of faithfulness mapping. Following Optimality Theory's (Prince and Smolensky 2004) basic tenet, I assume that alternations take place if and only if they improve on markedness profile (Moreton 1996). Under this assumption, the ratio of faithful mapping thus should more or less reflect the (un)markedness of input structures, everything else being equal.

Figure 1 compares the percentages of faithful mapping of HL, LL, HH, and LH. For the sake of visual clarity, HL and LL forms are shown in the left subfigure, whereas HH and LH forms are shown in the right subfigure. *N*s are shown at the bottom of each figure.

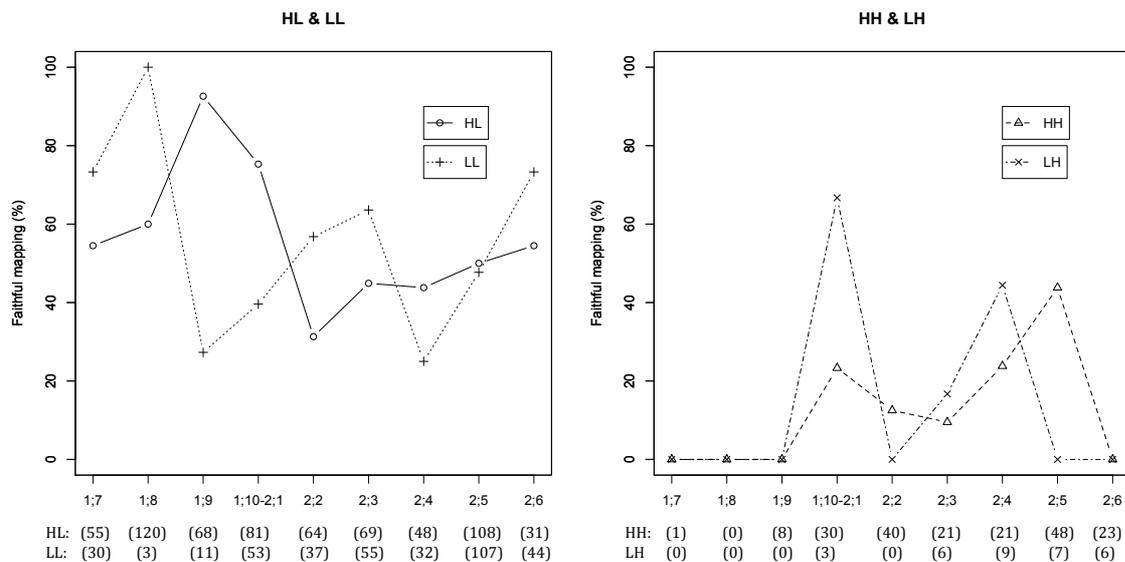


Figure 1: The percentages of faithful mapping. *N*s shown in parentheses.

HL and LL forms (the left figure) are more often faithfully mapped than HH and LH forms (the right figure). The average faithful percentages are: HL=56.3%; LL=56.3%; HH=12.5%; LH=14.2%. The fact that HL is favored confirms the prediction laid out in section 1.

It is worth noting here too that the number of LH words that this child attempted to use is very rare from the dataset in the first place (mean 3.4 tokens per month; cf. HL=71.6; LL=41.3; HH=21.3); it may be the case that the paucity of LH inputs instantiates a case of lexical avoidance, in which children avoid using words that are marked in the first place (Schwartz and Lenard 1982). This speculation seems justified because it is not the case that Japanese entirely lacks LH words which children may hear; e.g. *bu.doo* 'grapes,' *go.han* 'rice,' *ki.rin* 'giraff,' *o.moi* 'heavy,' *a.mai* 'sweet,' *to.kei* 'clock', etc.

3.2. Mapping for each prosodic type

Let us next examine how HH words are actually realized, as shown in Figure 2. In 1;7, the child uses one HH word, which was mapped to LL. In 1;8, he used no HH word at all. From 1;9 on, around 50 percent of the time, HH is mapped onto HL (e.g. *kaa.san* ‘mother’ → [da:.da]: 2;6). Albeit less frequently, HH is mapped onto LL (e.g. *buu.buu* ‘car (CDS)’ → [bubu]: 2;3). Most interestingly, HH is more likely to be mapped to HL than to HH.

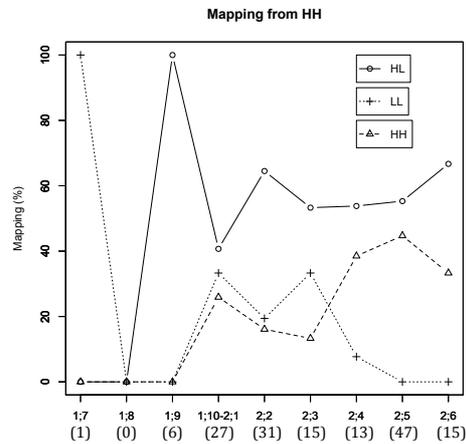


Figure 2: How /HH/ input words surface. *Ns* shown in parentheses.

One might suspect that avoidance of HH may simply reflect the avoidance of a coda or a diphthong. While this conjecture is still possible (Ota 1999), it is still important to take into consideration the global syllabic compositions of the words. The child is willing to map HH to HL but not to LH—if all that matters is a presence of a heavy syllable, this contrast between HL and LH remains unexplained. In addition, there are some instances of augmentation of LL to HL (e.g. *he.bi* ‘snake’ → [be:.bi]: 2;5). To illustrate this point, Figure 3 illustrates how LL words are mapped onto.

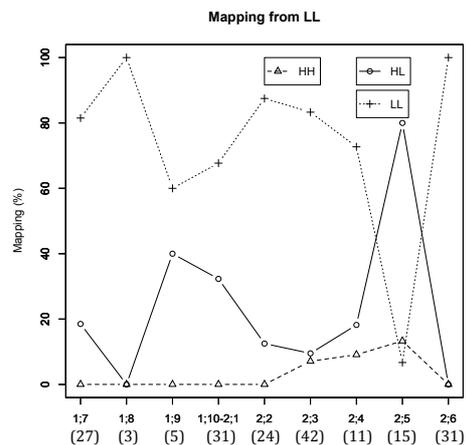


Figure 3: Mapping from input /LL/ words.

Even though the faithful mapping is generally the dominant pattern throughout (except in 2;5), there are some cases in which LL is augmented to HL, most clearly in 2;5. There are a few cases between 2;3 and 2;5 in which LL is augmented to HH (e.g. *nani* ‘what’ → [nan.ni:]: 2;5). At the end of these developmental periods, however, all LL inputs are mapped faithfully.

To complete the discussion, mapping from HL words is illustrated in Figure 4.

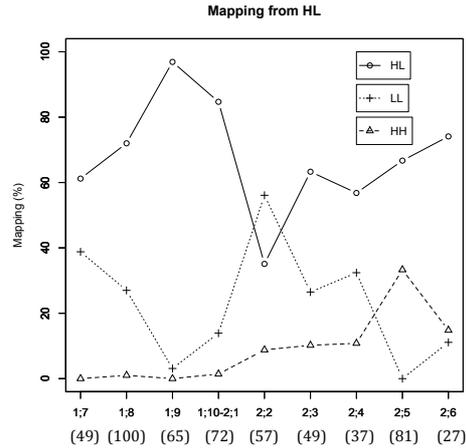


Figure 4: Mapping from input /HL/ words.

The dominant pattern is the faithful mapping, although there are cases in which HL forms are reduced to LL (e.g. *dooro* ‘street’ → [do.do]: 2;2). The patterns in Figures 3 and 4 show that the relative markedness between HL and LL may yet to be fixed for this child.²

4. Discussion

To summarize, the results show that HL and LL are unmarked in that (i) they usually surface faithfully, and (ii) HH is often rendered to HL and LL. LH words, on the other hand, are barely mapped faithfully, and the child may even avoid using LH words. Given these observations, one question that arises is where this skew comes from. It might be that the language inputs are biased such that HL and LL words are common, while LH and HH words are not; i.e. the observed asymmetry derives from differences in lexical statistics in the Japanese acquisition data (see, e.g., Ambridge et al. 2015 and Yang 2015 for recent discussion on this issue).

Whether the observed patterns can be solely derived from differences in lexical frequencies in the Japanese lexicon is yet to be investigated. However, Mazuka and Hayashi (1998) found that HL words account for only 1.2% of the items in *Shinmeikai Japanese Dictionary*, which may make the frequency-based explanation difficult to hold. On the other hand, as touched upon in section 1.2, there are many CDS-specific HL words, which may help them learn HL structures.

As for HH words, CDS in Japanese commonly uses HH reduplicated forms (e.g. [buu-buu] ‘car’; [n^yaa-n^yaa] ‘kitty’; [wan-wan] ‘doggy’; [pon-pon] ‘tummy’; [tʃun-tʃun] ‘sparrow’ etc). In addition, single heavy syllable name suffixes, like [-tan] and [-tʃan], can take a heavy syllable base, resulting in HH forms ([ken-tan]; [mii-tʃan] etc), which are not uncommon. Given that HH words are common in CDS, the question remains why the child exhibits dispreference against HH.

While bearing in mind that the effects of lexical frequencies should not be ignored, let us briefly consider in more formal terms why HL and LL are preferred, whereas HH and LH are not. Let us assume that Japanese feet are strictly bimoraic, a probably safe assumption to make (Poser 1990 *et seq.*). Then, the dispreference against HH can be derived if the child prefers to have only one foot, as HH must be parsed as (H)(H). More formally speaking, the dispreference against two feet has been expressed as the effect of ENDRULE, which requires the head foot to be aligned to the right/left edge of the word (McCarthy 2003; Prince 1983). On the other hand, (H)L and (LL) can be parsed into one foot. The relative markedness between (H)L and (LL) can switch between each other, because (H)L avoids

NONFINALITY(Ft) by way of having L word-finally, whereas (LL) forms “a perfect prosodic word”, a prosodic word consisting of a bimoraic foot and nothing else (Ito and Mester 2015, to appear). The dispreference against L(H) can be expressed as INITIALFT, which requires there to be a foot word-initially (Ito and Mester, to appear). See Ito and Mester (to appear) for more discussion on these ideas.

5. Conclusion

This paper has shown that HL, which is independently known to be unmarked in Japanese prosodic phonology, is preferred by the child. On the other hand, LH, which is independently known to be marked in Japanese phonology, is avoided by this child. These observations provide further support to the view that children acquire unmarked prosodic structures first. Since this study is based on the data from one child, however, the results here should be interpreted with caution and should be replicated with other children’s data. Whether the current results generalize to other Japanese children is certainly worth a further investigation.

Another point that is worth mentioning is that this observation provides further evidence that subsyllabic structures matter in the computation of prosodic markedness in Japanese. In terms of moraic structure, HL and LH are both sequences of three moras, but there exists a markedness difference between these two structures. This is not a trivial finding, as Japanese has long been believed to be a moraic language (Katada 1990; Labrune 2012; Trubetzkoy 1939), but the finding of this paper points to a role of syllables in Japanese prosodic phonology (McCawley 1968; Ito 1990; Ito and Mester to appear; Kawahara 2012, 2016; Kubozono 1999, 2003; Starr and Shih 2014; Tanaka 2013).³

Notes

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¹ LH inputs can sometimes be mapped onto HH as well (e.g. /u.mai/ → [mai.u:] ‘delicious’).

² Due to space limitation, mappings from input LH words are not shown in this paper. Recall from Figure 1, however, that the child did not attempt to use many LH words in the first place.

³ I acknowledge that in the syllable-less theory of Labrune (2012), it is possible to prohibit a special mora (a.k.a. *tokushu-haku*) word-finally to account for the patterns observed in this paper. However, see Ito and Mester (to appear), Kawahara (2012, 2016), Starr and Shih (2014), Tanaka (2013) and references cited therein for arguments against the syllable-less theory of Japanese.

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