The Prosodic Effects of VP and Embedded CP Boundaries in Japanese

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Research on the syntax-phonology interface (e.g., Selkirk 1984, Truckenbrodt 1995, et seq) has suggested that syntactic information (constituents or operations) is visible in phonology. E.g., Selkirk and Tateishi (1991), looking at patterns in downstep in Japanese, propose that the left edges of maximal projections of syntactic categories (XPs) are mapped onto the left edges of the Major Phrase boundaries. Kubozono (1989) shows that the prosody is different between phrases in left-branching and right-branching structures. Ishihara (2003) argues that each time there is syntactic Spell-Out at certain phrases (e.g., CP), the prosody is derived, and this operation is repeated cyclically until the last Spell-Out. Sugiyama (2012) argues that syntactic movements result in different prosodic phrasing than structures without movement. All these works support the hypothesis that if the syntax is different, the prosody may be different as well.

In this study, we investigate this hypothesis in (Tokyo) Japanese with two nodes that are relatively high in the clausal syntax, i.e., (a) an embedded CP and (b) a boundary between the subject NP and predicate VP. Our results suggest that the former does not affect the prosody, while the latter does. Thus, while the syntax actually matters to the prosody, not all types of syntactic information are relevant. Furthermore, we test the perception of these production results and find that the prosodic differences are not noticeable to listeners.

In testing whether the presence of an embedded CP affects prosody, we used three pairs of sentences, (1)-(3). Each pair has the same phonological lengths (counted by moras) and word accent patterns (apostrophes indicate word accent), but they differ in their syntax: sentences in (a) have an embedded CP with the complementizer *-to* (Saito 1987), while those in (b) do not.

(1) a. [a'ni-wa [hana'-to]$_{CP}$ itta.] b. [a'ni-wa hana'-o utta.]
brother-TOP flower-COMP say-PAST brother-TOP flower-ACC sell-PAST
'My brother said flower.' 'My brother sold flowers.'

(2) a. [a'ni-wa [hana-to]$_{CP}$ itta.] (hana 'nose') b. [a'ni-wa hana-o utta.]

(3) a. [a'ni-wa [kariforunia-to]$_{CP}$ itta.] (kariforunia 'California') b.[a'ni-wa kariforunia-o utta.]

(1) and (2) differ in terms of the accentuation on the second noun; in (1), *hana'* 'flower' has accent on the last syllable, while in (2), *hana* 'nose' is unaccented. We also consider the word length: (1) and (2) have the two-mora words *hana'/hana*, while (3) has a longer (six moras) word, *kariforunia* 'California'. According to Ishihara's (2003) proposal, the items in each pair are expected to have different prosodies, since he proposes that once a CP is generated, the prosody applies to that phrase; our pair sentences are expected to be pronounced differently.

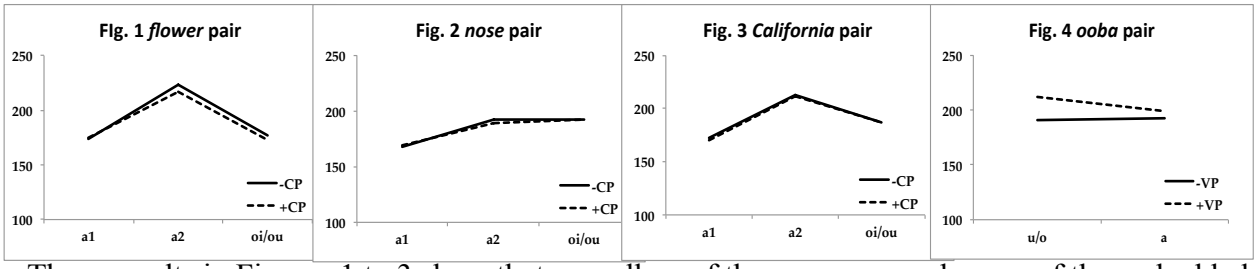
In order to test about the boundary between the subject NP and predicate VP, we used (4), the *ooba* pair: (4a) does not have any syntactic boundary within the six-mora window in *kariforunia*, whereas (4b) has a boundary between the subject NP (*kore*-ga) and predicate VP (*ooba*).

(4) a. [a'ni-wa [[ ]$_{NP}$ [kariforunia]$_{VP}$-to] itta.] (=(3a))
b. [a'ni-wa [[kore-ga]$_{NP}$ [ooba]$_{VP}$-to] itta.]
brother-TOP this-NOM ooba herb-COMP said 'My brother said this was ooba herb.'

Again, if it is only the phonological length and word accentuation that are important in the phonological phrasing, the prosody in this pair would be the same, since the accentual representation is the same (unaccented during the six-mora window; the initial lowering would be, and in fact was among our speakers, blocked in *ooba* as the first syllable is heavy, in which case the word would begin with a H tone); if this particular syntactic boundary should be realized in the prosody, these sentences would be pronounced with different prosodies.

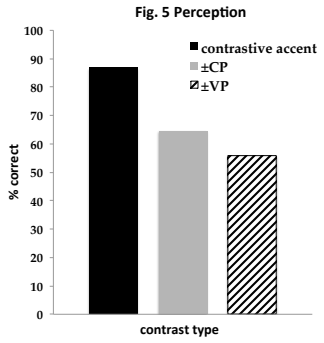
Six speakers pronounced the above seven sentences eight times. In examining the prosody, we used the pitch of three vowel portions that occurred in the same position in the pair and compared (e.g., [a'ni-wa [hana'-to]$_{CP}$ itta.] vs. [a'ni-wa hana'-o utta.]; [a'ni-wa [kariforunia-to]$_{CP}$ itta.] vs. [a'ni-wa kariforunia-o utta.]). We took the means of the fundamental frequencies (f0) to represent the pitch. We compared the f0s of the three vowel portions in each pair by performing liner mixed-effects analyses, using R (ver. 3.1.2) and *lme4* and *lmerTest* packages. We entered the speaker and repetition into the model as random effects and vowels as fixed effects.

The pairs in (1), (2), and (3) did not differ in terms of the pitch, but the pairs in (4) did differ. Figures 1 to 4 give the mean f0s as estimated from the linear analyses for (1) to (4) respectively: the lines in each pair run almost identically in Figures 1 to 3, but are farther apart in Figure 4.



These results in Figures 1 to 3 show that regardless of the presence or absence of the embedded CP, the pitch as examined in this study did not differ so long as the phonological information, in particular the word accentuation and the length, is the same in the sentences. This indicates that a CP boundary (and other syntactic boundaries that may differ in the pairs) may not be interpreted to surface prosodically. Recall that this is not expected from Ishihara's (2003) proposal.

On the other hand, the boundary between the subject NP and predicate VP is explicitly reflected in prosody. In Figure 4, the f0 declines from the vowel *u* to *a* in *kariforunia*, which can be interpreted as the natural lowering in the pitch, i.e., declination, whereas in the *ooba* sentence, f0 slightly ascends from the vowel *o* to *a* in *kore-ga ooba*, with a boundary between the subject NP and predicate VP before *o*. We propose that this particular syntactic boundary is strong and unavoidable in prosody, unlike the other XP boundaries, and thus the declination cannot continue across it. This result is along the lines of Selkirk and Tateishi (1991), who propose that in Japanese, a Major Phrase boundary is inserted at the left edge of an XP. *Kariforunia* does not have an XP boundary before *ru* and thus the declination continues throughout the word, whereas *korega ooba* does have the boundary before *o* and so such declination cannot continue across the boundary.



We next tested if the pairs in (1) to (4) are distinguishable to the listeners. For each pair, we extracted the pitch, removing the segmental information, and asked 60 participants to choose which item in the pair they heard. We also included control pairs where the syntactic structure is the same but they differ in the accent (e.g., (1a) vs. (2a)). The results (Fig. 5) show that pairs in (1), (2), and (3) are not identifiable; the listeners answered at nearly chance level (middle bar); this is expected, since the pitch curves do not differ in the stimuli (Figs. 1-3). However, they could not distinguish the *ooba* pair either, in which the pitch curves do reflect the syntactic differences (Fig. 4). This indicates that the syntactic differences that the speakers encode in pitch may not be noticeable for the listeners.