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The production of French continuation contours at different prosodic boundaries by Japanese learners

Rachel Albar, Hiyon Yoo

Université de Paris, UMR 7110-LLF

rachel.albar@univ-paris-diderot.fr, yoo@linguist.univ-paris-diderot.fr

Abstract

This study investigates the realisation of continuation contours at French prosodic boundaries by Japanese learners in read speech. We asked 17 Japanese learners to read small excerpts of text and analysed their productions.

Our results show that although Japanese learners are globally able to correctly produce rising contours when expected, variability remains and some of the learners produce a large percentage of low tones at prosodic boundaries usually realised with a rising contour. Furthermore, unlike native speakers, they do not differentiate prosodic levels in their production of duration and F0 prosodic cues. While native speakers produce a longer vowel and a greater F0 rise at intonational phrase (IP) than at accentual phrase (AP) boundaries, we do not observe a similar pattern in Japanese learners: they produce an equivalent continuation contour at all boundaries.

Results also show that learners tend to produce less lengthening of the accented vowel and a smaller F0 rise than native speaker at the prosodic levels above the AP. This result is unexpected with regards to previous studies which have found the presence of extra-rising contours in L2 production, indicating that further research on learners' prosodic interlanguage is still needed.

Index Terms: L2 prosody, French, Japanese learners, prosodic boundaries, reading task

1. Introduction

French is usually described as a language with at least two prosodic levels above the word, which are AP (accentual phrase) and IP (intonational phrase) (see among other, [1], [2], [3]). Continuation contours occur at the prosodic boundaries of these prosodic levels in non-final position and usually correspond to a rise of F0 and a lengthening of the last syllable. However, these contours can be produced as low tones (L*) for phonotactic and dependency constraints ([4], [5]). The production of the acoustic correlates of continuation contours also depends on the prosodic level. More specifically, continuation contours occurring at IP boundaries will be produced with a greater rise in F0 and more lengthening of the phrase-final syllable than contours produced at AP boundaries. This distinction has been observed by Delattre [6] who classified these contours into two categories: 'minor continuations' and 'major continuations'. Another prosodic level which is situated between AP and IP, the intermediate phrase (ip), has been integrated into some recent intonational theories ([7], [8]). This prosodic level is associated with a preboundary lengthening which is shorter than than that of IP but longer that of AP, and a partial pitch reset. [8]. However, this level in French prosodic hierarchy is still controversial and some authors argues that this level's specificities are similar to IPs' and that it only represents a phonetic variant of the IP [9]. We chose to integrate this level and differentiate it from IP level, even if we do not intend to confirm the existence of this phonological level in our study.

While French can be described as a 'boundary-language' [10], Japanese is described as a pitch-accent language and, unlike French, it does not associate its prosodic boundaries with rising contours. Japanese prosodic structure consists of APs and IPs: the AP carries the tonal accent and the IP is mostly characterised by downstepping. Moreover, in Japanese, each AP generally ends with a low tone (L%) ([11], [12], [13]). Rising contours named Boundary Pitch Movements (BPM) can occur at prosodic boundaries, especially in spontaneous speech, but they only contribute to the pragmatic interpretation of utterances and do not have any phrasing function ([14], [15]). These boundary pitch movements can, for example, be used as a turn-holding cue. Interestingly, it also has been shown that French major continuation contours have a similar interactional function in spontaneous speech [16].

In this paper, we propose to analyse how learners of a new language manage the two different phonological systems when they produce continuation, i.e., how do Japanese learners produce French continuation. During the language learning process, we know that L1 plays an important role and production can be partly explained by negative and positive transfer [17]. But it has been shown that language transfer alone cannot explain all the specificities of L2 interlanguage. Other universal patterns or strategies such as overgeneralisation of the target language's linguistic material seem to be shared with learners from different language backgrounds ([17], [18], [19], [20]). Santiago [21] showed that Spanish learners produce extra-rising contours at French IP boundaries even though it cannot be seen as resulting from an L1 transfer. He concludes that this form could either be an expression of linguistic insecurity or a default prosodic pattern, and questions if this may be a universal pattern in L2 French. Since French and Japanese phrasing greatly differ from each other and negative transfers can occur from L1, we can wonder if Japanese learners are able to produce rising contours at French prosodic boundaries and are able to accurately distinguish the type of contours depending on the prosodic levels in their production of the prosodic cues.

Our first hypothesis is that Japanese learners will produce fewer rising contours than native speakers because of a negative transfer from their L1 and the fact that Japanese prosodic boundaries are associated with a low tone (L%) in read speech. When rising contours are produced, we predict that their production of lengthening and F0 rises will differ that of native speakers. If we consider previous studies of Spanish learners' production, we also expect that some patterns will not be directly explained by transfer and that if learners do produce continuations, they will produce extra-rising contours at IP boundaries. Finally, we believe that learners are able to learn these prosodic features and that learners with higher proficiency levels will show results closer to native productions.

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2. Methodology

2.1. Materials

For our experiment we used four excerpts of texts from the COREIL corpus [22], which is an oral learner corpus that has been specifically designed to study the acquisition of phrasal phonology and intonation in French as a foreign language. The texts were about 50 words long each (43 to 58 words) and allow to observe all types of continuation contours in a variety of syntactic structures.

2.2. Participants

17 Japanese learners of French participated in the experiment. They were all students in Tokyo, aged 19 to 28 and none of them had lived in a French-speaking country for more than one month. Learners were divided into three proficiency levels following the number of French classes they had followed: a beginner group (A1-A2, N=2), an intermediate group (A2-B1, N=10) and a more advanced intermediate group (B1-B2, N=5). We also analysed data from five French native speakers from the COREIL corpus (see [23]) who were recorded in Paris as a control group.

2.3. Procedure

Participants were recorded in a soundproof room. They were asked to prepare and read the texts before being recorded. Participants controlled the pace of the experiment. The duration of the experiment was about 7 minutes long.

2.4. Data analysis

The data was first automatically segmented with SPPAS [24] and then corrected in Praat [25]. We also annotated different levels of prosodic boundaries in the corpus: 0 (no boundary; for example, between a clitic and a noun), 1 (lexical-word boundary, i.e., prosodic word PW), 2 (AP), 3 (ip), 4 (IP). We obtained a total of 115 occurrences (15, 22, 53, 13, and 12 respectively for each prosodic boundary) and we classified them as 'items'. We extracted the speech rate per sentence, the vowel duration and F0 values at different percentages of the vowel with Praat scripts. We calculated the F0 difference between the accented vowel at prosodic boundaries and the preceding vowel (F0 values at 75% of the vowel). We then annotated if a rising contour was produced or not for each prosodic boundary; criteria were that rising should be audible and that the difference in F0 exceeds 1 semitone. Hesitations were also manually annotated in another tier then excluded from the duration analysis, as well as creaky voice for the F0 analysis.

3. Results

In French, as discussed in section 1, phrasing is linked to the strength of continuation contours, which does not occur in Japanese phrasing. We predicted that Japanese learners would produce fewer rising contours than native speakers. If they produce rising contours, we predicted they would not able to distinguish the different prosodic boundaries, and that they will always produce similar contours. Since it has been observed in previous studies, we also expect learners to produce extra-rising contours. We will first present general results on the quantity of rising contours produced. Then we will present F0 and duration analysis and the vowel ratio of the accented vowel.

3.1. General results: rising contours

Except for beginners, Japanese learners produce the same amount of rising patterns as native speakers (see Fig.1): they are able to produce more rising contours at higher boundary positions (AP, ip and IP) and to produce fewer rising contours at weaker prosodic positions (no boundary and PW boundary). We used a Generalised Mixed Model (GLMM) with rising (1) or non-rising (0) as the binary variable, an interaction between proficiency and prosodic boundary as fixed effects, item and subject as random intercepts. The interaction between proficiency and prosodic boundaries was significant ($\chi^2(12) = 47.71$, $p < .001$***). For further analysis of the interaction we used the package *emmeans*. The model confirmed that there was no significant difference between A2-B1 and B1-B2 learners and native speakers, except at ip boundaries where A2-B1 learners produced fewer rising contours. Beginners produced fewer rising contours than native speakers at AP and IP boundaries.

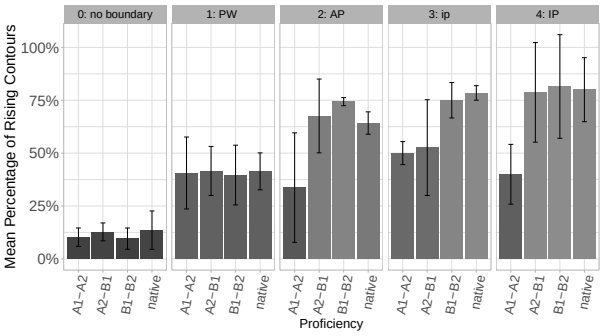

Figure 1: *Mean percentage of rising contours per proficiency and prosodic boundary. Error bars represent standard deviation from the mean*

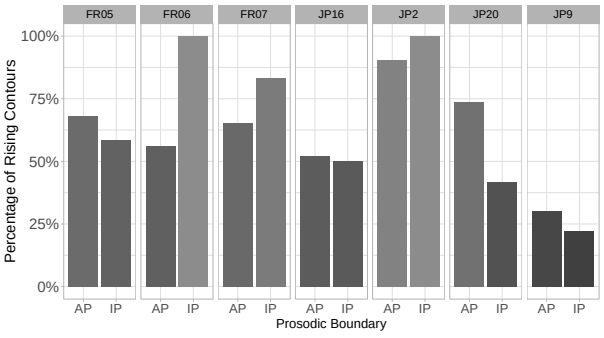

Figure 2: *Mean percentage of rising contours at AP and IP boundaries for some subjects*

We also observe a lot of variation between the speakers (see Fig.2). Native speakers tend to produce more rising contours at IP than AP boundaries but it is not the case for speaker FR05. They always produce a majority of rising contours (56 to 69% for APs and 58 to 100% for IPs). However, we observe different strategies in learners:

1. two learners produced less than 30% rising contours in both conditions (example in Fig.2: JP9).
2. two learners produced 50 to 55% rising contours in both conditions (example in Fig.2: JP16)

3. one learner produced less than half of the contours as rising only at IP boundaries (JP20)

4. the rest of the learners (12 learners, in A2-B1 and B1-B2 groups) produced a high percentage of rising contours with a percentage range even higher than native speakers' (71 to 90% for APs and 75 to 100% for IPs)

Learners using strategies 1 and 2 were either in the A1-A2 or A2-B1 proficiency group. It seems that even though there is not a general tendency of learners producing less rising contours than native speakers, we do observe speaker-dependent strategies as some learners productions are characterised by a very low percentage of rising contours. These strategies seems to be more frequent in the beginner and intermediate groups and may indicate that learners tend to produce less rising contours at the earliest stage of acquisition. But, since we only had two learners in the beginner group, we do not have enough power to generalise these observations.

3.2. F0 rise

When subjects produced a rising contour, we observe that native speakers differed from learners by producing a greater F0 rise at IP boundaries than AP and ip boundaries (see Fig 3). We used a Linear Mixed Model with F0 difference as the dependent variable, and an interaction between proficiency and prosodic boundary as fixed effects, item, subject and vowel as random intercepts. The interaction between proficiency and prosodic boundary was significant ($\chi^2(12)$=34.09, p<.001***). Again, we used the *emmeans* package to analyse the different contrasts in the interaction. The results confirmed that there was not a significant difference between the three AP, ip and IP levels for all groups of learners, while French native speakers distinguished IPs from APs (p<.001***) and from ip (p = .015*). However, there was no significant difference between AP and ip boundaries.

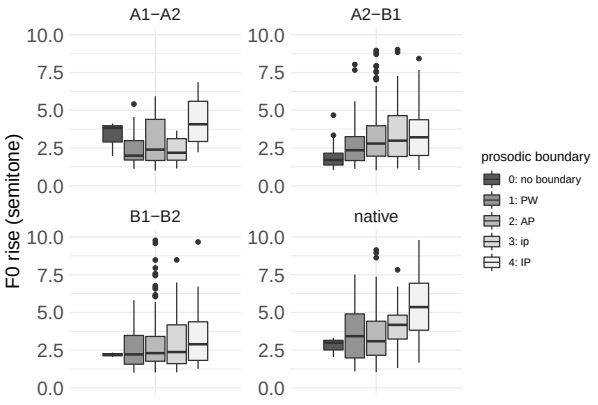

Figure 3: *Boxplot of F0 rise in semitones at prosodic boundaries by proficiency and boundary*

In Figure 4 we present the F0 rises in some speakers at AP and IP boundaries. We can observe that all native speakers clearly distinguished the two levels (FR05 production being the least clear distinction with overlapping boxplots). Only four learners showed a pattern approaching that of native speakers (examples in Fig 4: JP16, JP24) and the rest of them produced a similar rise at both prosodic positions (example in Fig 4: JP26).

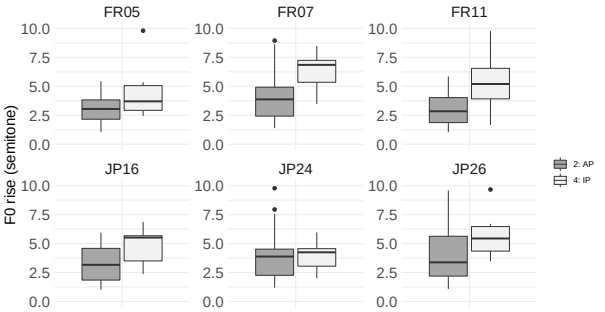

Figure 4: *Examples of speakers' F0 rise productions at AP and IP boundaries (top: native speakers, bottom: learners)*

Proficiency did not have an influence on the pattern produced by learners.

We also expected learners to produce extra-rising contours but we did not observe this strategy in our data. On the contrary, learners tend to produce smaller F0 rises than native speakers, especially at IP boundaries where native speakers' rises (M = 5.5 st) are significantly larger than A2-B1 (M=3.4 st, p=.001**) and B1-B2 learners' (M = 3.4 st; p=.006**). The difference between native speakers and A1-A2 learners (M=4.3 st) was not significant but can be explained by the lack of power of the statistical analysis, since we only had two persons in this proficiency group.

3.3. Vowel duration

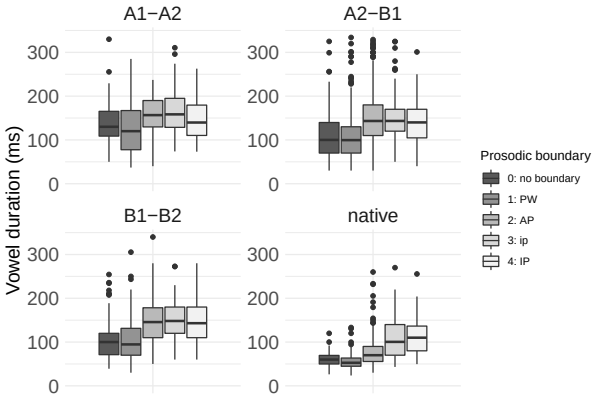

Figure 5: *Boxplot of the vowel duration at the last syllable in milliseconds by proficiency and prosodic boundary*

As we can see in Figure 5, learners tend to produce longer vowels at strong prosodic boundaries (AP, ip, IP) than at weak prosodic boundaries (no boundary, PW). But, similarly to the F0 rise results, we observe that learners do not distinguish the different prosodic levels and they seem to produce the same lengthening in all the cases. We used a Linear Mixed Model with duration as the dependent variable, speech rate per phrase and an interaction between proficiency and prosodic boundary as fixed effects, item, vowel and subject as random intercepts. The interaction between proficiency and prosodic boundary was significant ($\chi^2(12)$= 63.31, p<.001***). Further analyses of the contrast of the interaction with *emmeans* confirmed that native

speakers produced significantly longer vowels at ip (p<.004**) and IP (p=.019*) boundaries than at AP, and that it was not the case for the learners.

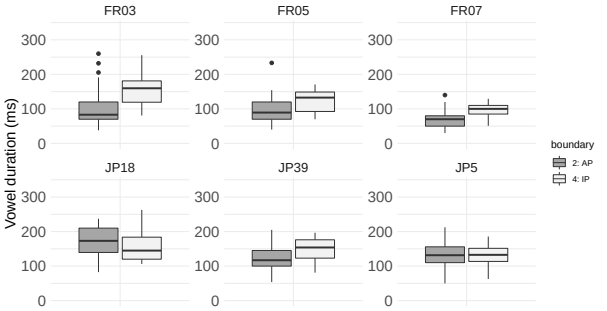

Figure 6: *Examples of accented vowel durations at AP and IP boundaries in some subjects (top: native speakers, bottom: learners)*

In Figure 6 we present the accented vowel duration at AP and IP boundaries in some speakers. Similarly to the F0 rise results, all native speakers distinguished the two levels (again, this distinction was the least clear for FR05). For learners, we observe three different patterns: two learners show a pattern comparable to native speakers' with a longer vowel at IP than AP (example in Fig 6: JP39), five learners produced a reverse pattern with longer vowel at AP than IP (example in Fig 6: JP18) and the rest of them produced a similar rise at both prosodic positions (example in Fig 6: JP5). Proficiency seems to have no influence on the type of pattern produced.

3.4. Vowel ratio

Duration results presented in 3.3 show that learners do not distinguish AP, ip and IP boundaries and produce a similar lengthening of the accented vowel for all three levels. The accented vowel (boundaries 1,2,3,4) / non accented vowel (0, no boundary) duration ratio is presented in Fig. 7.

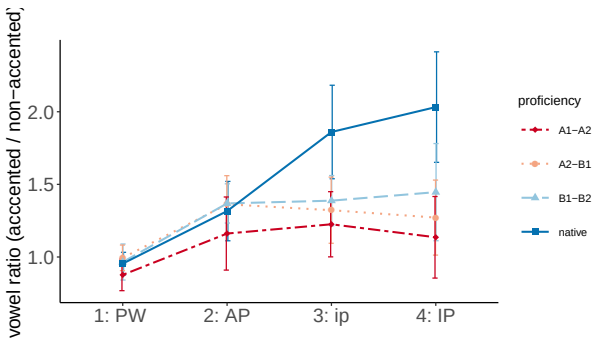

Figure 7: *Mean accented/non-accented vowel ratio by proficiency and prosodic boundary - Error bars represent standard deviation from the mean*

We observe that learners present a very different pattern to native speakers: they produce as much lengthening as native speakers at the prosodic word and AP boundaries but for the higher prosodic levels (ip and IP boundaries) they clearly produce less lengthening of the vowel. Learner's accented vowel duration at AP, ip and IP boundaries are not statistically different (see 3.3) and we are now able to see that the vowel duration ratio correspond to that of native speakers at AP boundary. This means that in comparison to native speakers, learners produce a lengthening comparable to native speakers at AP boundaries but they do not lengthen the accented vowel enough at ip and IP boundaries. However, it needs to be noted that Japanese learners had a significantly lower speech rate than native speakers and we do not know to what extent speech rate may influence syllable lengthening at prosodic boundaries, or if the vowel ratio observed remains the same for native speakers with a low speech rate.

4. Conclusion

The findings reported in this study suggest that, contrary to our first hypothesis, Japanese learners do not suffer from negative transfer from their L1 and are generally able to produce rising contours when expected. Thus, we observe variability and some learners produce a very low rate of rising contours. We only observed this strategy in the two first proficiency groups (A1-A2, A2-B1), meaning that it may be a pattern most used by beginners than more advanced learners. However, these observations cannot be generalised because we only had two learners in the beginner group (A1-A2), mainly because the beginners we asked to participate in this production experiment (which included other tasks from the COREIL corpus as image description or interview) were not confident enough to accept to be recorded.

Even if a majority of the learners were able to produce rising contours, we observed difficulties in their realisation. The Japanese learners seem not to be able to differentiate the contours at different prosodic boundaries in their production of prosodic cues (duration and F0 rise). They tend to produce the same type of continuation contour at AP, ip and IP boundaries while native speakers produce longer vowels and greater F0 rises at strongest prosodic boundaries. This result is consistent with previous work showing that Japanese learners are not able to perceive the different prosodic levels in French. [26]

Our hypothesis concerning the presence of extra-rising contours at IP boundaries has not been confirmed: we even observed an opposite trend since learners tended to produce smaller F0 rises at IP boundaries than native speakers. The same observations have been made for vowel ratio which was smaller for learners than for native speakers at ip and IP boundaries, meaning that their lengthening of the accented vowel was smaller at these prosodic positions.

We know that Japanese prosody differ between read and spontaneous speech and that boundary pitch movements can occur at prosodic boundaries in the latter. Furthermore, these prosodic movements share similar interactional functions with French continuation in discourse. The present study having only investigated read speech, further work needs to be done to establish whether the same results can be observed in spontaneous speech.

5. Acknowledgements

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