REALIZATIONS OF /r/ IN JAPANESE TALK-IN-INTERACTION

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ABSTRACT

The phonetic variability of Japanese /r/ is well known, but perhaps less-well accounted for in a quantitative way. This paper presents an initial sociophonetic study of one speaker's /r/s produced during conversation with both a known and an unknown interlocutor. Contrary to expectation, more reduced forms (lateral and retroflex approximants) were produced in the unknown condition. Phonological and morphological factors conditioning /r/ variation are also discussed.

Keywords: rhotic liquids, talk-in-interaction, Japanese, sociophonetic variation

1. INTRODUCTION

There are a number of descriptions of how /r/ (or more properly, /ɾ/) is phonetically realized in Japanese [1, 2, 8, 9, 13, 14, 16], but less work has focused on quantifying the factors which condition that variation. Since variation occurs more readily in extemporaneous talk-in-interaction, speech modality has also contributed to the difficulty in gathering naturalistic data for analysis.

This paper presents an initial analysis of Japanese /ɾ/ variants observed in the unscripted discourse of one female speaker ('Ako') across two conditions: with a *known* and an *unknown* interlocutor. The hypothesis is that Ako will hyper-articulate /ɾ/ in the *unknown* condition, producing /ɾ/ more often as a 'hard flap' [10] or 'weak plosive' [8, 9]. More reduced forms (lateral and retroflex approximants) are thus expected in the *known* condition. These hypotheses are tested using Goldvarb X [15], a software program which implements a variable rule ('varbrul') analysis step-wise regression algorithm [4]. Included in the analysis are phonological factor groups (/_V/, /V_/) and a morphological one: whether /ɾ/ occurs as part of a grammatical or lexical morpheme.

2. METHODOLOGY

As part of a larger study, Ako (a 30 y.o. tutor from Toyoama Pref. residing in Canada for 2 years) video-recorded two 30-minute conversations, first with an unfamiliar interlocutor and then with a known one. Both interlocutors were females in their mid-20s, and spoke a western variety of Japanese as their native dialects (Okayama [known] and Osaka [unknown]). Before each conversation, participants were shown different animated short films. The only instruction given prior to each conversation was that they could talk about anything they wished, but should at some point also talk about the video they watched. The data analyzed here are comprised of 200 serial intervocalic and post-nasal tokens of /ɾ/ from the mid-way point of each of Ako's conversations. Her interlocutors' productions are not included here.

2.1. Coding and analysis

Based on the author's auditory judgment and visual inspection of spectrograms using Praat [3], the 400 tokens of /ɾ/ were categorized by stricture and liquid type (4 levels respectively; see below), preceding and following segment (5 vowels and /n/), interlocutor (known or unknown), and morphological stem type (lexical or grammatical). Stricture was coded as <u>T</u>ight if the spectrogram featured either a release-like burst or frication in addition to the brief interruption of signal associated with flaps/taps [11, 12]. <u>M</u>id-range strictures featured a brief interruption of the formants as with canonical flaps. Strictures were judged as Open if there was evidence of modulation of formant frequencies and/or diminution of amplitude across frequencies similar to what would be expected of an approximant.

Liquid type was assessed auditorily: tokens with an auditory quality similar to [ɹ, ɚ] were coded as <u>R</u>hotic; those with a quality similar to [l, ɺ] were coded as <u>L</u>aterals. A small number of tokens (N= 5) featured rhoticism from a preceding vowel followed by a lateral articulation, such as a lateral flap. These tokens were coded a <u>B</u>oth rhotic and lateral. Tokens were coded as "Z" if they featured neither rhoticism nor laterality. This group included deletions as well as canonical non-lateral and weak-plosive flaps/taps. Table 1 in the following section presents the overall distribution of stricture and liquid type in the data.

3. RESULTS

Table 1 summarizes the totals for each category of realization created through the intersection of stricture and liquid type.

Table 1: Distribution of categories (sagittal) stricture type (*y* axis) and liquid type (*x* axis) across the entire dataset. (Z= neither rhotic nor lateral; R= rhotic; B= both rhotic and lateral; L= lateral; T= tight stricture, M= mid-range, O= open stricture, X= no discernable stricture).

		Z	R	B	L	=
T	N	55	1	0	18	74
	%	74.3	1.4	0.0	24.3	18.5
M	N	90	15	1	26	132
	%	68.2	11.4	0.8	19.7	33.0
O	N	35	49	4	38	126
	%	27.8	38.9	3.2	30.2	31.5
X	N	68	0	0	0	68
	%	100	0.0	0.0	0.0	17.0
=	N	248	65	5	82	400
	%	62.0	16.2	1.2	20.5	

The upper leftmost cell in the central box is the intersection of stricture category T and liquidity category Z. That is, the 55 productions of /r/ in this cell had tight articulatory strictures and were neither rhotic nor lateral-sounding: flaps/taps that featured either a burst-like release or frication. These productions made up 74.3% of the total 74 instances of the category 'T' in the dataset. The total (74) at the right of the row represents the sum of tokens for that row. Below this sum is a percentage: 18.5%. Where '74.3%' in the cell T-Z meant 'Z comprises 74.3% of all category T tokens,' the 18.5% below the T-row total means that 74 represents 18.5% of the entire dataset's 400 tokens. Similarly, looking at the bottom of the Z column, we see that 248 tokens out of 400, or 62%, were neither rhotic nor lateral. Less-populated cells represent rare sounds in the dataset. For instance, only 5 tokens were both rhotic and lateral.

3.1. Known and unknown conditions

Tables 2 and 3 contrast category frequencies between the *known* (Table 2) and *unknown* (Table 3) halves of the dataset. Recall that the hypothesis considered here is that Ako would produce more tight, non-rhotic non-lateral realizations of /ɾ/ when speaking with an unknown interlocutor. That is, the greater social distance involved in the unknown condition is assumed to be amenable to hyper- as opposed to hypo-articulation of /ɾ/.

Table 2: Distribution of stricture and liquid type in the *known* condition.

		Z	R	B	L	=
T	N	36	1	0	10	47
	%	76.6	2.1	0.0	21.3	23.5
M	N	43	6	1	14	64
	%	67.2	9.4	1.6	21.9	32.0
O	N	17	21	2	15	55
	%	30.9	38.2	3.6	27.3	27.5
X	N	34	0	0	0	34
	%	100	0.0	0.0	0.0	17.0
=	N	130	28	3	39	200
	%	65.0	14.0	1.5	19.5	

Table 3: Distribution of stricture and liquid type in the *unknown* condition.

		Z	R	B	L	=
T	N	19	0	0	8	27
	%	70.4	0.0	0.0	29.6	13.5
M	N	47	9	0	12	68
	%	69.1	13.2	0.0	17.6	34.0
O	N	18	28	2	23	71
	%	25.4	39.4	2.8	32.4	35.5
X	N	34	0	0	0	34
	%	100	0.0	0.0	0.0	17.0
=	N	118	37	2	43	200
	%	59.0	18.5	1.0	21.5	

The total frequency of T (tight strictures) is 47 (23.4%) for the known condition versus 27 (13.5%) for the unknown condition – the opposite of what was predicted. Also, glancing across the bottom row of column totals for Tables 2 and 3, the numbers for rhotics and laterals are greater in the unknown condition versus the known – again contrary to the prediction. A possible explanation for the results is taken up in the Discussion.

3.2. Variable rule analyses

Separate variable rule analyses were conducted using Goldvarb X [15], with the application values 'T,' 'L,' and 'R' as the dependent variables. Provided categorical variables organized into factor groups as input, Goldvarb X calculates the probability that a given factor specification (or 'rule') will apply in a particular condition. Probabilities, or factor weights (FW), are expressed as values between 0 and 1, where 1 represents the highest probability and 0 the lowest. A value of 0.5, then, represents a 50% probability. Table 4 summarizes the results of the analyses.

Table 4: Summary of results for 3 variable rule analyses for the application of a. T (tight stricture), b. L (laterality), and c. R (rhoticism) across 4 factor groups: sociolinguistic (SOC.), morphological (MORPH.), preceding phonological environment (PHON: /V_/) and following phonological environment (PHON: /_V/. Non-significant values appear in square brackets, and are taken from binomial, one-step varbrul along with values for χ^2/cell. Factor weights (FW) represent probability where 1=100% and 0=0%. Significance values, log likelihoods, and significant factor weights (FW) represent values select from best step-up or step-down run in a binomial, up-and-down varbrul. *r* = range.

a.	APP. VALUE: T			b. APP. VALUE: L			c. APP. VALUE: R		
	χ^2/cell= 0.764			χ^2/cell= 0.622			χ^2/cell= 0.828		
	Log likelihood= -176.110			Log likelihood= -173.200			Log likelihood= -154.881		
	Significance= 0.005			Significance= 0.004			Significance= 0.003		
	FW	%	N	FW	%	N	FW	%	N
SOC.									
Known	0.600	23.5	47	[0.479]	19.5	39	[0.446]	14.0	28
Unknown	0.400	13.5	27	[0.521]	21.5	43	[0.555]	18.5	37
r	0.200								
MORPH.									
Lexical	[0.572]	22.1	44	[0.420]	14.6	29	[0.458]	15.6	31
Grammatical	[0.428]	14.9	30	[0.580]	26.4	53	[0.541]	16.9	34
PHON: /V_/									
/i/	0.681	29.8	14	0.187	11.8	47	0.224	8.5	4
/e/	0.597	20.9	9	0.527	10.8	43	0.116	2.3	1
/u/	0.686	30.9	21	0.275	17.0	68	0.588	17.6	12
/o/	0.294	7.5	3	0.319	10.0	40	0.885	42.5	17
/a/	0.402	12.6	174	0.683	49.8	199	0.550	15.6	31
/n/	0.939	66.7	2	0.929	0.8	3	–	0.0	0
r	0.676			*r* 0.724			*r* 0.769		
PHON: /_V/									
/i/	[0.487]	18.2	12	0.417	16.5	66	0.271	9.1	6
/e/	[0.477]	15.9	11	0.667	17.2	69	0.302	13.0	9
/u/	[0.599]	24.8	29	0.327	29.2	117	0.575	14.5	17
/o/	[0.545]	30.8	8	0.489	6.5	26	0.779	19.2	5
/a/	[0.415]	11.5	14	0.620	30.5	122	0.608	23.0	28
				r 0.340			*r* 0.508		
	Total N = 400			Total N = 400			Total N = 397		

3.2.1. Stricture type

Goldvarb X identified two factor groups as significant in a binomial up-and-down variable rule analysis with T (tight stricture) as the application value. Table 4(a) shows that the sociolinguistic factor group (*known* versus *unknown* interlocutor) is significant along with the preceding phonological environment. Counter to the prediction made at the outset of this paper, /ɾ/s produced with tighter strictures are more likely in the *known* condition.

Phonologically, tighter strictures are more likely following high vowels and /e/, and least likely following /o/. The phonological data are less conclusive than their factor weights suggest as the number (N) of tokens in each cell is relatively small, which in turn results in exaggerated factor weights for /e, o/ and especially /n/.

Another anomaly is the low FW before /i/. Given the articulatory configuration for /i/ and its closeness to a configuration for full oral closure, a greater probability of T would be expected. That morphological conditioning (i.e., whether /r/ was part of a lexical or grammatical morpheme) was not selected as significant here is also surprising, given the FW range and cell token numbers. As a tendency, though, tight strictures seem more likely in lexical rather than grammatical morphemes.

3.2.2. Laterality and rhoticism

Neither the sociolinguistic nor the morphological factor groups were significant in the analyses run for L and R, although the tendency in both is for laterals and [ɹ, ɝ]-like variants of /ɾ/ to be produced in the *unknown* and *grammatical morpheme* conditions. This tendency is stronger for both L and R in the morphological factor group where there is a substantial (but not significant) range in FW values. Phonological environments were significant, with laterals most probable following /a/ and preceding /a, e/. This is consistent with descriptions in the literature (e.g. [1, 2, 9, 16]) that suggest /a, e/ are amenable to laterals. The FWs also tell us that laterals are less likely to occur preceding or following /i, u/. Since laterality in Japanese is gradient and not strictly categorical, these results suggest that laterals are mostly conditioned by phonetic parameters. That is, vocalic environments that more readily allow for air to pass over the sides of the tongue are more amenable to lateral realizations of /r/.

Vocalic environment was also significant for rhoticism, with the highest factor weights following and preceding /o, u, a/. Three post-/n/ tokens were 'knocked-out' of the analysis due to low token numbers. The addition of /u/ here where it was disfavoured for laterals provides further support for the idea that phonetic parameters condition laterality and rhoticism. That is, the raising and retraction [6] of the tongue dorsum towards the velo-pharynx as for /u/ is consistent with similar raising and retraction for 'bunched' /r/ [5]. A hypothesis worth pursuing in subsequent articulatory-phonetic work is that rhoticism in Japanese /r/ variants is the product of the timing relationships between vowel and consonant gestures. That is, as the tongue passes from a raised and retracted position for /o, u/ to a non-retracted apical gesture for /r/, it passes through an 'r-space' amenable to the percept of [ɹ, ɚ] (see [7] for a similar analysis of excrescent schwa).

4. DISCUSSION AND CONCLUSION

The effect of known versus unknown interlocutor was opposite to what was expected both in terms the probability of tight strictures as well as the probabilities for laterality and rhoticism. It may be that the phonetic parameters with which Ako accommodates her speech to that of her interlocutors are not limited to those that define flaps/taps. While tightness (or brevity) of sagittal stricture is a parameter that defines [ɾ], the same parameter is involved in another contrastive category: /d/. Other phonetic parameters such as tongue retraction (as for [ɹ, ɚ]) and laterality do not jeopardize phonological contrasts in Japanese. If attended-to speech involves augmenting contrast for an unfamiliar partner, Ako may have opted for phonologically 'safer' phonetic parameters.

Given that this study has only considered a small sample of the speech of one individual, any conclusions are necessarily speculative. That said, further research on how speakers exploit contrastive and non-contrastive phonetic parameters is needed to gain a better understanding of talk-in-interaction.

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6. REFERENCES

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