2aSC10

The Degree of Word-Initial Low Tone in Japanase:

Syntactic Boundaries and Speech Rate

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Goal is to show ..

(i) Word-initial low pitch may be retained in some degree in connected speech, contra previous theoretical studies.

(ii) The degree of low depends on speech rate and the number of syntactic boundaries between the word and the immediately preceding word.

(iii) The phenomena can be explained by syntax-phonology mapping and silent demibeat deletion (Tokizaki 1999, 2006).

1

Previous studies: Word-initial low tone deletion

(1) a. amai 'sweet'
L HH

b. momo 'peach'
L H

(2) amai momo 'sweet peaches'
LHH L H
-> LHH H H (Initial low deletion)

It has been claimed that initial low is assimilated to the high pitch in connected speech (cf. Selkirk and Tateishi 1988).

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Q: Is the word-initial low pitch deleted completely?

A: No.

The word-initial low pitch may be retained in some degree, which depends on ..

(i) speech rate

(ii) the numbers of syntactic boundaries between the word and its immediately preceding word.

(3) momo-to nira 'sweet peach'
L H H LH ->
L H H LH/MidH/HH (initial low may be retained)

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Experiments

Four native speakers of Japanese are asked to read out printed sentences twice at three speech rates: slow, normal, and fast.

The pitch difference between the first and the second mora of the unaccented word is caluculated.

(4) [Momo-to nira-o] … nira
peach-and leek-Acc LH in isolated form

(5) [[Amai momo-to] nira-o] …
sweet peach-and leek-Acc

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Test sentences

(4) Momo-to nira-o yome-ni ageta
peach-and leek-Acc daughter-in-law gave
'I gave my daughter-in-law peaches and leek.'

(5) Amai momo-to nira-o yome-ni ageta
sweet peach-and leek-Acc daughter-in-law gave
'I gave my daughter-in-law sweet peaches and leek.'

Amai 'sweet' modifies *momo* 'peach' only, because *nira 'leeks'* are not sweet: [[*amai momo-to*] *nira*].

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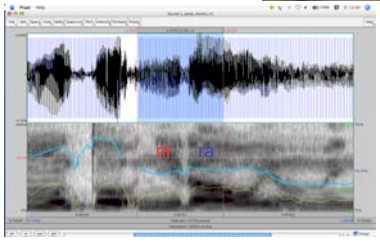
Methods

Speech sounds are recorded (PCM) with SONY Hi-MD Walkman (MZ-RH1) and analyzed with Praat installed in MacBook.



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Pitch difference between the first and the second mora: *momo-to nira-o* (ex. Subject 1)

Subject 1					
rate\pos.	*to*	*ni*	*ra*	*ra-ni*	*ra-ni* av 1&2
slow1	273.58	205.02	206.74	1.72	
slow2	258.02	191.65	194.74	3.09	slow 2.405
normal1	296.43	244.39	241.76	−2.63	
normal2	247.15	204.05	209.87	5.82	normal 1.595
fast1	288.42	237.45	238.93	1.48	
fast2	262.44	224.56	227.43	2.87	fast 2.175

An example of the result (Subject 1). The numbers in *ra-ni* show pitch difference of the first (*ni*) and the second (*ra*) mora, i.e. the degree of initial low. **Initial low is retained in connected speech.**

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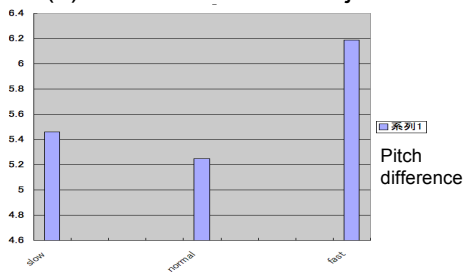
Pitch difference between the first and the second mora: *momo-to nira-o*

Rate\Subj	Subj 1	Subj 2	Subj 3	Subj 4	av 1-4
Slow 1	1.72	3.44	3.85	6	
Slow 2	3.09	3.24	14.65	7.7	
Slow av	2.405	3.34	9.25	6.85	5.4612
Normal 1	−2.63	3.17	2.97	14.51	
Normal 2	5.82	2.91	9.24	5.98	
Normal av	1.595	3.04	6.105	10.245	5.2462
Fast 1	1.48	2.37	5.33	13.97	
Fast 2	2.87	1.29	4.94	17.25	
Fast av	2.175	1.83	5.135	15.61	6.1875

Only Subject 4 shows increasing degree of initial low with increasing speech rate. Subject 4 uses intentional pause before *ni*.

Pitch difference and speech rate (4) *momo-to nira-o*: Subj 1-4



The degree of initial low decreases from slow to normal, and Increases from normal to fast (because of Subject 4).

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Pitch difference between the first and the second mora: *momo-to nira-o*: subj 1-3

	subject 1	subject 2	subject 3	av S1-3
slow1	1.72	3.44	3.85	
slow2	3.09	3.24	14.65	
slow av	2.405	3.34	9.25	4.9983
normal1	−2.63	3.17	2.97	
normal2	5.82	2.91	9.24	
normal av	1.595	3.04	6.105	3.58
fast1	1.48	2.37	5.33	
fast2	2.87	1.29	4.94	
fast av	2.175	1.83	5.135	3.0467

If we exclude Subject 4, we can say that **the degree of initial low decreases as speech rate increases**.

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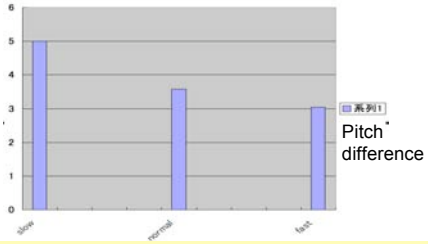
Pitch difference and speech rate (4) *momo-to nira-o*: Subj 1-3



To sum, the degree of initial low decreases as speech rate increases. (Note that Subject 4 is omitted here.)

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Constituent boundary and pitch difference: [[*amai momo-to*] *nira-o*]

subject 1					
	to	*ni*	*ra*	*ra-ni*	*ra-ni* av 1&2
slow1	262.48	192.97	199.38	6.41	
slow2	240.87	192.81	195.66	2.85	4.63
normal1	275.28	216.04	223.22	7.18	
normal2	241.51	204.89	209.54	4.65	5.915
fast1	254.83	215.18	221.89	6.71	
fast2	239.32	200.88	205.91	5.03	5.87

Amai 'sweet' is added to *momo-to 'peach-and'*, making a constituent boundary before *nira 'leek'*. An example of the result (Subject 1).

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Pitch difference between the first and the second mora: [[*amai momo-to*] *nira-o*] S1-4

	Subj 1	Subj 2	Subj 3	Subj 4	av Subj 1-4
slow1	6.41	5.41	5.11	5.79	
slow2	2.85	3.19	4.51	4.64	
slow av	4.63	4.3	4.81	5.215	4.7387
normal1	7.18	5.54	9.09	8.11	
normal2	4.65	7.2	2.3	7.67	
normal av	5.915	6.37	5.695	7.89	6.4675
fast1	6.71	4.98	6.12	9.95	
fast2	5.03	−0.82	9	18.28	
fast av	5.87	2.08	7.56	14.115	7.40625

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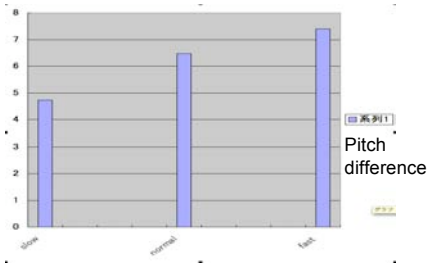
Pitch difference between the first and the second mora: [[*amai momo-to*] *nira-o*] S1-4



Pitch difference increases as speech rate increases. (?!)

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Pitch difference between the first and the second mora: [[*amai momo-to*] *nira-o*] S1-3

	subject 1	subject 2	subject 3	av S1-3
s1	6.41	5.41	5.11	
s2	2.85	3.19	4.51	
average	4.63	4.3	4.81	4.58
n1	7.18	5.54	9.09	
n2	4.65	7.2	2.3	
average	5.915	6.37	5.695	5.993333
f1	6.71	4.98	6.12	
f2	5.03	−0.82	9	
average	5.87	2.08	7.56	5.17

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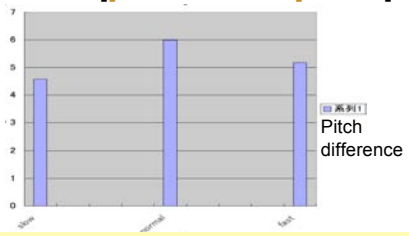
Pitch difference between the first and the second mora: [[*amai momo-to*] *nira-o*] S1-3



Pitch difference is maximum at the normal speech rate.
(Note that Subject 4 is omitted.)
Small pitch difference at the low speech rate might be attributed to mora-to-mora pronunciation.

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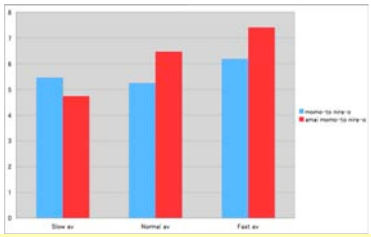
■ [*momo-to nira-o*] vs
■ [[*amai momo-to*] *nira-o*]



Pitch difference is larger in [[*amai momo-to*] *nira-o*] than in [*momo-to nira-o*] at normal and fast rates (but not at slow), which shows the effect of syntactic boundary on pitch.

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Syntax-phonology mapping and assimilation blocking by silent demibeats

(13) Syntax *Spell-Out* Phonetic Form

{ [,] } --> x (silent demibeat)
(cf. Selkirk 1984)

(14) ■ [[momo-to] [nira-o]]
xx momo-to xx nira-o xx
H L H -> H M H
2 demibeats does not block assimilation to H

■ [[[amai] [momo-to]] [nira-o]]
xxx amai xx momo-to xx nira-o xx
H L H
3 demibeats block assimilation to H

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More silent demibeats are deleted as speech rate increases

(15) Delete *n* silent demibeats between words.
(*n*: a natural number corresponding to rate)

(16) [[momo-to] [nira-o]]

Slide 11 is explained.

xx momo-to xx nira-o xx (slow: *n*=0) (H L H -> H M H)

x momo-to x nira-o x (normal: *n*=1) (H L H -> H M/H H)

momo-to nira-o (fast: *n*=2) (H L H -> H H H)

[[[amai] [momo-to]] [nira-o]]

xxx amai xx momo-to xx nira-o xx

The same is expected but see Slide 16. Life is not that simple …

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Conclusion

- Word-initial low tone may be retained in some degree in connected speech.
- Low tone becomes higher as the speech rate increases.
- Low tone does not become higher if it immediately follows a constituent boundary.
- These phenomena can be explained by the bare mapping (Tokizaki 1999, 2006).

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