THE PRODUCTION AND PERCEPTION OF POTENTIALLY AMBIGUOUS INTONATION CONTOURS BY SPEAKERS OF RUSSIAN AND JAPANESE

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ABSTRACT

The present study deals with the production and perception of short Russian and Japanese declaratives, interrogatives and exclamations with similar segments and rise-fall or falling intonation contours. Results indicate that intonation can successfully function as the only means of sentence type disambiguation even for short phrases with similar (potentially ambiguous) contours for Russian listeners, whereas interrogative and exclamatory contours remain ambiguous for the Japanese. Factors accounting for sentence type misidentification include differences between Russian and Japanese intonation contour parameters such as peak timings, end timings, pitch slope, and pitch range.

1. INTRODUCTION

The study focuses on Russian and Japanese 2 syllable falling contours and 3-syllable rise-fall contours. The patterns chosen are fairly common in many languages and are considered archetypal (Vassiere, 4). Both Russian and Japanese have rise-fall and falling contours for declaratives and exclamations (Miura, Hara, 1; Ohde, 2; Svetozarova, 3). However, while interrogatives with the rise-fall contour are typical for Russian, they are more marked in Japanese, and frequently function as echoes. The purpose of the study was to verify:

1) whether speakers of two languages apply similar or different strategies while listening to their native language and a foreign language;

2) whether listeners can identify subtle differences between similar (rise-fall and falling) intonation contours

3) whether native contour recognition patterns are 'transferred' (applied) to an unknown foreign language;

4) whether there are any parametric intonation correlates for misconstrued recognition of foreign language contours

2. MATERIALS AND METHODS

2.1 Informants and Stimuli

A 32-year old male standard Japanese speaker and a 26-year-old male standard (St. Petersburg) Russian speaker recorded a list of 24 two-syllable and 13 three-syllable words, each prononunced as an exclamation, interrogative and a declarative. The Japanese and Russian sets of data were matched for vowel and consonant type. Japanese words were 'high, low' for the 2-syllable and 'low, high, low' for the 3-syllable structures. Russian words had a stressed first syllable for 2-syllable words and a stressed second syllable for the 3-syllable words.

2.2 The equipment

The one-word phrases were processed on a Visipitch 6095/6097 and SONA programme (37 words X 3 sentence types X 2 informants = 222 words) to obtain pitch, duration, intensity and calculated statistics, which were then input on an Excel chart for sorting.

2.3 The stimuli and subjects for the listening experiment

The original recording was edited into 2 random-order lists. The Japanese list had 32 two-syllable and 26 three-syllable phrases, and the Russian - 35 and 22, respectively. Each stimulus was recorded three times with intervals of about 2 seconds. The lists were presented to 20-21 Russian subjects, and 63-64 Japanese subjects, male and female, aged 17 to 23, who were requested to a make a forced choice between a

declarative, interrogative, or exclamation.

3. RESULTS AND DISCUSSION

3.1 Results of the listening experiment

Russian and Japanese subjects, employ different listening strategies when listening to their native language intonation contours.
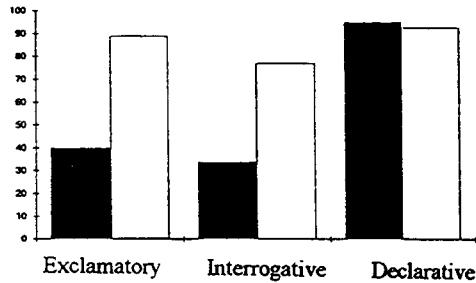

Figure 1: Percentage of correct identification of exclamations, interrogatives, and declaratives Japanese (black) and Russian (white) subjects listening to their native language

Russians have a higher percentage of correct recognition responses than the Japanese subjects (Figure 1). Possible contributing factors are: the subjects' linguistic experience and expectations based on the frequency of occurrence for each sentence type, and the function of grammatically unmarked utterances in each language.

Russian and Japanese subjects also manifest different perception patterns when listening to the intonation contours of an unknown foreign language. While the Japanese subjects tend to misidentify both Russian exclamations and interrogatives as declaratives, the Russian subjects are apparently able to hear the differences between Japanese interrogatives and exclamations, but they 'label' them incorrectly, systematically perceiving Japanese interrogatives as exclamations (48,5%), and exclamations as interrogatives (62,8%). These facts can be accounted for by the Russian and Japanese interrogative and exclamation parameter differences that are further discussed in Section 3.2. Results of the perception test are as follows:

Type	Percvd	Japanese Listeners						Russian Listeners					
		Japanese Speaker			Russian Speaker			Russian Speaker			Japanese Speaker		
		2-syl.	3-syl.	Total	2-syl.	3-syl.	total	2-syl.	3-syl.	total	2-syl.	3-syl.	total
!	!	45.2	33.2	f 40.1	36.1	61.3	f 45	87.1	91.4	g 88.7	24.6	e 16.9	21.3
!	?	29.4	43.6	35.4	14.3	15.3	14.7	0.4	2.1	1	58.3	68.8	62.8
!	.	25.4	23.3	24.5	49.6	23.4	40.3	12.5	6.4	10.3	17.1	14.3	15.9
?	!	40.6	54.7	46.6	34.5	14.4	26.9	17.3	0	10.6	50.4	46	48.5
?	?	36.1	30.9	c 33.9	30.2	28.2	c 29.5	66.4	93.6	c 76.9	c 22.6	d 36	28.3
?	.	23.3	14.5	19.5	35.3	57.8	43.6	16.4	6.4	12.5	27	18	23.1
.	!	3.5	3.2	3.3	11.1	8.3	10	4.2	b 11.3	7	11.3	11.9	b 11.6
.	?	1.4	1.8	1.6	12.3	10.7	11.6	0	1.3	0.5	4.8	6	5.4
.	.	95.1	95	a 95.1	76.7	81	a 78.4	95.8	87.5	a 92.5	83.9	82.1	a 83

Table 1: Percentage of subjects who perceived each sentence type as an exclamation (!), interrogative(?) or declarative (.) Russian listeners are able to differentiate the three sentence types, while Japanese only perceive the difference between declarative/non-declarative.

The percentage of correct recognition is highest for declaratives (Table 1 a). This can be attributed to gradual rise/fall and low peaks in both languages. Regarding incorrect recognition, declaratives seem to be mistaken for exclamations rather than interrogatives by Russian listeners for both languages (Table 1 b).

Correct recognition is lowest for interrogatives (Table 1 c) (with the exception of 3-syllable Japanese words perceived by Russian listeners - Table 1 d - where the percentage of correct recognition for exclamations is even lower - Table 1 e). Correct recognition for exclamations is lower than declaratives but better than interrogatives for the Japanese

subjects (both languages) (Table 1-f) and for Russians listening to Russian (Table 1-g).

3.2 The results of the instrumental analysis

Some intonation parameters for which there are notable differences between the Japanese and Russian speakers are:

pitch peaks timing, total duration of the utterance, and pitch peak height. Listeners misperceptions (see 1.1) might be caused by differences in the velocity of the pitch rise, the total relative/absolute duration of the utterance, length of the last syllable, devoicing and similarity in Russian and Japanese overall contour shape as shown in Figure 2.
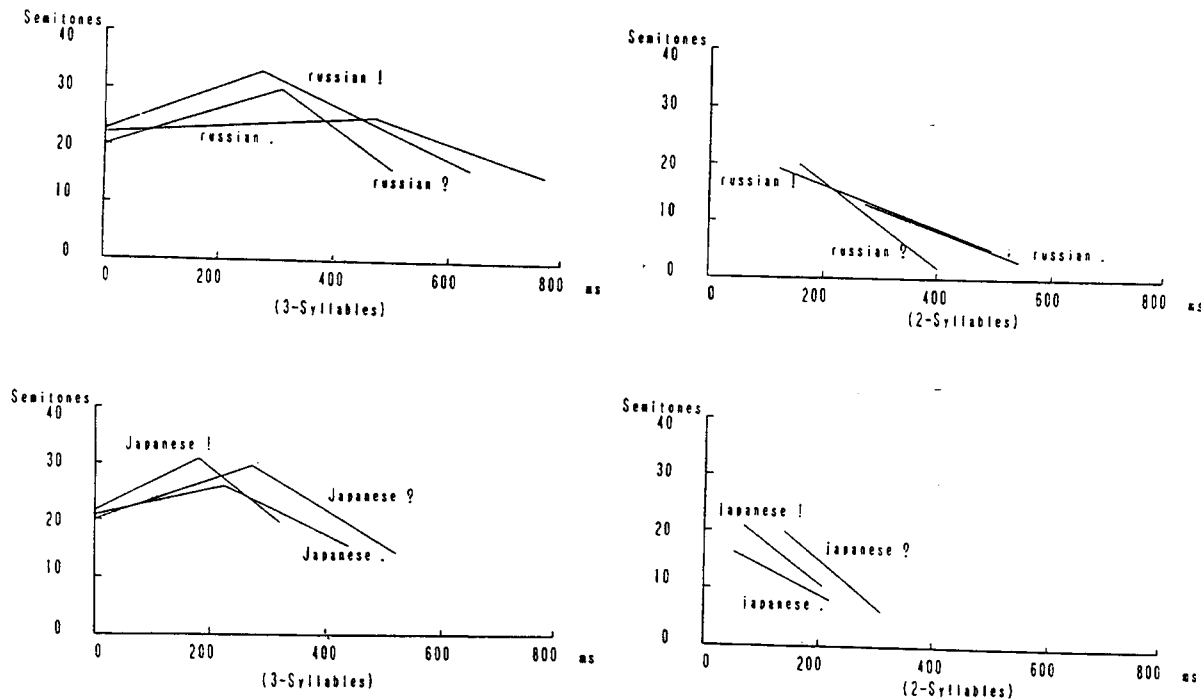

Figure 2: Russian and Japanese speaker average pitch as a function of time

		pitch		total		peak	
		Japan.	Russ.	Japan.	Russ.	Japan.	Russ.
3-syll.	exclamat.	early	early	short	mid	high	mid
	interrogat.	late	mid	long	short	mid	high
	declarat.	mid	late	mid	long	low	low
2-syll.	exclamat.	mid	early	short	mid	high	high
	interrogat.	late	mid	long	short	mid	mid
	declarat.	early	late	mid	long	low	low

Table 2. Average relative pitch/duration (each box is discrete: eg. a short, mid, long combination only relates to other durations within the same box. i.e. The absolute length of a Japanese long may be shorter than a Russian short)

Various factors account for the listener misconceptions.

Japanese exclamations are probably misconstrued by **Russians as interrogatives** because of similarities between the two sentence types (cf. Figure 3) such as: early endings, shortest total duration for both the 2 and 3-syllable words, similar angle of slope for the 2-syllable words, and the steepest fall, the shortest rise and partial devoicing of the last syllable for the 3-syllable words.

Japanese interrogatives are perceived by **Russians as exclamations** apparantly because they resemble Russian exclamations in the height of pitch, long fall and prolonged ends for the 2-syllables and have similar contour shape, longest total duration and the same absolute rise length for the 3-syllable words (Figure 3). Japanese interrogatives are probably drawn out in the end because the typical Japanese question

rises in the end. This rise is most probably replaced by duration.

Russian "tata!"   Russian "tata?"
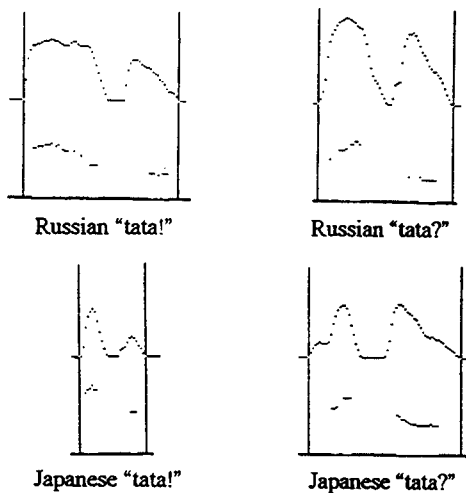
Japanese "tata!"   Japanese "tata?"

Figure 3: Pitch (upper half of graph) and Intensity (lower half of graph). Pitch contours for the Russian exclamations resemble the Japanese interrogatives, and Japanese exclamations resemble Russian interrogatives

Japanese listeners have difficulty identifying **interrogatives** even in their native tongue. The angle of the slope rise for **Russian interrogatives** is similar to all three Japanese contours, and therefore Japanese listeners fail to correctly identify this sentence type. **Russian exclamations** are apparently misidentified by the **Japanese** listeners as declaratives because both types have a similar angle of slope and earliest peak for 2-syllable phrases. However, the **Russian exclamations** are correctly identified as **exclamations** for the 3-syllable phrases because the absolute pitch peak is highest for both languages, pitch height being a parameter Japanese listeners frequently rely on. The percentage of correct responses by Japanese listeners is higher for 3-syllable Russian exclamations than for 2-syllables. This may be because 3-syllable phrases have a rise which is the shortest of the three sentential types, in both languages. Recognition was highest for declaratives, which have distinct characteristics in both languages - a gradual pitch rise/fall, low pitch peak.

SUMMARY

The use of phonetic parameters such as pitch, relative/absolute duration, velocity of rise/fall (angle of slope), shape of contour, and devoicing were somewhat different for interrogatives and exclamations, but similar for declaratives, for the Russian and Japanese informant. Interaction of the parameters and listener expectations lead to correct/incorrect perception of the three sentence types. In some cases, numerous parameters were substantially similar for both languages, resulting in high positive/negative transfers for that sentence type. Results indicate that a combination of native language parameters was employed by the subjects to interpret the foreign language.

For instance, the Russian and Japanese informants use similar phonetic parameters to realize sentence types such as declaratives (gradual rise/fall, low peak). Perception tests indicate that this common parameter usage leads to a high rate of accurate recognition for that particular sentence type across languages. On the other hand, infrequently used sentence types such as the Japanese rise-fall-rise interrogative, were not accurately perceived by the Japanese listeners.

Therefore, a combination of phonetic parameters, listener expectations, and native language listening strategies seem to account for the majority of the positive/negative transfers and native language perception observed in this experiment.

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