Downstep in Japanese revisited: Lexical category matters

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It has been widely acknowledged that an F0 after an accented word is noticeably lower than after an unaccented word in Japanese (i.e., downstep) (Poser, 1984; Kubozono, 1989; Pierrehumbert and Beckman, 1988). In pursuing research concerning the syntax-phonology interface, Selkirk and Tateishi (1991) call attention to the lack of downstep at the left edges of maximal projections of syntactic categories (XPs), and propose that the left edges of XPs are mapped onto the left edges of the major phrase boundaries that block downstep. More interestingly, they compare two lexical categories: adjectives (A) and nouns (N) ([A₁ [A₂ N]] vs. [N₁ [N₂ N₃]]), and report that downstep occurs only in A₂, not in N₃. Based on this observation, Selkirk and Tateishi claim that N₃ is at the left edge of a maximal projection NP, whereas [A₂ N] does not constitute a maximal projection.

Testing the effect of different lexical categories on downstep is an important line of research, as the distinction between different categories is frequently ignored in the literature on Japanese downstep. However, Selkirk and Tateishi’s diagnostic is rather syntagmatic in that the mean F0s of two adjacent phrases are compared within a single utterance. Traditionally, the presence or absence of downstep has been tested paradigmatically by comparing the pitch peaks of targets following accented and unaccented words. Therefore, a more strictly controlled paradigmatic investigation is needed to confirm the probable influence of lexical categories.

This study investigates the effect of lexical categories, particularly N and A, both paradigmatically and syntagmatically. Two sets of utterances are used, each of which having two test sentence pairs: (1) APs and (2) NPs. Each of these pairs has the same phonological lengths and right-branching structures [X [X X]]. The two sentences in each pair differ in terms of accentuation on the triggers of downstep; words indicated by underlines in (a) are accented (A), while those in (b) are unaccented (U). Apostrophes indicate accented moras. The F0s of triggers and targets in the accented conditions (1a & 2a) are compared for syntagmatic diagnostics, whereas the F0s of targets in each pair (1a vs. 1b and 2a vs. 2b) are compared for paradigmatic examination. By testing how the accentness of triggers affects the F0s of targets, the presence or absence of downstep can be diagnosed paradigmatically.

(2) a. a'ni-wa no’mo-no na’ra-no mame’-o utta.
brother-TOP Nomo-GEN Nara-GEN bean-ACC sell-PAST

‘My brother sold Nomo’s beans from Nara.’

b. a’ni-wa ono-no na’ra-no mame’-o utta.
brother-TOP Ono-GEN Nara-GEN beans-ACC sell-PAST

‘My brother sold Ono’s beans from Nara.’

Six speakers read eight target sentences together with ten fillers eight times. The participants were asked to read the lists at a comfortable speed. A total of 384 tokens were analyzed (2 sets*2 categories A, N*2 accent patterns A, U*6 speakers*8 repetitions). In examining prosody, the maximal and mean F0s of each phrase (separated by spaces in (1) and (2)) were measured; linear mixed-effects analyses were performed using R version 3.1.2 and the lme4 and lmerTest packages. The speaker, item, and repetition were entered into the model as random effects (slope and intercept for speaker, and intercept for the rest).

To test the influence of lexical category (A vs. N) on downstep syntagmatically, A and N were compared using pitch differences between the first phrase (topic as a reference) and the third (targets).
The results (see Figure 1) failed to reveal any significant differences between A and N (max F0: $t = -0.744, p = 0.5082$; mean F0: $t = -1.006, p = 0.3986$). Both categories involving accented targets (Adj_A & N_A) exhibited extremely similar max and mean F0s.

![Figure 1. Max and mean F0s of the four conditions (2 categories x 2 accentuatedness) (speaker RA)](image)

Thus, the mean F0 differences found in Selkirk and Tateishi, which were dependent on lexical category, were not replicated. It is unclear how to account for this discrepancy, but it could be attributable to the small data set that they used, as their materials consisted primarily of consecutive Ns; moreover, no quantitative results were provided for the distinct lexical categories. The present study determined that syntactically, N_2 in the [N_1 N_2 N_3] structure is downstepped in the same way as A_2 in [A_1 [A_2 N]].

Concerning the paradigmatic comparisons, A and N did indeed differ. The F0s of targets between the accented and unaccented tokens for A and N were compared individually, thereby revealing that the unaccented targets (Adj_U & N_U) yielded quite different F0s depending on their lexical category (see Figure 1). In N, both the max and mean F0 of the unaccented N (N_U) was quite higher than that of the accented counterpart (N_A), therefore indicating the presence of downstep. This difference reached statistical significance (max F0: $t = 4.934, p = 0.00365$; mean F0: $t = 4.908, p = 0.00363$). Hence, downstep does occur in N.

In contrast, no appreciable differences were found between unaccented and accented adjectives (Adj_U vs. Adj_A). In A, there was no significant difference between the max F0s in targets with accented and unaccented triggers ($t = 1.139, p = 0.30632$). If the mean F0 is inspected more closely, the aforementioned targets are only marginally different ($t = 2.657, p = 0.045074$). That is to say there is no downstep in A, at least based on a traditional understanding of the phenomenon (i.e., in terms of max F0s in a paradigmatic fashion).

This result from the paradigmatic diagnostics reveals that distinct lexical category does in fact influence the presence or absence of downstep in Japanese. Furthermore, the occurrence of downstep in the N condition casts doubt on Selkirk and Tateishi’s generalizations concerning the syntax-phonology interface. As mentioned earlier, they argue that in Japanese major phrase boundaries are inserted at the left edges of XPs. Given that major phrase boundaries block downstep, a pitch reset rather than a downstep is expected in this structure. Instead, this study’s results suggest that a new approach is necessary that is capable of accounting for a fuller range of data. Moreover, this research has an important implication regarding the methodology of Japanese phonology. In testing downstep, sentences are commonly used without considering the difference between A and N. However, these results indicate that F0s are affected by the lexical category of materials, suggesting that lexical category should be carefully controlled in the study of Japanese downstep.

References