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Acquisition of Rendaku by Bilingual Children: A Case Study

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Abstract
The present paper presents research on rendaku acquisition by bilingual children. Rendaku is a morphophonemic process in Japanese that voices the initial obstruent of the second member (N2) of a compound. Recent studies suggest that preschoolers develop their own rendaku strategy (preschooler-specific rendaku strategy) and revise it in the process of acquiring an adult grammar of rendaku. A longitudinal study of monolingual children's rendaku acquisition shows that two factors determine the acquisition patterns of children's rendaku: prosodic (pitch accent of N2) and morphological (word length of N2) factors. In order to test the plausibility of the two factors and the preschooler-specific rendaku strategy, we conducted a compound noun formation task with two bilinguals and found that they showed the preschooler-specific rendaku strategy just as monolinguals do. Longitudinal data from a simultaneous English-Japanese bilingual showed strictly rule-based rendaku acquisition, which is a unique acquisition pattern. Some implications are considered.*

Key words: acquisition of rendaku, bilinguals, word length, pitch accent

1. Introduction

Rendaku is a morphophonemic process that voices the initial consonant of the second member of a compound (Vance 2015, Kubozono 2015).

(1)	**N1**	+	**N2**	→	**N3** (=compound noun)
	ori	+	*kami*	→	*origami* (/k/ → /g/)
	'folding'		'paper'		'paper folding'

Rendaku does not apply to every compound. Although there are some exceptions, rendaku is generally subject to two conditions (Otsu 1980 cited in Tsujimura 1996, Kubozono 1999). First, rendaku is 'restricted to the very large class of *Yamato* morphemes (native vocabulary) (Fukuda & Fukuda 1999: 38)'. Second, rendaku is blocked when the second member of a compound already contain a voiced obstruent (Lyman's Law).

For the purpose of developing an experimental design for rendaku acquisition, we assume the following rendaku conditions to be an adult grammar of rendaku. These conditions reflect widely observable characteristics of rendaku, but they are general tendencies, not inviolable restrictions (Ito & Mester 1986, 1995, Fukuda & Fukuda 1999, Fukuda 2002).

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(2) Rendaku conditions
① N2 is a *Yamato* morpheme (native vocabulary).
② N2 contains no voiced obstruent (Lyman's Law).

Previous studies on children's rendaku (Fukuda & Fukuda 1999, Fukuda 2002) have assumed these conditions without showing that they are really in place when children start the acquisition process.

Recent psycholinguistic studies suggest that preliterate preschoolers do not conform to adult rendaku conditions (Sugimoto 2013a). Rather, children seem to construct and apply an original rendaku strategy on their own, using cognitive resources that are accessible to them. In particular, three-year-olds easily apply rendaku to unaccented *Yamato* words (e.g., *sakura*, *hatake*, *sakana*), but even five-year-olds do not apply rendaku to some accented *Yamato* words (e.g., *ta'nuki*, *ka'rasu*). This tendency cannot be explained on the basis of adult conditions on rendaku.

1.1 Word length of N2 and children's rendaku

Japanese monolingual preschoolers show a preference for trimoraic N2 words in the process of rendaku acquisition (Sugimoto 2015a). That is, children become able to voice trimoraic N2s before they voice bimoraic N2s. The typical length of a *Yamato* vocabulary item is trimoraic or bimoraic (Sato 1989, Kubozono 2011). Even though bimoraic words are shorter and thus should be easier to process in the application of rendaku, children become able to voice bimoraic N2s only at around the age of 4 years or later (Sugimoto 2015a). In contrast, children start voicing trimoraic N2s at around the age of 3 years, much earlier than bimoraic N2s (Sugimoto 2015a).

1.2 Prosodic factor: Pitch accent of N2

Preliterate preschoolers also use the prosodic information of N2 as a cue for applying rendaku (Sugimoto 2013b, 2015b). That is, preliterate preschoolers are more likely to apply rendaku to unaccented N2s than to accented ones (preschooler-specific rendaku strategy, Sugimoto 2013b). The preschooler-specific rendaku strategy appears to reflect the distribution of pitch accent types in the native vocabulary (Kubozono 2011, Table 1), to which rendaku mainly applies. As the table shows, each lexical stratum (*Yamato*, Sino-Japanese, and loanwords) has its unmarked or typical pitch accent type: for *Yamato* words, unaccented word are the typical word type; loanwords tend to be accented (pitch accent on the penultimate mora).

Although children as young as three years old show a strong preference for voicing unaccented N2s instead of accented N2s, it disappears in middle childhood, and their rendaku patterns become similar to those of adult speakers (Sugimoto 2014). Young children may be aware that rendaku applies to N2s which belong to a certain category of words. In fact, for preliterate children, prosodic information about words is the most accessible information.

Table 1 Word categories and pitch accent (data from Kubozono 2006)

	Accented words (on the penult μ)	Unaccented words
Yamato words (native vocabulary)	29% (*ka'rasu* 'crow')	71% (*sakana* 'fish')
Sino-Japanese words (words of Chinese-origin)	49% (*hu'dan* 'daily')	51% (*saihu* 'purse')
Loan words (excluding Sino-Japanese)	93% (*ke'eki* 'cake')	7% (*pijano* 'piano')

1.3 Patterns of rendaku acquisition by Japanese monolinguals (Sugimoto 2015b)

In summary, two factors are at work in children's rendaku acquisition: word length and pitch accent. These two factors affect children's rendaku acquisition, but we do not know exactly how they work or how they interact. Recent longitudinal studies report that children follow a certain path in rendaku acquisition (Sugimoto 2015b).

(3) Order of rendaku acquisition by monolinguals (Sugimoto 2015b)

	Unaccented 3μ words	>	Unaccented 2μ words	>	Accented 2μ words	>	Accented 3μ words
e.g.	*sakura* 'cherry blossom'		*kani* 'crab'		*ka'me* 'turtle'		*ka'rasu* 'crow'

As the order in (3) shows, within unaccented N2s, rendaku acquisition of trimoraic N2s precedes that of bimoraic ones. Within accented N2s, however, rendaku acquisition of bimoraic N2s precedes that of trimoraic ones. In monolingual children's acquisition, the direction of the prosodic factor is consistent (unaccented N2 > accented N2), but the direction of the morphological factor reverses (3μ → 2μ, 2μ → 3μ). This difference suggests that these two factors may reflect essentially different aspects of language development. We need to examine the rendaku acquisition patterns of different types of speakers. The present study focused on bilinguals and investigated how they develop.

1.4 Purposes of this paper

The purposes of this paper are (a) to investigate how the two factors affect two bilingual children's acquisition of rendaku, using a compound noun formation task, and (b) to compare bilinguals with monolinguals (regarding whether rendaku is determined by rule or by lexicalized combinations). There are two research questions in this paper.

(4) Research questions

a. How do the two factors interact with each other in bilingual children's acquisition of rendaku?
b. Are there any differences in acquisition pattern between monolinguals and bilinguals? If so, what are the differences and where do they come from?

We can propose three hypotheses.

(5) Hypotheses

a. The prosodic factor takes precedence over the morphological factor.
b. The morphological factor takes precedence over the prosodic factor.
c. Each combination of one of the two levels of one factor with one of the two levels of the other factor (e.g., accented bimoraic N2) is different.

1.5 Predictions

Based on the above hypotheses, we can make the following predictions.

(6) Predeicions

a. Prosodic factor > Morphological factor
   If the prosodic factor (i.e., pitch accent type of N2) takes precedence over the morphological factor, we would expect that children become able to voice unaccented N2s before accented N2s (unaccented N2 > accented N2).

b. Morphological factor > Prosodic factor
If the morphological factor (i.e., the length of N2) takes precedence over the prosodic factor, we would expect that children become able to voice all trimoraic N2s before voicing bimoraic N2s.

c. Combination of the two factors
If a combination of each level of the two factors (i.e., unaccented vs. accented, 2μ vs. 3μ) functions in children's rendaku acquisition, we would expect a pattern like the following (as one example).
e.g., unaccented 3μ > unaccented 2μ > accented 3μ > accented 2μ

2. Method

We conducted an experiment using a compound formation task (Nicoladis 2003, Sugimoto 2013a). We did a longitudinal study of an English-Japanese simultaneous bilingual from 2013 through 2014, and a single case study of Chinese-Japanese bilingual in April 2015 (Yamamoto 2014).

2.1 Procedure

(7) Compound noun formation task (Sugimoto 2013a)

N1	+	N2	→	N3 (Compound noun)
hima'wari	+	*ka'rasu*	→	*himawariga'rasu*
'sunflower'	+	'crow'	→	'sunflower crow'



'Here's a *hima'wari*' + 'Here's a *ka'rasu*.' → 'How would you name it?'

2.2 Stimuli

The experimental design and stimuli were the same as those of Sugimoto (2015b). We controlled the length (morphological factor) and the pitch accent type (prosodic factor) of N2. In order to focus on the effect of N2, we also controlled N1 by always using the same item (*hima'wari*).

Children were tested individually in a quiet room. We went through three trials: 4 warm-up trials, 4 comprehension trials, and finally the 16 test trials (N1=*hima'wari*). In each trial, children were shown 3 types of pictures on a laptop computer, with N1 and N2 in a random order. The experimenter read N1 and N2 aloud and then asked the children to name N3.

2.3 Participants

We investigated the two bilinguals described below in (8). For Subject A (an English-Japanese simultaneous bilingual) we did a longitudinal study, and for Subject B (a Chinese-Japanese sequential bilingual) we did a single case study. Prior to the studies, parental permission was obtained for each subject.

(8) Participants

Subject A: a six-year-old female English-Japanese simultaneous bilingual living in the Tokyo dialect area

Subject B: a six-year-old female Chinese-Japanese sequential bilingual living in the Tokyo dialect area

2.4 Times of measurement

Both subjects were female. The same experiment was conducted twice on subject A, an English-Japanese simultaneous bilingual, at the ages of 72 months and 78 months. She started attending a nursery school at the age of 1 and was there until she became 79 months old.

Subject B, a 72-month-old Chinese-Japanese sequential bilingual, first learned Chinese as her mother tongue and then at the age of 3 years started attending a kindergarten where she learned spoken Japanese. Subject B participated in our study only once; therefore our data is from just one session.

2.5 Data judgments

We used a SONY IC recorder (ICD SX-1000) and recorded the children's utterances in the experiment. Two people, one of whom was the author, listened separately to the recordings and transcribed them, judging whether or not the children voiced the target consonant. We calculated the reliability of the judgments (Cohen's kappa coefficient (Omura 2000)). The agreement ratio was κ=.98, which is considered highly reliable.

Our scoring was the following. All of the 16 compound nouns in the test trial are subject to rendaku (see Appendix). When a subject voiced the morpheme-initial obstruent of N2, then we judged that he/she had correctly applied rendaku; for each compound, one point was added to the score. We calculated the total scores and subtotals by condition (pitch accent, word length).

3. Results and Discussion

The results of our study are given in Figures 1 and 2. We have four points to discuss. First, we observed the preschooler-specific rendaku strategy in the two bilinguals. Both bilinguals could voice unaccented trimoraic N2s, whereas they did not voice accented N2s. That is, just like Japanese monolingual preschoolers (Sugimoto 2014), bilingual preschoolers make reference to the prosodic information of N2 in applying rendaku in the compound noun formation task. Both for monolinguals and for the two bilinguals, the default type of N2 for undergoing rendaku is an unaccented trimoraic word.

Second, the English-Japanese simultaneous bilingual showed a strictly rule-based acquisition pattern. Rendaku acquisition was determined by the prosodic factor: after she became to voice all unaccented N2s, she started voicing accented N2s. Thus, the rendaku acquisition pattern of the English-Japanese bilingual, though it is a single-subject study, supports prediction (a) (prosody > morphology, unaccented > accented).

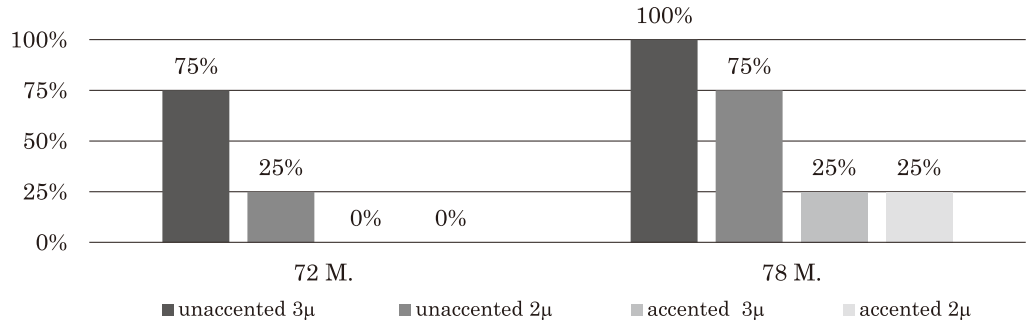

Figure 1 Rendaku rates for an English-Japanese simultaneous bilingual (2 sessions)

Third, in the case of the sequential Chinese-Japanese bilingual, the acquisition pattern seems to be different from that of the English-Japanese bilingual, but it is rather similar to that of monolinguals shown above in (3). As Figure 2 shows, the Chinese-Japanese bilingual showed a strong preference for unaccented 3μ N2s, the preschooler-specific rendaku strategy also observed in monolinguals. As for bimoraic N2s, however, she voiced only 25% of the target words, indicating that she was still in the process of rendaku acquisition. We would like to know how she continued to develop voicing in bimoraic N2s, both accented and unaccented.

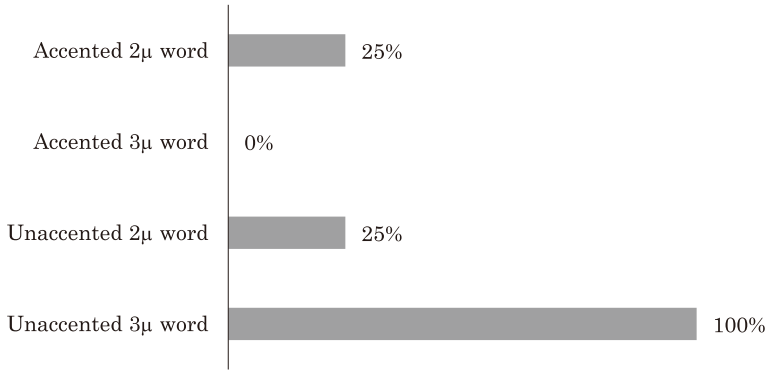

Figure 2 Rendaku rates (Chinese-Japanese sequential bilingual, 72m.)

(9) Rendaku acquisition pattern in a Chinese-Japanese bilingual
unaccented 3μ > unaccented 2μ & accented 2μ > accented 3μ

Fourth, just like monolinguals, the two bilinguals apply rendaku to unaccented words more often than to accented words. This means that bilinguals also make reference to prosodic information (i.e., the pitch accent of N2) and apply rendaku first to unaccented trimoraic words. Thus, our study of bilingual children provides evidence for the preschooler-specific rendaku strategy. In short, both monolinguals and bilinguals share the preschooler-specific rendaku strategy, but they differ in the acquisition patterns of bimoraic N2s and accented trimoraic N2s. The results are summarized in Table 2.

Table 2 Comparison of acquisition patterns: bilinguals and monolinguals

	English-Japanese Simultaneous Bilingual (single-subject longitudinal study)	**Chinese-Japanese Sequential Bilingual (single-subject study)**	**Japanese Monolinguals (N=40) (data from Sugimoto 2014)**
Default Type	Unaccented 3μ words	Unaccented 3μ words	Unaccented 3μ words
Process of Acquisition	・Strictly rule-based ・Rapid & **exhaustive** (Unaccented first, then accented)	・Rule-based, but **gradual & nonexhaustive**	・Rule-based, but **gradual & nonexhaustive**
Order of Acquisition	Unaccented > Accented 1) Unaccented { 3μ > 2μ } 2) Accented { 3μ≒2μ } no order	Unaccented > Accented 1) Unaccented 3μ 2) Accented 2μ ≒Unaccented 2μ ? 3) Accented 3μ	Unaccented > Accented 1) Unaccented { 3μ > 2μ } 2) Accented { 2μ > 3μ }
Primary Factors	Pitch accent	Longitudinal not available	Combination of pitch accent & word length

The primary factor for the English-Japanese bilingual's acquisition pattern is the prosodic factor (prediction a) whereas for the Japanese monolinguals it is the combination of the two factors (prediction c). As for the Chinese-Japanese sequential bilingual, we need longitudinal data since she is still in the process of rendaku acquisition.

In short, children are aware that rendaku applies to a certain category of words. Based on the limited data they have encountered, they construct their own original definition of rendaku: rendaku applies to unaccented N2s, i.e., N2s with the typical pitch accent pattern of the native vocabulary.

Based on the rendaku acquisition patterns of monolinguals and the two bilinguals, we could say that trimoraic unaccented words are the default type of N2 in rendaku acquisition. Trimoraic N2s, as opposed to bimoraic N2s, create an unmarked type of compound. The initial syllable of a trimoraic N2 typically coincides with the pitch fall of compound accent, and this is the pitch pattern we see in X+*ga'rasu* 'X crow' and X+*za'kura* 'X cherry blossom'. In the former, the compound preserves the accent of the independent word *ka'rasu* 'crow', but in the latter, unaccented *sakura* 'cherry blossom' is modified.

Why, then, are preschoolers not likely to apply rendaku to accented 3μ N2s, as in X+ *ka'rasu*, where the morpheme boundary coincides with the antepenultimate pitch accent of the compound? One possible explanation is that preliterate children know accented 3μ words are typical for loanwords but not for native words in Japanese.

In summary, the present study revealed that bilinguals also show the preschooler-specific rendaku strategy just as monolinguals do. Their rendaku acquisition patterns are different from monolinguals in terms of the degree of exhaustiveness of rule application. The English-Japanese simultaneous bilingual followed the preschooler-specific rendaku strategy without exception (unaccented N2s first, then accented). But the Japanese monolinguals and the Chinese-Japanese bilingual were less strict about the acquisition order after voicing unaccented trimoraic N2s. They gradually became able to voice bimoraic N2s regardless of pitch accent.

4. Conclusion

We have seen that both bilinguals, one simultaneous and the other sequential, show the preschooler-specific rendaku strategy in the process of acquisition; that is, they prefer voicing unaccented trimoraic N2s first. Children seem to start from the preschooler-specific rendaku strategy; the monolinguals and bilinguals differ in the acquisition patterns of bimoraic N2s and accented trimoraic N2s.

The English-Japanese bilingual used the preschooler-specific rendaku strategy exhaustively: she only began voicing accented N2s after mastering the voicing of unaccented N2s (for both 3μ and 2μ N2s), contrary to monolinguals, who started voicing accented N2s before mastering the voicing of unaccented N2s.

We have also discussed the nature of the prosodically-based preschooler-specific rendaku strategy. Both monolinguals and bilinguals show a preference for voicing of 'unaccented trimoraic' N2s, i.e., N2s with the typical pitch pattern of the native vocabulary. In contrast, both bilinguals and monolinguals showed an unwillingness to voice accented trimoraic N2s, i.e., N2s with the typical pitch accent pattern of loanwords. Their preference for and avoidance of certain types of words as N2s may reflect their current linguistic knowledge and competence.

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Appendix

List of word stimuli used for N2 (16 words)

	Trimoraic N2s		Bimoraic N2s	
	Accented	Unaccented	Accented	Unaccented
1	*ta'nuki* 'racoon dog'	*sakura* 'cherry blossom'	*ka'me* 'turtle'	*hosi* 'star'
2	*ka'rasu* 'crow'	*tukue* 'desk'	*ka'sa* 'umbrella'	*kani* 'crab'
3	*ho'oki* 'broom'	*hatake* 'field'	*ko'ma* 'spinning top'	*same* 'shark'
4	*ho'taru* 'lightning bug'	*kuruma* 'car'	*ta'ko* 'octopus'	*tori* 'bird'

幼児の連濁獲得を規定する諸要因の検討

——バイリンガル児の事例から——

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要旨

先行研究から，日本語モノリンガル幼児の連濁には，複合名詞主要部（N2）のピッチアクセント（韻律要因）と単語の長さ（形態要因）が関与していることが示されてきた。日本語と外国語のレキシコンを発達させている子どもではどうだろうか。本事例研究では，バイリンガル児 2 名を対象に複合名詞産出課題を行った。その結果，日英バイリンガルと日中バイリンガルはモノリンガルと同様に，平板型 3 モーラ語の連濁が先行し，2 モーラ語の獲得へと進むことが分かった。また，縦断研究から，日英語同時バイリンガル児は，平板型アクセント語の連濁を先に獲得し，頭高型アクセント語の連濁が後から完成してくる過程が確認された。モノリンガル児は，平板型と頭高型アクセントの 2 モーラ語の連濁を徐々に獲得していくのに対し，日英バイリンガル児はアクセント型に沿った規則に忠実で，一気に獲得していく過程であることを論じた。

キーワード：連濁の獲得過程，バイリンガル，単語長，ピッチアクセント