ローゼンの法則と強いライマンの法則の心理的実在に関する実験

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Testing Rosen's Rule and Strong Lyman's Law

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Abstract

The current experiment investigates the psychological reality of Rosen's Rule and Strong Lyman's Law. Rosen's Rule predicts, in part, that rendaku is more likely to occur when N1 has three moras than when it has two moras. Strong Lyman's Law predicts that rendaku is less likely when N1 contains a voiced obstruent. Our wug-test shows neither of these predictions to be borne out. Although the null results must be interpreted with caution, by comparing the current results with those from previous experimental studies on rendaku, we conclude that the effects of these two factors are not substantial, and that they are not synchronically active in the minds of Japanese speakers, at least not for the Japanese community as a whole.*

Key words: rendaku, Rosen's Rule, Lyman's Law, experimental phonology, wug-test

1. Introduction

1.1 General background

Rendaku is a morphophonological phenomenon in Japanese in which the first consonant of the second member of a compound becomes voiced (***t**ako* vs. *oo-**d**ako* 'big octopus'). The application of this process, however, is affected by many factors, some of which are phonological and others of which are morphological, or even arguably syntactic (see Vance, to appear for a recent summary). One well-known factor is the blockage of rendaku by a voiced obstruent in the second member of a compound, which is known as Lyman's Law (e.g. ***t**oka**g**e* vs. *oo-**t**oka**g**e* 'big lizard'; Lyman 1894 *et seq* and see in particular Vance 2007). Another oft-discussed factor is the right-branch condition, in which only the elements on a right-branch undergo rendaku (e.g. [[*nise-**d**anuki*]-*jiru*] '[[fake raccoon] soup]' vs. [*nise*-[***t**anuki-jiru*]] '[fake [raccoon soup]]') (Otsu 1980; see Vance 1980a and Kubozono 2005 for criticisms). There are many other factors that are claimed to affect the applicability of rendaku, which we do not attempt to review here (again see Vance, to appear).

There have been a number of experimental studies that address whether these factors are psychologically real or not. Some factors, for example, Lyman's Law, have been found to be active in experimental settings in that speakers consistently apply rendaku to a nonce word less often if it violates Lyman's Law (Vance 1979, 1980b, Ihara et al. 2009, Kawahara & Sano 2013; see also

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Kawahara 2012 for a related naturalness judgment experiment). On the other hand, other factors, such as the right-branch condition, have been shown to have no impact on the applicability of rendaku, when studied experimentally with native speakers of Japanese (Kozman 1998, Kumagai 2009). In such cases, it may be concluded that the influence of these factors is not psychologically real in the minds of contemporary Japanese speakers (see Vance 1979 for extensive discussion on this point). See Kawahara (to appear) for a recent review of experimental studies of rendaku.

This paper is a part of our larger project which, building on this experimental tradition, aims to investigate experimentally whether factors that are claimed to affect rendaku in the lexicon are psychologically real in the minds of contemporary Japanese speakers. We take up two factors in the current paper: Rosen's Rule and "the strong version of Lyman's Law" (or "Strong Lyman's Law"). We start by reviewing these two factors in detail, and then move on to the report of the actual experiment.

1.2 Rosen's Rule

Rosen's Rule is (partly) about the role of the first element (=N1) on the applicability of rendaku on the second element (=N2[1]). This rule was first discovered by Rosen (2001, 2003), and Vance (to appear) proposes to call it "Rosen's Rule", the convention that we will follow here. The rule states that if N1 is three moras or longer, then the compound will have rendaku regardless of whether or not N2 usually undergoes rendaku, unless N2 is an item which never undergoes rendaku intrinsically.[2] For example, *hune* 'ship' does not always undergo rendaku (e.g. *kuro-**h**une* 'black ship'), but having a trimoraic N1 encourages rendaku (e.g. *yakata-**b**une* 'a kind of tourist ship') (Vance, to appear). This rule has been further studied in subsequent work (Irwin 2009, Vance, to appear) and has been shown to be not as exceptionless as Rosen envisioned, but it seems to be that the general tendency holds. Yet, whether this distributional tendency is psychologically real in Japanese speakers' minds has yet to be tested.

To put it in an experimental perspective, Rosen's Rule predicts that rendaku is more likely when N1 is three mora long than when it is two mora long (when N2 nouns are not immune to rendaku).

1.3 Strong Lyman's Law

Another factor that the current paper examines is "the strong version of Lyman's Law" (henceforth "Strong Lyman's Law"). It is well-known—and shown to be psychologically active in various experiments—that a voiced obstruent in N2 blocks rendaku (*oo-**t**oka**g**e* 'big lizard'), and this blocking effect is called Lyman's Law because of Lyman's seminal (1894) paper. On the other hand, whether the presence of a voiced obstruent in *N1* blocks rendaku or not is a controversial

[1] The influence of N1 on N2 rendaku application is less well studied than the influence of lexical natures of N2 themselves or the morphosyntactic relationship between N1 and N2. For previous experimental studies on the influence of N1 on the application of rendaku, see Tamaoka et al. (2009), Tamaoka & Ikeda (2010), and Kawahara & Sano (2014).

[2] More technically, Rosen (2001, 2003) classifies Japanese lexical items into three classes: (i) rendaku-immune (those that never undergo rendaku, including those that would violate Lyman's Law), (ii) rendaku-hater (those that usually do not undergo rendaku), and (iii) rendaku-lover (those that often undergo rendaku). Rosen's Rule states that unless N2 is rendaku-immune, if N1 is three moras or longer, N2 undergoes rendaku, regardless of whether it is rendaku-hater or rendaku-lover.

matter. It has been shown that this restriction was active in Old Japanese (e.g. Unger 1975; Vance 2005), but its synchronic status has been debated. Sugito (1965) and Zamma (2005) have shown that in family name formation, rendaku is much less likely to occur to the morpheme *-ta*, when N1 contains a voiced obstruent (*sima-**da*** vs. *si**b**a-**ta***) (though see also Kubozono 2005 for further complications). Itô & Mester (1996) discuss further potential examples of Strong Lyman's Law. Tamaoka & Ikeda (2010) found a hint of the activity of Strong Lyman's Law in a post-hoc analysis of their experimental results in that *so**b**a* 'barley' and *mu**g**i* 'wheat' induced less rendaku on *syootyuu* 'alcoholic drink' than *kome* 'rice' and *imo* 'potato', although they themselves do not interpret these results as the effect of Strong Lyman's Law.

Indeed, it is not hard to find lexical exceptions to this rule (e.g. *ka**g**e-**b**osi* 'drying in the dark') (Irwin 2014, Vance, to appear), and it is possible, or even likely, that Strong Lyman's Law is nothing more than a historical residue of an old phonological restriction, which bears no synchronic significance. Our experiment was thus designed to test whether or not a voiced obstruent in N1 makes rendaku less likely in the synchronic phonology of Japanese; i.e. whether Strong Lyman's Law is active in the minds of contemporary Japanese speakers.

2. Method

To summarize, the current project used a nonce word experimentation technique to test whether Rosen's Rule and Strong Lyman's Law are psychologically active. The format was a classic two-way forced-choice wug-test (Berko 1958).

2.1 Stimuli

To examine the activity of Rosen's Rule and Strong Lyman's Law, the current experiment used four types of N1:

(1) Four types of N1 that were used in the experiment
(a) bimoraic N1 with no voiced obstruents (e.g. *aka*).
(b) bimoraic N1 with a voiced obstruent in the first mora (e.g. ***g**omi*).
(c) bimoraic N1 with a voiced obstruent in the second mora (e.g. *i**b**o*).
(d) trimoraic N1 with no voiced obstruents (e.g. *hukuro*).

The comparison between (a) and (d) tested the activity of Rosen's Rule on rendaku: Rosen's Rule predicts that rendaku is more likely in (d) than it is in (a), assuming that nonce words are not immune to rendaku (an assumption that is apparently true; see the experimental results below as well as the previous experimental studies of rendaku, reviewed in Kawahara, to appear). The comparison between (a) on the one hand and (b) and (c) on the other tested the activity of Strong Lyman's Law. If Strong Lyman's Law is active, it should block rendaku in (b) and (c). The comparison between (b) and (c) was intended to test the effect of locality on Strong Lyman's law. In previous experiments on Lyman's Law, whether the blocker consonant is adjacent to the rendaku-undergoer or not affected the rendaku applicability in some experiments (Ihara et al. 2009, Vance 1980b), but not in others (Kawahara & Sano 2013; see also Kawahara 2012). The comparison between (b) and (c) was thus added to test this locality aspect of Strong Lyman's Law; (b) results in a non-local violation, while (c) results in a local violation.

Seven items were chosen for each of the four types of N1 ((a)–(d)). See the appendix for the complete list of the stimuli. For N2, the experiment used three nonce words: *tatuka*, *kimane*, and *semaro*, adopted from Vance (1979) and Kawahara (2012). The stimulus structure is thus 4 N1 types * 7 N1 items * 3 N2 items = 84 items in total. All the factorial combinations of N1 and N2 were tested so that any influence of N2 is constant across the four N1 conditions.

2.2 Task

For each combination of N1 and N2, the participants were provided with compound forms with and without rendaku. For example, given *ao* and *semaro*, they were asked which form sounds more natural to them: *ao-**s**emaro* or *ao-**z**emaro*. The participants were told that the N2 nonce nouns were names of old animals that used to inhabit Japan. Both N1 and N2 were written in *hiragana*. These procedures were intended to encourage the participants to treat N2 as old native, Yamato-words, as rendaku applies mostly to Yamato elements. This technique was deployed in some of the previous studies (Vance 1979, 1980b, Kawahara 2012).

2.3 Procedure

The experiment was conducted online via Surveymonkey.[3] After reading the consent forms, the participants received an explanation of what rendaku is. Then they went through two practice questions using real N2 words. In the main session, all the target stimuli were presented; the order of stimuli was randomized for each participant by Surveymonkey. Thirty-six native speakers of Japanese participated in this experiment, excluding those who explicitly noticed the purpose of the experiment. The majority of the participants were undergraduate and graduate students in Japanese universities, and the participants were mostly in their twenties or thirties at the time of the experiment.

2.4 Analysis

For a statistical analysis, we deployed a logistic linear-mixed model with subjects and items as random variables (Jaeger 2008), since the responses were binary (yes rendaku or no rendaku).

3. Results

Figure 1 illustrates the effect of Rosen's Rule by plotting the rendaku response ratio for each condition. Controlling for the effect of Strong Lyman's Law, the longer N1 resulted in slightly more rendaku responses: 0.48 (2 moras) vs. 0.50 (3 moras). However, the difference is small and not significant ($z = 0.65$, *n.s*).

[3] See Reips (2002) and Sprouse (2011) for the reliability of online experimentation in psychology and linguistics, respectively.

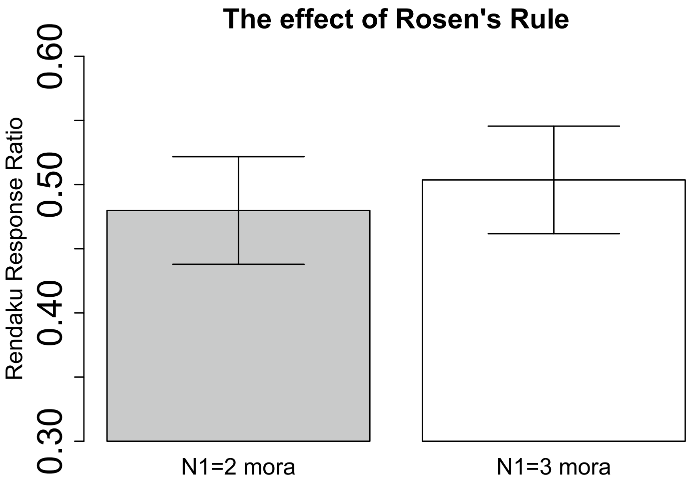

Figure 1 The effect of Rosen's Rule. The error bars represent binomial 95% confidence intervals.

Figure 2 illustrates the results that pertain to Strong Lyman's Law. The presence of a voiced obstruent in N1 slightly decreased rendaku applicability: 0.48 (no-LL-violation) vs. 0.45 (local-LL-violation), 0.45 (non-local LL-violation). However, this difference is again small, and not significant (z = *0.56*, *n.s*). There were no effects of locality either—the second and the third condition look almost identical (0.45 vs. 0.45; z = *0.35*, *n.s.*).

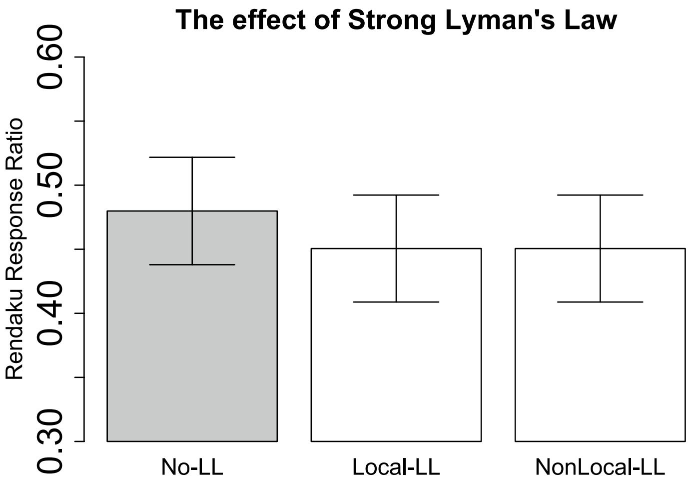

Figure 2 The effect of Strong Lyman's Law. The error bars represent binomial 95% confidence intervals.

4. Discussion

4.1 Interpreting the null results

To summarize, the current experiment found no convincing evidence for the psychological reality of Strong Lyman's Law or Rosen's Rule. This conclusion should be interpreted with a grain of salt, because null results do not support the conclusion that there are no differences; they merely fail to reject the null hypothesis that there are no differences.[4] However, at least, the overall effects of these two factors are not substantial, if they exist at all. Recall that the effect of Rosen's Rule was about 2% and the effect of Strong Lyman's Law was about 3%, and that these differences are based on the results of an experiment using 36 native speakers.

We can compare these results with other experiments of ours that we ran at about the same time in 2013 with a very similar format (Kawahara & Sano 2013, 2014). For example, the effect of rendaku blocking due to a ban against adjacent identical CV moras is about 15% (Kawahara & Sano 2014). The effect of rendaku blocking due to a local Lyman's Law violation in N2 is about 19% (Kawahara & Sano 2013). The effect of rendaku blocking due to adjacent identical moras in a Lyman's Law violating environment is about 12% (Kawahara & Sano 2013). It thus seems that the effects of Rosen's Rule and Strong Lyman's Law are not substantial, and perhaps non-existent.

4.2 Further exploration of the data

In order to understand why we did not obtain clear differences due to Rosen's Rule or Strong Lyman's Law, we looked further into the patterns of individual speakers. Figure 3 plots rendaku responses for each speaker for the two conditions that are relevant to Rosen's Rule. Each dot represents a speaker. The y-axis represents rendaku responses when N1 is three-mora long, whereas the x-axis represents rendaku responses when N1 is two-mora long. Those dots (or speakers) that are above the diagonal axis (i.e. y=x) are those that showed a tendency to follow Rosen's Rule, and those that are below showed a tendency to go against Rosen's Rule. Those on the diagonal axis showed the same number of rendaku responses for the two conditions (i.e. no effects of Rosen's Rule).

[4] Statistically showing that there are no differences between conditions is important in psycholinguistic (and other scientific) work, and Bayesian Statistics is useful for that purpose (Gallistel 2009). However, we are, regrettably, incapable of executing a Bayesian analysis with confidence at the current moment.

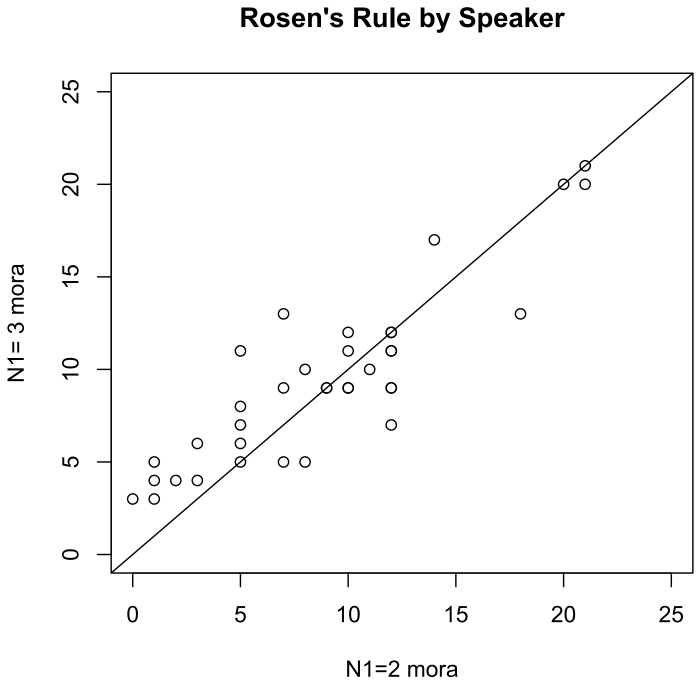

Figure 3 Results of Rosen's Rule by speaker.

We observe that although there are a number of speakers who tended to follow Rosen's Rule, there are also those who show the exact opposite pattern, as well as those who are insensitive to the length of N1. We thus conclude that there is a large degree of inter-speaker variability, enough so that Rosen's Rule cannot be sustained as a valid rule in the community of Japanese speakers as a whole. We would, however, like to leave open the possibility that Rosen's Rule may be active for some subset of Japanese speakers.

Since we did not collect much personal data about the participants in the current experiment, the question of how this inter-speaker variability should be explained must be left for future research. Recall that the majority of the participants were in their twenties or thirties, so age was more or less controlled. A post-hoc correlation analysis was nevertheless run between age and the effect of Rosen's Rule (the difference between the N1=2-mora condition and the N1=3-mora condition). The result shows a positive but non-significant correlation (using a non-parametric Spearman test, *rho=.10, n.s.*). There were no differences due to gender either (tested by a between-subjects non-parametric Wilcoxon test).

Moving on to Strong Lyman's Law, Figure 4 shows a similar by-speaker analysis of the Strong Lyman's Law effect. The x-axis averages over the local Strong Lyman's Law condition and non-local Strong Lyman's Law condition. Those who are affected by Strong Lyman's Law should be distributed above the diagonal axis. As was the case for Rosen's Rule in Figure 3, we observe much inter-speaker variability. There are those who are above, on, and below the diagonal axis; it is thus hard to conclude that Strong Lyman's Law has any consistent effect on the community of Japanese speakers as a whole. Again, exploring the source of inter-speaker variability is an interesting topic for future research. Post-hoc tests show that neither age nor gender explains the observed variability.

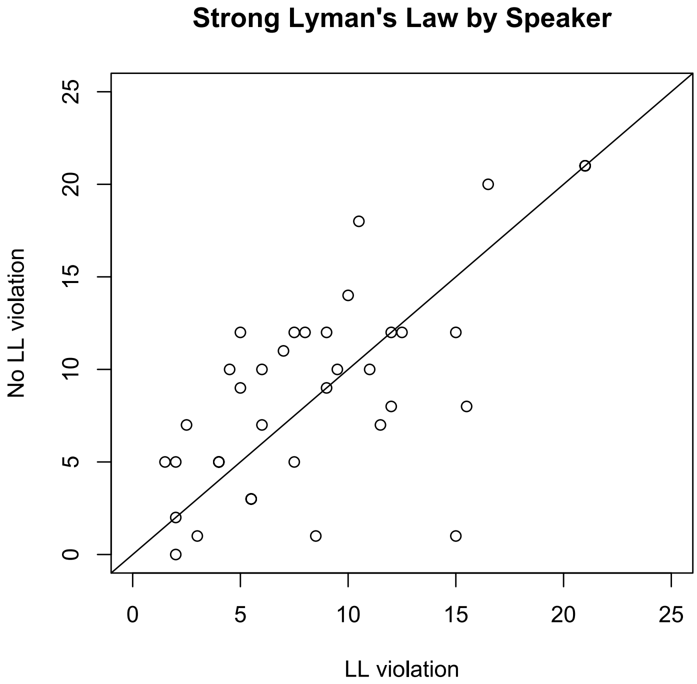

Figure 4 Results of Strong Lyman's Law by speaker.

4.3 Concluding remarks

In summary, the current experiment did not find clear evidence for the psychological reality of Rosen's Rule or Strong Lyman's Law among the community of contemporary Japanese speakers. Overall, we obtained null results, and further investigation of individual patterns revealed too much inter-speaker variability to make any conclusive statements. We certainly do not wish to imply that our current results should not be challenged in future experimental work. It is possible that some confounding factors, which we are not aware of, may have hidden the true effects of Rosen's Rule and Strong Lyman's Law. We therefore hope that these results will be replicated, challenged, and further explored in future studies.

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Appendix: Stimulus List

(a) bimoraic N1 with no voiced obstruents
(b) bimoraic N1 with voiced obstruent in the first mora
(c) bimoraic N1 with voiced obstruent in the second mora
(d) trimocaic N1 with no voiced obstruents

(a)	(b)	(c)	(d)
ao 'blue'	*baka* 'stupid'	*aza* 'bruise'	*hukuro* 'bag'
aka 'red'	*gomi* 'garbage'	*ibo* 'wart'	*hayasi* 'grove'
aho 'stupid'	*buti* 'dapple'	*mago* 'grandchild'	*kuruma* 'vehicle'
hari 'needle'	*busu* 'ugly'	*kiza* 'snobbish'	*utuwa* 'vessel'
mori 'forest'	*zusi* (place name)	*iga* 'bur'	*takara* 'treasure'
natu 'summer'	*boro* 'rag'	*kuzu* 'scrap'	*musume* 'daughter'
huyu 'winter'	*doro* 'mud'	*hebo* 'poor'	*kumori* 'cloudy'

ローゼンの法則と強いライマンの法則の心理的実在に関する実験

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要旨
本研究では，実験によりローゼンの法則と強いライマンの法則についてその心理的実在を検証した。ローゼンの法則に従えば，複合語前部要素が2モーラよりも3モーラの方が連濁が起こりやすくなる。また，強いライマンの法則に従えば，複合語前部要素に濁音が含まれている場合，連濁が起こりにくくなる。しかしながら，無意味語を用いた実験の結果，両法則の影響は確認されなかった。統計的に有意でない結果から負の証明は不可能であるものの，他の実験結果と比較しても，両法則の影響は本質的なものではなく，現在の日本語話者の知識においては機能していないと思われる。

キーワード：連濁，ローゼンの法則，ライマンの法則，実験音韻論，無意味語