

Lexical category in downstep in Japanese

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ABSTRACT

It has often been found that syntactic structure is referred to in phonology (e.g., [1, 2]). This claim has been tested, for example, in downstep in Japanese ([6]), wherein accented phrases are lower-pitched after an accented phrase within the domain of a major phrase ([3, 4, 5]). Considering, in particular, the finding in the literature that syntactic category has an effect on this process ([7, 8, 9]), we conducted a production experiment testing nouns and verbs modifying a noun and nouns in the predicate VP. Downstep occurs in all of them. Putting these together, adjectives in the attributive use may block downstep, whereas those in the predicative use as well as nouns and verbs in either use do not. We propose an explanation that takes into account the function of downstep and natural ordering of adjectives in attributive modification.

Keywords: downstep, Japanese, prosody, syntactic category

1. INTRODUCTION

In the literature on syntax-phonology interface, it is often found that syntactic structure is visible in phonology, especially in prosody (e.g., [1], [2], et seq.). Downstep in Japanese, where accented accentual phrase triggers the following accentual phrase to be on a lower-pitched register (e.g., [3], [4], [5]), offers an excellent place from which to test the claim, because it is a phrase-level prosodic process. For example, the boundary between the subject and predicate VP [6] and the left edge of a maximal projection of an XP [7] were found to (variably) block downstep. Additionally, certain syntactic categories have been argued to be involved in the application; [7] reports that NPs block downstep whereas APs do not, although the opposite results are reported in [8]. At the same time, not all syntactic boundaries are referred to in downstep. For example, relative clause boundaries do not block it ([9]).

In this paper, considering the findings in the literature ([7], [8], [9]), we further investigate the effect of syntactic categories on downstep. In particular, we focus on verbs and nouns. The results suggest that they do not block downstep. After

considering all the results in the literature ([8], [9]), we will propose that it may not be the syntactic category in itself but rather the consequences for the semantic interpretation of a particular category in a particular syntactic position (attributive) that may block downstep.

We review the relevant studies in §2, then present our experiment in §3. Then, we discuss with past results in §4. Finally, §5 provides a brief summary.

2. LITERATURE ON SYNTACTIC CATEGORY AND DOWNSTEP

Lexical categories have been argued to affect downstep in Japanese. For example, adjectives (A) and nouns (N) are compared in [7] in structure [A₁ [A₂ N]] vs. [N₁ [N₂ N₃]]: downstep occurs only in A₂, not in N₂.¹ In [8], which increases the number of speakers and follows the more traditional definition of downstep found in the Japanese literature (see note 1), the opposite pattern is found: downstep occurs in N₂ but is blocked in A₂.

The finding in [8] that adjectives block downstep whereas nouns do not may be explained if we assume that (attributive) adjectives, being inflected for tense, project relative clauses whereas nouns (modifying other nouns) do not in Japanese ([10]). [9] tested the hypothesis that relative clause boundaries block downstep by using the past tense forms of adjectives and verbs: [[V_{PAST}]_{RC} [A_{PAST}]_{RC} N]_{NP} vs. [[V_{PAST}]_{RC} [V_{PAST}]_{RC} N]_{NP}. If the hypothesis was correct, downstep would be blocked in both of these, at the second relative clauses that house A and V, respectively. [9] also tested A and V in predicative position, that is, without involving the relative clause boundary: N-ga A vs. N-ga V (-ga is a nominative marker). If the hypothesis was correct, downstep would occur in A and V, because there was no relative clause boundary here. Downstep occurred in both A and V conditions regardless of the presence or absence of the relative clause boundary, suggesting that this particular type of syntactic boundary does not block downstep. Note that adjectives overall did not block downstep in [9] unlike in the results in [8]. However, importantly, interspeaker variation is noted in [9] for the A condition involving the relative clause, as opposed to the N condition in the same structure, for which

the results were more robust (see [9] for details of the interspeaker variability).²

To recapitulate the results in [8, 9], summarized in Table 1, among the categories examined (in particular syntactic conditions), adjectives in their attributive use may block downstep. The results also suggest that more research is necessary in order to fully understand the role of the syntactic category in downstep in Japanese.

Table 1: Presence (√) and absence (X) of downstep in [8, 9].

	Noun	Adjective	Verb
Nonpast	√ ([8])	X ([8])	
Past (in RC)		√/X ¹ ([9])	√ ([9])
Predicative		√ ([9])	√ ([9])

¹ Interspeaker variation noted.

3. EXPERIMENT

In this paper, we fill the missing possibilities in Table 1 so that we can discuss the category effect in general, which we will do in §4. In particular, we investigate in a production experiment whether downstep occurs in nouns with the copula in the past tense, modifying a head noun, verbs in nonpast tense forms modifying a head noun, and nouns in the predicate VP. We first discuss the methodology, including our test sentences (§3.1) and details of recording and measurements (§3.2). We report the results in §3.3, where we will show that downstep occurred in all the conditions examined in the experiment.

3.1. Test sentences

The test phrases used in the experiment are given in (1) to (3). The acute accent indicates a lexical accent. Phrases in (1) and (2) are noun phrases as a whole. In phrases in (1a) and (2a), the second noun (1a) and verb (2a) are the target of downstep.³ The target noun in (1a) is with the copula in the past tense form and the target verb in (2a) is in the nonpast form. If downstep occurs, the pitch of those target phrases in (1a) and (2a) would be lower than the pitch of the target phrases in (1b) and (2b), respectively, where the trigger phrases are unaccented and thus the target is not in the downstep environment. (3) gives a different syntactic structure for the target noun than in (1) and (2); it is used predicatively, whereas the targets in (1) and (2) are in the attributive position in the sense that they modify the head noun. If downstep occurs in (3a), the pitch of the target noun would be lower than the pitch of the target noun in (3b), which is not in the

downstep environment because of the unaccented phrase in the trigger position.

- (1) *Trigger* *Target* *Head N*
a. *nayán-da* *damé datta* *mago*
worry(V)-PAST no good(N) was grandchild
‘(my) grandchild who worried and that was no good’
b. *manan-da* *damé datta* *mago*
study(V)-PAST no good(N) was grandchild
‘(my) grandchild who studied and that was no good’
- (2) *Trigger* *Target* *Head N*
a. *mayó-u* *nayám-u* *mago*
get lost(V)-NON PAST worry(V)-NON PAST
‘(my) grandchild who studies and that worries’
b. *manab-u* *nayám-u* *mago*
study(V)-NONPAST worry(V)-NONPAST
‘(my) grandchild who studies and that worries’
- (3) *Trigger* *Target*
a. *magó-ga* *námi*
grandchild-NOM Nami(N)
‘(my) grandchild is called Nami’
b. *mei-ga* *námi*
niece-NOM Nami(N)
‘(my) niece is called Nami’

There are two phrases for each of the types in (1) to (3), totaling twelve test phrases. These were put in the carrier phrase *áni-wa* ___ *to itta* ‘(my) brother said ___.’ Eight lists were made; each list had the test sentences in different order.

3.2. Recording and acoustic analysis

Six female speakers from Tokyo or nearby areas participated in the experiment. They read the eight lists discussed in §3.1. The recording was done in a studio with sound-attenuated walls. A unidirectional dynamic headset microphone (SHURE SM10A; frequency response: 50–15,000 Hz) and a digital recorder (Marantz PMD661), with a 44,100 Hz sampling rate and 24-bit quantization, were used. The peak f₀ in each phrase, including the subject/topic phrase *áni-wa* in the carrier, was measured using a script called ProsodyPro ([12]). F₀ perturbation was fixed manually when observed.

3.3. Results

To examine whether the targets were downstepped, linear mixed-effects analyses were conducted on the relation between the peak f₀s of the target and the trigger accentuation, using R (ver. 3.1.2) and

lmerTest package. The speaker and item were entered into the model as random effects; random intercepts and random slopes were included for both. The results are given in Table 2. Downstep was observed in all three types investigated in the experiment: the accent difference (accented vs. unaccented) has a significant effect on f_0 of the target phrase in pairs (1a) vs. (1b) ($p = 0.034$), (2a) vs. (2b) ($p = 0.00272$), and (3a) vs. (3b) ($p = 0.00492$).

Table 2: Results of linear mixed-effects analyses

Type		β (Hz)	t	p
(1)	(Intercept)	235.591	32.477	< .001
N	Trig.Unacc.	9.315	2.894	0.034
(2)	(Intercept)	229.687	36.813	< .001
V	Trig.Unacc.	10.779	5.496	< .01
(3)	(Intercept)	230.285	46.675	< .001
Pred.	Trig.Unacc.	10.008	5.777	< .01
N				

The presence of downstep can be seen in graphs in Figures 1 to 3, showing the mean peak f_0 values of the six speakers for each phrase in the test sentence. Error bars indicate standard errors. We can see that the pitch peak in the target phrase is lower when the preceding phrase is accented (solid line) than when it is unaccented (dotted line) in each graph (i.e., an indication of downstep).

Figure 1: Peak f_0 s of each phrase in (1): Noun

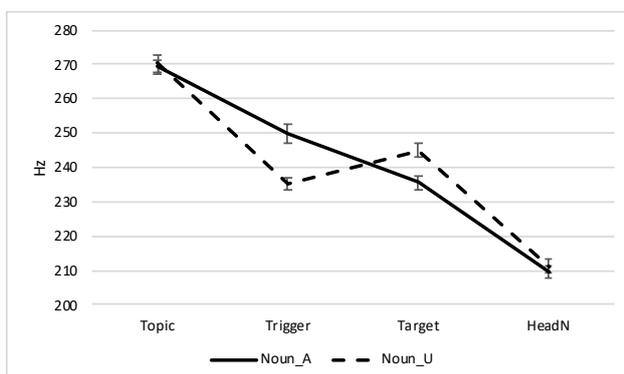


Figure 2: Peak f_0 s of each phrase in (2): Verb

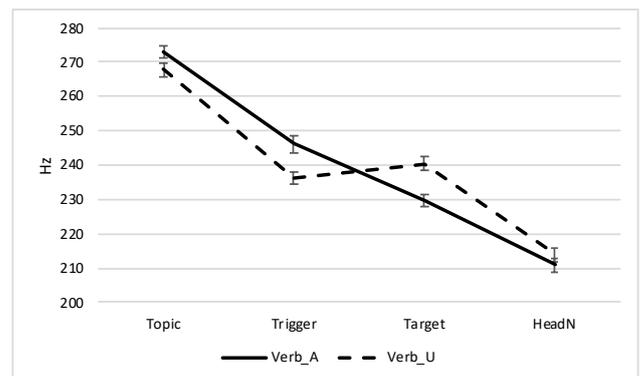
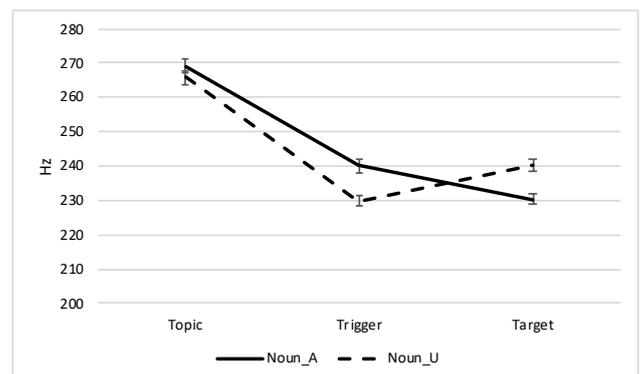


Figure 3: Peak f_0 s of each phrase in (3)



4. DISCUSSION

The current experiment suggests that downstep occurs in nouns with the past tense form of the copula modifying the head noun (1a), verbs in the nonpast tense form modifying the head noun (2a), and also in nouns in the predicate VP position (3a). These results, together with those in [8] and [9], are summarized in Table 3.

We can see that downstep occurs in all conditions except attributive adjectives in the nonpast tense form. Recall that it was noted in [9] that the relative clause-internal adjectives in the past tense form (modifying the head noun) had interspeaker variation whereas the verbs showed a more stable pattern across speakers. Putting together, these indicate that adjectives, in particular when used attributively modifying a noun, may block downstep while predicative adjectives and other categories (noun and verb) do not do so.

Table 3: Presence (√) and absence (X) of downstep in [8, 9] and current study.

	Noun	Adjective	Verb
Non-past	√ ([8])	X ([8])	√
Past (in RC)	√	√/X ¹ ([9])	√ ([9])
Predicative	√	√ ([9])	√ ([9])

¹ Interspeaker variation noted.

We propose that this pattern of the attributive adjective blocking downstep can be explained if we think of the function of downstep and the role of adjectives when used in the attributive modification. Downstep demarcates a Major Phrase ([3, 4, 5]). Because it is blocked when there is an attributive adjective, attributive adjectives, when they are used in a row of words individually modifying a head noun, insert a Major Phrase boundary. Assuming that a Major Phrase marks a domain for a sequence of words that is united in terms of meaning in the sentence, we can interpret the blocking of downstep with attributive adjectives as showing an interruption in the natural flow in meaning in the sequence of phrases modifying the head noun ([A [A N]]).

What, then, creates the interruption of natural flow at the adjective in that particular position? We speculate that there are two reasons. One is that the structure where two adjectives individually modify a head noun is not natural, although not ungrammatical, in Japanese. In fact, in our intuition, when there are two adjectives modifying a noun, a structure in which the first one is in the conjunctive *-te* form ([[A-*te* A] N]) sounds more natural. This unnatural construction might have caused the speaker to make a boundary between the two adjectives.

Another line of possible reasoning for the interruption of natural flow involves the order of attributive adjectives in Japanese. Although it has been said that the order is free in Japanese, unlike in languages such as English where there exists a natural order (e.g., *small square table* but **square small table* ([13]:783, taken from [16]:565)), recent studies argue that certain attributive modifications (both with adjectives and nouns) have a natural order in Japanese ([13]). If the two adjectives in [8] were of the kind involving such an order and their order did not follow the hierarchy presented in [13], the particular sequence of adjectives used in the experiment in [8] might have caused the speaker to insert a Major Phrase boundary at the beginning of the second adjective in the [A [A N]] sequence.

5. CONCLUSION

This paper investigated the role of the syntactic category in prosody, in particular in Japanese downstep. The literature diverges about the effect of the category. The left edges of NPs block the application in [7], whereas they do not have the blocking effect in [8]. Rather, (attributive) adjectives may block the application in [8] and [9]. Verbs do not affect downstep, either ([9]). Moreover, in the predicate position, downstep occurred in adjectives and verbs.

To gain a more complete view of how the syntactic category may be involved in downstep, an experiment was conducted in which six speakers participated. The results suggest that downstep occurs in verbs in the non-past form that modify the head noun, in nouns with the past tense form of the copula modifying the head noun, and in nouns in the predicate VP position.

The results in [8] and [9] and the current experiment overall suggest that adjectives in attributive use may block downstep, whereas nouns and verbs modifying a noun and all three (adjectives, nouns, and verbs) in the predicate VP position are downstepped.

We propose that the explanation lies in the function of downstep and naturalness of word order in attributive modification. Blocking downstep creates a major phrase boundary, which signals an interruption in the flow of the natural sequence of words that otherwise would make a single major phrase. The attributive adjectives in [8] (and in [9] to the extent that there was interspeaker variation) created unnatural flow due either to the structure used in the experiment or to the violation of ordering hierarchy expected for attributive modification in Japanese ([13]). Hence, a major phrase boundary was inserted, and downstep was blocked there. The above reasons are sheer speculation, and an experiment is needed to see whether it is the (un)natural flow of words in a sequence that explains the pattern that the attributive adjectives show in downstep.

6. REFERENCES

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¹ Downstep is defined differently in [7], using the syntagmatic diagnostic ([11]), than in most studies on Japanese downstep (which use paradigmatic diagnostic).

² Speaker variation was virtually negligible in the adjective condition in [8] due to the small number of speakers. It would be interesting to investigate with a larger number of participants.

³ We assume that adjectival nouns, including *dame*, are a subclass of nouns; see [14] and [15], where it is argued that the boundary between those two word classes is not always clear.