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Prosodic matters in intervention effects in Japanese: An experimental study

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Abstract

This paper is an experimental investigation of the effect of prosody on the intervention effect (IE) in Japanese. The experiment reported here compares the acceptability ratings of visual-only stimuli with those of visual-stimuli accompanied by audio-stimuli in which focal prominence was not assigned to the interveners. The results show that with lexically accented interveners, the ratings of the visual + audio stimuli were significantly higher than those of the visual-only stimuli. We argue that this contrast arises because language users tend to assign focus prosody to accented interveners as a default strategy when they process IE-sentences via silent reading. Furthermore, such silent prosody implicitly focalizes the interveners, which leads to lower acceptability. Thus, the current study confirms the relevance of Implicit Prosody in silent reading and supports an approach which treats IEs not as a reflex of ungrammaticality, but as the amalgam of acceptability-lowering effects caused by diverse extra-grammatical factors.

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1. Intervention effects – what they are

Wh-interrogative sentences host a wide variety of phenomena that have made a significant impact on generative theorizing. The *Intervention Effect* (henceforth IE) is one of the newer additions to the list of such phenomena, but it has nonetheless attracted a great deal of attention in both the syntactic and the semantic circles (e.g., Hoji, 1985; Takahashi, 1990; Kim, 1991; Beck, 1996; Beck and Kim, 1997; Tanaka, 1997; Hagstrom, 1998; Kim, 2005; Beck, 2006; Tomioka, 2007, among others). The core property of this phenomenon is schematically expressed below:

(1) At the level of surface syntax:



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(2) below lists typical examples of 'IE'-sentences in Japanese, together with the acceptability judgments provided in the literature.^{1,2}

- (2) a. [?]***Daremo** *nani-o* *yom-ana-kat-ta-no?* (NPI)
 anyone what-ACC read-NEG-PAST-Q
 'What didn't anyone read?'
 b. ***Ke'n-si**^(h)**ka** *nani-o* *yom-ana-kat-ta-no?* (NPI)
 Ken-but what-ACC read-NEG-PAST-Q
 'What didn't anyone but Ken read?'
 c. ^{??}**Da'remo-ga**/^{??}**Da'reka-ga** *nani-o* *yon-da-no?* (∀/∃)
 everyone-NOM/someone-NOM what-ACC read-PAST-Q
 'What did everyone/someone read?'
 d. ^{???}*[**Zy'on-ka** *Bi'ru*]-*ga* *nani-o* *yon-da-no?* (Disjunction)
 John-or Bill-NOM what-ACC read-PAST-Q
 'What did John or Bill read?'
 e. ^{??}**Ke'n-dake**^(h)-*ga* *nani-o* *yon-da-no?* (Focus particle)
 Ken-only-NOM what-ACC read-PAST-Q
 'What did only Ken read?'

This restriction is considered applicable only to the surface structure — once the structural relation is reversed via scrambling of the *wh*-phrases over the interveners, the sentences are reported to become more acceptable.

- (3) a. Nani-o₁ daremo t₁ yom-ana-kat-ta-no
 ↑
 b. Nani-o₁ Ke'n-si^(h) ka t₁ yom-ana-kat-ta-no
 ↑
 c. Nani-o₁ da'remo-ga/da'reka-ga t₁ yon-da-no
 ↑
 d. Nani-o₁ [Zy'on-ka Bi'ru]-ga t₁ yon-da-no
 ↑
 e. Nani-o₁ Ke'n-dake^(h)-ga t₁ yon-da-no
 ↑

Although the paradigm shown above gives the impression that the IE is a clear-cut, well-defined phenomenon, there are many intricate issues that make it far more complex than it appears. Among such complications is the matter of the interveners themselves. 'Interveners' are certain operator-like expressions that exhibit various degrees of difficulty in taking surface positions from which they c-command *wh*-phrases. The repertoire of potential interveners is not 100% identical across languages. In Japanese, it includes negative polarity items (NPIs), such as *daremo* 'anyone', NP-*sika* 'anything/anyone but NP', quantifiers based on *wh*-indeterminate pronouns, such as *da're-mo* 'everyone' and *da're-ka* 'someone', the disjunction with *ka* 'or', and NPs with focus sensitive particles (*-dake* 'only', *-sae* 'even', *-mo* 'also/even'). First of all, it is not easy to give a precise definition of 'potential intervener'. The expressions that cause IEs have often been characterized as quantificational (cf. Hoji, 1985; Beck, 1996; Beck and Kim, 1997), but it was also noted that this terminology is rather imprecise (e.g., Beck, 1996, 2006; Tomioka, 2007; Miyagawa, 2010). There are some non-quantificational interveners, such as NPs with *even* and *also*, which are quite common across languages, and not all quantificational NPs induce IEs.³ Second, not all interveners have the same effect on acceptability. For instance, Tomioka (2007, 2011) claim that, in Japanese, NPIs manifest the strongest effects while the others are comparatively weaker, as the range of the acceptability markings in (2) suggests.

¹ In Hoji (1985), the IE sentences are uniformly judged ungrammatical (*). Beck and Kim (1997) mention differences in acceptability judgments based on interveners in Korean. The judgments reported here follow those in Tomioka (2007, 2009, 2011).

² We need to exercise care in distinguishing two distinct types of *daremo*: the negative polarity item (NPI) 'anyone' as in (2a) and the universally quantified item 'everyone' as in (2c). The former is lexically unaccented while the latter is accented as indicated by an apostrophe in (2c). In all example sentences that follow, we indicate the lexical accents of all and only interveners with an apostrophe. If an apostrophe does not accompany an intervener, it is unaccented. See also (20) in Section 6.2.1 for a possible variation in the location of an extra F0 boost in the focus prosody.

³ The quantifiers that do not cause IEs in Japanese include *subete-no* 'all', *hotondo-no* 'most', and *daibun-no* 'most'.

Recently, however, there has been some positive development towards a more reliable way to identify potential interveners. Beck (2006) and Kim (2002, 2005), for instance, offer new insight on this issue by appealing to the semantic notion of focus. Their generalization states that potential interveners are expressions that elicit non-singleton sets of alternatives in the sense of the *Alternative Semantics for Focus* (Rooth, 1985, 1992; Kratzer, 1991). In Beck's (2006) semantic account, intervention effects arise in the following structural configuration.

- (4) $*[_{CP} Q \dots [\sim [_{YP} \dots [XP]_F \dots [Wh] \dots]]]$
; where \sim is Rooth's focus operator, and Q is a question operator.

Following Hamblin's (1973) semantics of interrogatives, Beck assumes that a *wh*-phrase denotes a set of possible constituent answers. Beck's invention is to connect this set denotation to focus semantics. More concretely, the Hamblin denotation is the focus value of a *wh*-phrase (in the sense of Rooth, 1992), and its ordinary value is undefined. Any constituent that contains a *wh*-phrase also lacks the ordinary value until the derivation meets a Q operator. The role of a Q operator is to elevate the focus value of its sister constituent to the ordinary value. In the configuration in (4), however, the intervening focus operator \sim accidentally closes off the focus value of the *wh*-phrase. A typical focus operator (with the sole exception of a Q operator) requires both the ordinary and the focus values of its sister constituent. YP in (4), on the other hand, only has a focus value, which means that neither semantic value of the constituent, $\sim + YP$, is defined. This semantic undefinedness is inherited all the way up to the sentence level. Thus, "the interpretation component of the grammar derives uninterpretability, hence ungrammaticality, of the intervention data. (p. 1)" Beck's analysis is a reincarnation of the concept of *minimality*, in which the dependency between α and β is disrupted by the presence of γ , an element similar to α , when γ structurally intervenes between α and β . The idea goes back at least to Aoun's (1986) *Generalized Binding* and gained popularity with Rizzi's (1990) *Relativized Minimality*. Beck's invention is to extend this general scheme to semantic licensing.⁴

Tomioka (2007) offered another focus-related categorization, appealing to the pragmatic definition of focus based on properties of information structure. Tomioka assumes, following the spirit of Krifka (2001), that an ordinary *wh*-question is divided up in a way similar to the focus-background partition: the *wh*-phrase is information-structurally focused while the rest of the sentence belongs to the background against which the question is asked. The grammatical realization of informational partitioning in Japanese is done by the combination of morphology, prosody, and syntactic positions assigned to the items in distinct positions. Roughly speaking, information-structural focus receives prosodic prominence, and backgrounded material appears either in the post-focal position in some prosodically reduced form or as a topic, typically indicated with the topic marker *wa* at or near the left periphery of an utterance. (The details of focus prosody in Japanese will be described in section 3.3 below.) Tomioka claims that it is the notion of information-structural focus, rather than semantic focus, which is relevant to the explication of IEs. The crucial observation is that all of the potential interveners in Japanese and Korean, such as NPIs, disjunctive NPs, and *wh*-indeterminates, resist the morphological marking of topichood (i.e., *wa* in Japanese and (*n*)*un* in Korean) while the non-interveners, whether they are quantificational or not, are compatible with the topic morphology. This 'anti-topicality' leads to the increased likelihood of the interveners being interpreted as information-structural foci unless they are clearly indicated as non-foci via prosodic reduction. A typical IE sentence, exemplified in (2), places the intervener before a *wh*-phrase, which is a less than ideal location for prosodic reduction. Tomioka proposes a pragmatic account of IEs in which he ascribes the degradation of IE sentences to the imperfect realization of the needed information structure for a *wh*-question. The degree of imperfection in the mapping between grammar and information structure is gradable and varies with factors other than syntactic positions, such as prosody and contextual information.

These two approaches to IEs, which exploit the focal nature of interveners, share one common feature: the potential interveners are more likely to be construed as informational foci.⁵ However, there is a matter in which the two analyses make different predictions. If the inherent semantic nature of an intervener as a focus-demanding expression is at the core of IEs, as Beck assumes, focal prominence makes no impact. Those interveners require non-singleton focus meanings whether they are information-structural foci or backgrounded, while focal prominence is sensitive primarily to the information-structural notion of focus. Tomioka's notion of anti-topicality makes a similar prediction but in a different way. The *wa*-marking is an effective way to force its bearer to be included in the background, and the lack of topic-marking

⁴ The source of the unacceptability of IE sentences is semantic undefinedness, and it is a new idea to use the concept of definedness for this purpose. It nonetheless shares the common feature with the tradition of syntactic constraints in that there is no middle ground — the consequence must be either positive (semantically defined/no constraints violated) or negative (semantically undefined/some constraint(s) violated).

⁵ A good illustration is the widely accepted meaning of *only* proposed by Horn (1972): for a sentence of the form *only* [_S [X] [Y]], where X is the focus associate of *only*, the presupposition is the proposition denoted by the prejacent S (= the sentence meaning without *only*), and the sentence as a whole asserts that, among the focus values of X, for no alternative X' such that X' ≠ X, [_S [X'] [Y]] is true. This means that the linguistic materials that correspond to Y must be in the background, which in turn means that *only* + X is the sentence focus. Of course, *only* and its focus associate can be confined within the background (e.g., a case of the *Second Occurrence Focus* construction), but such a case needs a very specific context and should not be considered a default scenario.

increases the likelihood of its interpretation as an information-structural focus.⁶ In Tomioka's pragmatic account, therefore, focal prominence should have an impact on the acceptability judgments of intervention sentences, because the prosodic indication of foci unambiguously signals the informationally focalized statuses of the interveners, which is expected to contribute to the further degradation of IE sentences.

In this work, we will report the results of our experiment on the acceptability judgments of sentences and argue that the 'implicit' prosody reflected in language users' minds (Fodor, 1998) can be one of the decisive factors to induce IE. This finding leads us to support the approach in which IE is analyzed not as a reflex of ungrammaticality but as the amalgam of acceptability lowering effects. Such effects are caused by several extra-syntactic (or extra-grammatical) factors, one of which, we believe, is information packaging and the specific prosodic pattern associated with it. In our experiment, we also made some unexpected discoveries, some of which are quite surprising to virtually all approaches to the IE phenomena in the past. We will also propose what we consider to be reasonable accounts of these unexpected findings.

2. Implicit prosody and intervention effects

There is a specific hypothesis for sentence processing that we critically appealed to in designing our experiment on acceptability judgments. Suppose a language user is attempting to provide acceptability judgments for sentences presented in writing. In an effort to identify the syntactic structure involved in the sentence, the parser may pronounce it with a prosodic/intonational pattern that the parser considers to be naturally associated with the particular construction at hand. Interestingly, recent psycholinguistic findings suggest that similar prosodic processes are involved even when judging the acceptability of a written sentence without reading it aloud. Sentence parsing data for languages as diverse as Japanese and Croatian are argued to be explicable in terms of (5) (Fodor, 1998).

- (5) *The Implicit Prosody Hypothesis:* (Fodor, 2002:113)
In silent reading, a default prosodic contour is projected onto the stimulus, and it may influence syntactic ambiguity resolution. Other things being equal, the parser favors the syntactic analysis associated with the most natural (default) prosodic contour for the construction.⁷

It is assumed, in other words, that prosody is always present in the processing of language, whether by ear or by eye. And because prosodic structure and syntactic structure are tightly related (Selkirk, 2000), those who solicit syntactic judgments need to control for prosody. This will be particularly important for any construction that requires a non-default prosodic contour, since readers are inclined to assign a default contour in their silent reading.

As case studies to support this hypothesis, Kitagawa and Fodor (2006) (henceforth K&F) report their experimental results from English and Japanese. First, they took up a construction in English which involves potentially ambiguous scope interpretations, as in (6).

- (6) Marvin didn't leave the meeting early **because** he wanted to kill time.

The literature on experimental results for written materials indicates that the preferred interpretation has narrow-scope negation — that is, the *because*-clause is outside the scope of the negation (Frazier and Clifton, 1996). It was also noted by Hirschberg and Avesani (2000:90) that the intonation contours for the (preferred) narrow-scope-negation “usually exhibit major or minor prosodic phrase boundaries before the subordinate conjunction” and “usually were falling contours,” as indicated in (7) by // and an arrow, respectively.

- (7) Marvin [_T didn't leave the meeting early] // [**because** he wanted to kill time ↘]

On the other hand, the intonation contours for the (dispreferred) wide-scope negation, as indicated in (8) below, “rarely contain internal phrase boundaries” and “often end in a ‘continuation rise’.” (Hirschberg and Avesani, 2000:90)

- (8) Marvin didn't [_{VP} leave the meeting early [**because** he wanted to kill time ↗]]

⁶ This tendency is particularly strong with a matrix subject, for which the absence of *wa* is interpreted as indicating that the subject is focused (cf. Heycock, 1994).

⁷ For an examination of various linguistic phenomena in several different languages, see Bader (1998), Fodor (2002), Hirose (1999), Pynte and Colonna (2000), Lovric (2003), Kitagawa and Fodor (2006), among others.

This prosody – especially the sentence-final rise – is generally perceived to be highly marked for English (Hirschberg and Avesani, 1997; Koizumi, 2009).

In their experiment, K&F used the same ‘*not-because*’ construction, crucially disambiguating its potential ambiguity with the inclusion of a negative polarity item in the *because*-clause as in (9).

(9) Marvin didn’t leave the meeting early because he was mad at **anyone**.

The acceptability of this sentence depends on the scope of the negation: Under the wide-scope negation reading, which places the NPI in the scope of the negation, it would be grammatical, but with the reverse hierarchical order, the NPI fails to be licensed. Translating these scope asymmetries into prosody, it is predicted that the sentence will be grammatical only with the more marked prosody as in (10b).

(10) a. *Marvin [_T didn’t leave the meeting early] // [because he was mad at **anyone**]
 b. Marvin didn’t [_{VP} leave the meeting early [because he was mad at **anyone**]]

They conducted tests involving both silent reading and listening, assigning this marked prosody to their audio stimuli. The results showed that the acceptance rate was extremely low in the silent reading condition, while there was a striking increase in acceptance for these sentences in the listening condition, suggesting that in their silent reading the participants tend to assign the default prosody as in (10a) (= the narrow-scope negation prosody), which fails to license the NPIs.⁸

Let us now return to the matter of intervention effects in the context of implicit prosody. The focus-based analyses of intervention effects assume that the interveners are likely to be interpreted as information-structural foci. This would certainly affect the prosodic patterns of the sentences in which they appear. More concretely, it is expected that the interveners are likely to be prosodically marked as being foci. In Japanese, a focused phrase receives an increased pitch peak (F0 boost). Assuming that a *wh*-phrase is also focused in a *wh*-interrogative sentence, we expect a kind of multi-foci structure and the prosodic pattern shown in (11).⁹

(11) a. [Ke’n-da**KE**-ga]_F [NA’ni-o]_F yon-da-no?
 Ken-only-nom what-acc read-past-Q?
 b. [NA’ni-o₁]_F [Ke’n-da**KE**-ga]_F t₁ yon-da-no
 what-acc Ken-only-nom read-past-Q?
 ‘What did only Ken read?’

Such prosody has different theoretical consequences. As sketched out in section 1, in Tomioka’s (2007) pragmatic theory of IEs, the source of the degradation in IE sentences is the imperfect information structure. Tomioka assumes that in an ordinary *wh*-question, the *wh*-phrase is focused and the rest of the sentence must be backgrounded. Second, potential interveners are anti-topical and hence cannot belong to the background as topics. The most effective way for the interveners to be confined within the background is to be prosodically reduced. Therefore, the multiple focus prominence in (11) is considered to induce informational incongruence. This leads us to predict that if the implicit prosody assigns focus prominence to a potential intervener, it will negatively affect the acceptability judgment in silent reading. We also predict that if such prosody is explicitly removed in the presentation of audio stimuli, the ill effect of the implicit prosody will also be removed, and the acceptability judgment is expected to improve. It is worth noting that Tomioka’s pragmatic account predicts the improvement to be significant for both orders in (11). Like any other analysis of IEs, the pragmatic analysis expects (11b) to be more acceptable than (11a) both in silent reading and in audible presentation. However, both (11a) and (11b) should improve with the explicit prosody that discourages the focused interpretation for the *NP-dake*.

⁸ Similar experiments were conducted on a larger scale by Koizumi (2009), which reinforced this conclusion. More detailed investigation of the marked prosody in (10b) and its correlation with the associated information packaging would be another interesting topic to pursue. Note the similarity of this prosodic pattern to Jackendoff’s (1972) B-accent.

⁹ We will elaborate on the focus prosody in question in Section 3.3. See Kori (1989), Maekawa (1991), Deguchi and Kitagawa (2002), and Ishihara (2003), among others for an examination and discussion of focus prosody in *wh*-questions. In all examples that follow, the F0 boost of a focused element is indicated by capital letters in bold face. As will be described in more detail in (20) of Section 6.2.1, there are a few alternative prosodic patterns for the intervener in (11). For example, it is possible to pronounce it as *KE n-dake-ga* with the F0 peak falling on the first syllable. This option is available for all phrases with focus sensitive particles, such as *dake* ‘only’, *sae* ‘even’, and *sura* ‘even’.

On the other hand, if the IE arises due to the semantic definition of focus, the role of prosody is not expected to be a factor in the generation of a non-singleton set meaning. Focus-sensitive particles, such as *only* and *even*, demand such sets for the focus values of their associates regardless of their information-structural status. If IEs are sensitive to the semantic notion of focus rather than the pragmatic one, implicit prosody will not affect the acceptability judgment. With or without focus intonations, as long as the interveners c-command the *wh*-phrases, IEs are predicted to arise.

The main objective of the current study is to confirm the presence or absence of the implicit prosody effects in the IE environments in Japanese by comparing the acceptability judgments of two different types of stimuli: visual-only stimuli and visual stimuli accompanied by audio-stimuli.

3. Experiment

An experiment was conducted to examine the influence of word order and focus prosody on the acceptability of both *wh*-questions and declarative sentences involving three distinct interveners *dake*, *daremo* and *sika*.

3.1. Materials

For the stimulus sentences in our experiment, we paired an *IE*-sentence ('Intervener ^ *wh*') with one involving the reversed order ('*wh* ^ intervener': *Non-IE* sentence). Each experimental sentence contained one of the potential interveners listed in (12).

- (12) a. Focus particle:
 -dake⁽ⁱ⁾ 'only'
- b. Negative Polarity Item (NPI):
 (i) *-si*⁽ⁱ⁾*ka* 'only'/'anyone/thing but'
 (ii) *daremo* 'anyone'

As a non-NPI intervener, we selected *dake* 'only' since it is often assumed to mark a focused element and induce an alternative set, and it is also semantically similar to *sika* 'anyone/thing but', which we selected as a negative polarity (NPI) intervener. An example from each experimental paradigm of *wh*-questions containing one of the above potential interveners is listed in (13)–(15).

- (13) The *dake* 'only' + *wh* stimuli:
 a. Ma'riko-**dake**⁽ⁱ⁾-*ga dare-o sasot-ta-no?* (IE order: *Int* ^ *Wh* = Base-generated order)
 Mariko-only-NOM who-ACC invite-PAST-Q
 'Who did only Mariko invite?'
 b. *dare*₁-*o Ma'riko-dake⁽ⁱ⁾-*ga t*₁ *sasot-ta-no?* (Non-IE order: *Wh* ^ *Int* = Scrambled order)
 who-ACC Mariko-only-NOM invite-PAST-Q*

- (14) The *sika* 'anyone but' + *wh* stimuli:
 a. Mi'nako-**si**⁽ⁱ⁾**ka dare-o sasow-ana-katta-no? (IE order: *Int* ^ *Wh*)
 Minako-anyone.but who-ACC invite-NEG-PAST-Q
 'Who didn't anyone but Minako invite?'
 b. *dare*₁-*o Mi'nako-si***⁽ⁱ⁾**ka t**₁ *sasow-ana-katta-no?* (Non-IE order: *Wh* ^ *Int*)
 who-ACC Minako-anyone.but invite-NEG-PAST-Q

- (15) The *daremo* 'anyone' + *wh* stimuli:
 a. **daremo dare-o sasow-ana-katta-no?** (IE order: *Int* ^ *Wh*)
 anyone who-ACC invite-NEG-PAST-Q
 'Who didn't anyone invite?'
 b. *dare*₁-*o daremo t*₁ *sasow-ana-katta-no?* (Non-IE order: *Wh* ^ *Int*)
 who-ACC anyone invite-NEG-PAST-Q

We also paired these *wh*-questions with 12 *declarative* sentences, in which the *wh*-phrases were replaced by non-*wh* phrases, as exemplified in (16)–(18).

- (16) The *dake* + NP stimuli:
- a. Ma'riko-**dake**^(*o*)-*ga* Yuuzi-*o* sasot-ta. (IE order: *Int* ^ *NP*)
 Mariko-only-NOM Yuji-ACC invite-PAST
 'Only Mariko invited Yuji'
- b. Yuuzi₁-*o* Ma'riko-**dake**^(*o*)-*ga* *t*₁ sasot-ta. (Non-IE order: *NP* ^ *Int*)
 Yuji-ACC Mariko-only-NOM invite-PAST
- (17) The *sika* + NP stimuli:
- a. Mi'nako-**si**^(*o*)**ka** Naoya-*o* sasow-**ana**-katta. (IE order: *Int* ^ *NP*)
 Minako-anyone.but Naoya-ACC invite-NEG-PAST
 'Anyone but Minako didn't invite Naoya. (= No one but Minako invited Naoya.)'
- b. Naoya₁-*o* Mi'nako-**si**^(*o*)**ka** *t*₁ sasow-**ana**-katta. (Non-IE order: *NP* ^ *Int*)
 Naoya-ACC Minako-anyone.but invite-NEG-PAST
- (18) The *daremo* + NP stimuli:
- a. **daremo** Yuuzi-*o* sasow-**ana**-katta. (IE order: *Int* ^ *NP*)
 anyone Yuji-ACC invite-NEG-PAST
 'Anyone didn't invite Yuji. (= No one invited Yuji.)'
- b. Yuuzi₁-*o* **daremo** *t*₁ sasow-**ana**-katta. (Non-IE order: *NP* ^ *Int*)
 Yuji-ACC anyone invite-NEG-PAST

We prepared these control sentences so that we could obtain base-line judgments for the experimental sentences in (13)–(15) when they do not involve intervention effects. For each sentence in the paradigm above, we prepared another set of similar examples involving a distinct verb (*home* 'praise') and a distinct subject nominal (listed in [Appendices A and B](#)), and hence had 12 experimental *wh*-sentences and 12 declarative sentences (i.e., 24 target sentences in total). All of the above stimulus sentences were combined with 51 filler sentences and presented to the participants in a randomized order. Out of the 51 filler sentences, 17 were what we regarded as clearly acceptable sentences, 13 as less acceptable sentence, and 21 as clearly unacceptable sentences. Some of the filler sentences taken from these three groups are listed in the [Appendices C–E](#).

3.2. Participants

51 native speakers of Japanese (16 males, 35 females) participated in this experiment, which was conducted in September 2009. They were either undergraduate or graduate students at Nagoya University in Japan, and none of them were students of linguistics. They were all paid for their participation. After analyzing the obtained data carefully, we decided not to take into consideration those provided by 5 of the participants for the following reasons. First, 4 participants did not complete the provided questionnaire, yielding some missing values. Furthermore, 1 participant provided the same response to most of the items irrespective of their obvious acceptability/unacceptability. In the end, data from 46 participants were used for the analysis of the 24 target sentences.

3.3. Procedure

A questionnaire study was conducted in a large quiet room equipped with a large monitor and speakers. All of the stimulus sentences (i.e., target + filler sentences) were randomized twice and each set was presented to the participants in two separate sessions. In the first session, the stimuli were presented only visually – that is, without any prosody – and the participants were asked to silently read the example sentences projected on the monitor one by one and complete the questionnaire. (The example sentences were also printed on the questionnaire.) When the first session was over, the participants took a break. The interval between the two sessions was 15 min, during which the participants were allowed to act freely: they walked around, conversed, used a cell phone, had a snack/beverage, and so on. In the second session, the same stimuli were presented in another randomized order. In this session, the stimulus sentences were again presented visually on a large monitor as well as on a questionnaire sheet. At the same time, they were presented aurally through speakers with an interval of approximately 7.5 seconds between sentences. In effect, we doubled the number of stimuli to 150, 48 of which were the target stimuli.

Typical *wh*-focus prosody was assigned to the audio stimuli of all the experimental *wh*-questions, as illustrated by the pitch-track diagrams in [Fig. 1](#). The recordings were made by one of the authors (Kitagawa), who is a native speaker of Tokyo Japanese. (The F0 boost in the focus prosody is indicated by capitalization and arrows.)

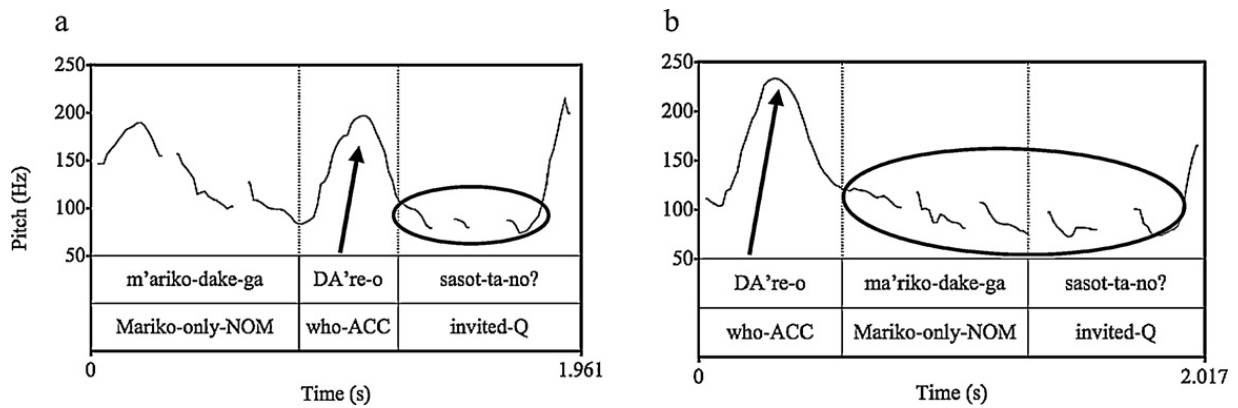


Fig. 1. Pitch-track diagrams for the audio stimuli involving *dake* 'only' in a *wh*-question. (a) IE order; (b) Non-IE order.

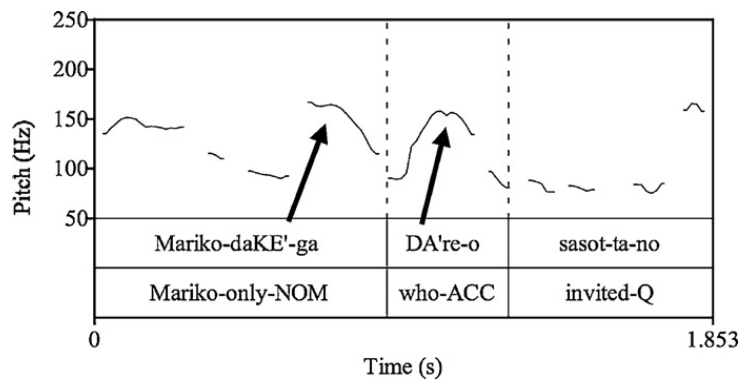


Fig. 2. Pitch-track diagrams when focus prominence is placed on *dake*. (This prosodic pattern was not assigned to our audio stimuli.)

The assigned *wh*-focus prosody typically involves an emphatic F0 boost on the *wh*-word itself (as indicated by the upward arrows in Fig. 1). This pitch prominence is then followed by *post-focal reduction* (indicated by the oval), which significantly (though not completely) compresses the pitch range of all items following a focused element, thereby considerably reducing any rises from a low tone to a high tone up to the end of the focus domain. Therefore, when the *dake* 'only' intervener appeared after the *wh*-phrase (i.e., post-focally), its pitch range was significantly compressed, as shown in Fig. 1b. When the intervener appears in a position preceding the *wh*-focus as in Fig. 1a, on the other hand, we did not impose such prosodic reduction. At the same time, we intentionally avoided assigning any notable focus prominence. If we did, the *dake* phrase would have shown a clear prosodic peak (*ma'riko-daKE'-ga*) in addition to the *wh*-peak as in Fig. 2.

In the declarative control sentences, focus prominence was assigned only to the *dake* phrase (*ma'riko-daKE'-ga*) irrespective of the word order, as illustrated in Fig. 3a and b.

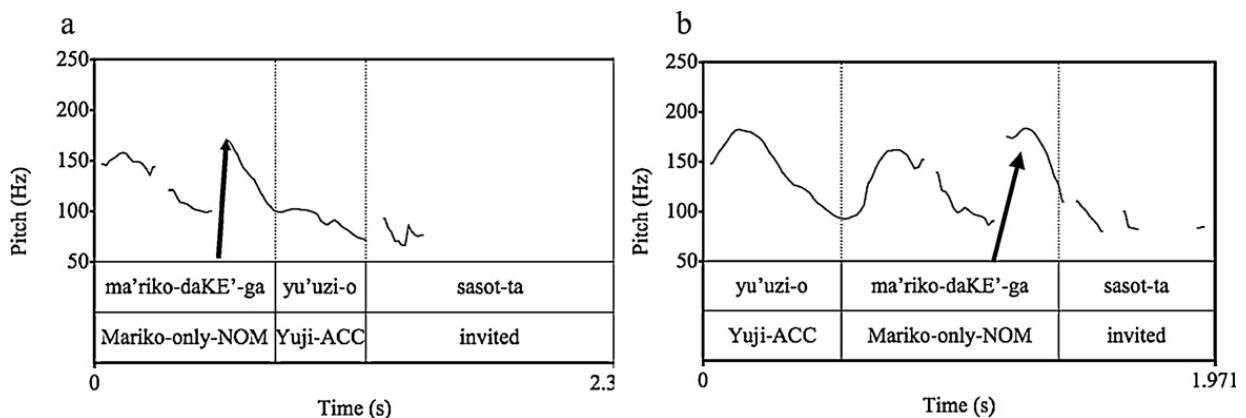


Fig. 3. Pitch-track diagrams for the audio stimuli involving a declarative sentence. (a) IE order; (b) Non-IE order.

The naturalness of the prosody of all the recorded stimuli was confirmed by two third-party speakers of a '(near) standard' dialect of Japanese, one a linguist and the other a non-linguist. The same speakers also confirmed that the prosodic pattern represented in Fig. 2 is rather unnatural.

In both sessions, the participants were asked to provide an acceptability rating for each sentence by selecting one of the six options indicated in (19) below as the slide went by for both visual-only and visual-and-audio stimuli.¹⁰

- | | | | |
|------|---|---------------|---|
| (19) | 5 | 日本語としてまったく適切 | 'Entirely appropriate as a Japanese sentence' |
| | 4 | 日本語としてかなり適切 | 'Quite/Rather appropriate as a Japanese sentence' |
| | 3 | 日本語としてやや適切 | 'Somewhat appropriate as a Japanese sentence' |
| | 2 | 日本語としてやや不適切 | 'Somewhat inappropriate as a Japanese sentence' |
| | 1 | 日本語としてかなり不適切 | 'Quite/Rather inappropriate as a Japanese sentence' |
| | 0 | 日本語としてまったく不適切 | 'Entirely inappropriate as a Japanese sentence' |

4. Analysis

The acceptability of the sentences was measured by the 6-point scale in (19). The present study assumed this scale as parametric data. The 48 target stimuli were controlled by two conditions — word order and prosody — in each of the *wh*-interrogative sentences and the declarative sentences involving one of the three distinct interveners *dake*, *daremo* and *sika*. Two sets of sentence stimuli involving two different verbs, *sasow* 'invite' and *home* 'praise', respectively, were used in the experiment, and the obtained acceptability scores for the two sets were averaged in each condition for the analysis.

The three distinct interveners (*dake*, *daremo* or *sika*) and the two distinct sentence types (*wh*-interrogative or declarative) were not directly compared among themselves, because they involve fundamentally distinct syntactic structures and properties: *dake* 'only' and *sika* 'anyone/anything but' involve the form *NP-particle* while *daremo* 'anyone' and *dare* 'who' are single lexical items. In addition, *sika* and *daremo* (NPIs) must appear in a negative sentence while *dake* and *dare* need not.

If, as suggested in section 2, the implicit prosody involving illicit multi-focus intonation indeed is a significant partial source of IEs, the removal of the focus prosody (i.e., removal of the extra F0 boost) from the interveners in our audio *wh*-stimuli is predicted to eliminate its ill effect and hence to reduce the IEs. Moreover, if one adopts the approach that regards IEs not as pure and simple ungrammaticality but as a composite acceptability-lowering phenomenon caused by heterogeneous extra-syntactic or extra-grammatical factors, it is predicted that the word order difference (IE order vs. non-IE order) may not induce as clear and uniform IEs as claimed in many syntactic/semantic approaches to IEs. Accordingly, the acceptability scores of IE sentences might not necessarily hit rock bottom.

A series of two-way 2 (IE order or non-IE order) × 2 (presence or absence of prosody) analyses of variance (ANOVAs) with repeated measures were conducted on the acceptability scores (0–5 points) of the 48 target stimuli. These stimuli

¹⁰ An anonymous reviewer raises the concern that, since the two experimental sessions were conducted on the same day, some of the experimental sentences presented in the first session might have remained in the memory of the participants and affected the experimental results of the second session. It was also pointed out that, since the participants were exposed to the scrambled word order before the non-scrambled word order in some of the target sentences, they might have already identified the intended interpretation and circumvented the intervention effect. While these concerns are legitimate, we consider that such factors were unlikely to have significantly affected the acceptability results in the current experiment, which measured the subjective acceptability of sentences rather than the performance measurement of reaction time. As described above, the participants were engaged in various activities unrelated to the experiment during the 15-min interval between the two sessions. In addition, the experiment involved a large number of stimuli (24 target and 51 filler sentences), which were separately randomized for each session. Together, we believe, these factors provided the minimally necessary neutralization of the memory effect. It also is the case that ungrammatical and hence clearly unacceptable sentences are generally unlikely to improve as drastically as they did in the cases we will observe in the next section. The sentence in (ib) below, for instance, does not seem to improve in any significant way even after we encounter (ia) and understand its intended interpretation.

- (i) a. John-wa kodomo-ni gohan-o tabe-sase-ta.
 John-TOP child-DAT meal-ACC eat-CAUSE-PAST
 'John let/made his child have a meal.'
- b. John-wa kodomo-*o gohan-o tabe-sase-ta.
 John-TOP child-ACC meal-ACC eat-CAUSE-PAST
 'John let/made his child have a meal.'

As will be presented and discussed in the following sections, the scrambled order in fact did not necessarily induce such drastic improvement in acceptability in our experiment.

involved 6 distinct combinations of interveners and sentence types.¹¹ When a significant interaction or at least its trend was detected, a series of simple contrasts were also conducted between each of the distinct conditions. The results of the analysis of the acceptability scores are reported in section 5 for each of these 6 distinct combinations.

5. Results

5.1. *dake*

5.1.1. *dake* + *wh*

For the stimuli with *dake* 'only' in a *wh*-sentence, the mean acceptability scores and their standard deviations (in parentheses) are shown in Table 1. All of the data and their graphic summaries presented below indicate the average scores of the two stimulus sets. Table 1 indicates, for example, the average score of (13a) and (26a) (IE order) and that of (13b) and (26b) (non-IE order). (Examples (26a and b) can be found in Appendix A.)

Table 1
Means and standard deviations of acceptability scores (*dake* in a *wh*-sentence).

	IE order (<i>dake-ga</i> ^ <i>wh-o</i>)	Non-IE order (<i>wh-o</i> ^ <i>dake-ga</i>)
No Prosody	2.76 (1.34)	2.88 (1.36)
Prosody	3.10 (1.24)	3.11 (1.15)

The two-way 2 (IE order or non-IE order) \times 2 (presence or absence of prosody) ANOVA with repeated measures of both variables indicated that the main effect of the word order was not significant [$F(1,45) = 0.651$, $MSe = 0.943$, $p = 0.651$, $\eta_p^2 = 0.005$] while the main effect of the presence/absence of prosody was significant [$F(1,45) = 5.429$, $MSe = 0.677$, $p < 0.05$, $\eta_p^2 = 0.108$]. The interaction of these variables was also not significant [$F(1,45) = 0.258$, $MSe = 0.528$, $p = 0.614$, $\eta_p^2 = 0.006$].

Specifically, the acceptability score of the 'IE order' (*dake-ga* ^ *wh-o*) was significantly increased by the presence of prosody ($M = 2.76$ vs. $M = 3.10$). Likewise, the acceptability score of the scrambled 'Non-IE order' (*wh-o* ^ *dake-ga*) was significantly increased by the presence of prosody ($M = 2.88$ vs. $M = 3.11$). However, due to the null main effect of word order, the acceptability scores between the IE and Non-IE orders did not differ significantly, whether or not prosody was assigned.

5.1.2. *dake* + *NP*

For the stimuli with *dake* 'only' in a *declarative* sentence, the mean acceptability scores and their standard deviations (in parentheses) averaged over the two sets are shown in Table 2 below: those of (16a) and (32a) (IE order) and those of (16b) and (32b) (non-IE order). (Examples (32a and b) can be found in Appendix B.)

Table 2
Means and standard deviations of acceptability scores (*dake* in a declarative sentence).

	IE order (<i>dake-ga</i> ^ <i>NP-o</i>)	Non-IE order (<i>NP-o</i> ^ <i>dake-ga</i>)
No Prosody	4.51 (0.52)	4.34 (0.68)
Prosody	4.08 (0.80)	4.51 (0.60)

As in section 5.1.1, the same 2 \times 2 ANOVA was conducted and showed neither a main effect of the word order [$F(1,45) = 3.873$, $MSe = 0.202$, $p = 0.055$, $\eta_p^2 = 0.079$] nor a main effect of the presence/absence of prosody [$F(1,45) = 3.671$, $MSe = 0.213$, $p = 0.062$, $\eta_p^2 = 0.075$], although both F -values approached the 5% significance level.

¹¹ An anonymous reviewer questions whether the term 適切 (appropriate) in (19) can indeed be interpreted on a par with "acceptable." Alternatively, we could have used expressions like 文法的 (grammatical), 容認可能 (acceptable), or 自然だ (natural). Each and every one of these expressions, however, seems to have the potential to invite some irrelevant and undesirable aspect of the participants' evaluation of the stimulus sentences. What particular expression should be used to describe the standard of acceptability presumably is a problem common to all experiments attempting to measure the degree of acceptability of linguistic expressions, irrespective of the type of scale adopted in the questionnaire. What we are treating as the acceptability scores in this work, therefore, must be regarded as our best approximation of the acceptability judgments of linguistic expressions, which in reality reflect the participants' evaluation of stimuli involving somewhat heterogeneous aspects of linguistic communication. Acknowledging the importance of this issue, we must leave its further discussion to our and others' future research.

The interaction of both variables was significant [$F(1,45) = 15.828$, $MSe = 0.269$, $p < 0.001$, $\eta_p^2 = 0.260$]. Therefore, pairwise simple contrasts were conducted. The acceptability scores for the IE order ($M = 4.51$) showed a significant decrease with the presence of prosody ($M = 4.08$) [$F(1,45) = 16.438$, $MSe = 0.529$, $p < 0.001$, $\eta_p^2 = 0.268$]. Prosody thus produced negative effects in this particular case. In the Non-IE order, on the other hand, a slight increase in the scores was observed — $M = 4.34$ without prosody and $M = 4.51$ with prosody — although the difference was not significant [$F(1,45) = 3.193$, $MSe = 0.436$, $p = 0.081$, $\eta_p^2 = 0.066$]. Without prosody, the difference in acceptability scores between the IE order ($M = 4.51$) and the Non-IE order ($M = 4.34$) was not significant [$F(1,45) = 2.996$, $MSe = 0.469$, $p = 0.092$, $\eta_p^2 = 0.062$]. With the presence of prosody, however, the difference in acceptability scores between the IE order ($M = 4.08$) and the non-IE order ($M = 4.51$) was significant [$F(1,45) = 18.367$, $MSe = 0.473$, $p < 0.001$, $\eta_p^2 = 0.290$].¹²

5.2. sika

5.2.1. sika + wh

For the stimuli with the NPI intervener *sika* ‘anyone/anything but’ in a *wh*-sentence, the mean acceptability scores and their standard deviations (in parentheses) averaged over the two sets are shown in Table 3 below: those of (14a) and (27a) (IE order) and those of (14b) and (27b) (non-IE order) (Examples (27a and b) can be found in Appendix A.)

Table 3
Means and standard deviations of acceptability scores (*sika* in a *wh*-sentence).

	IE order (<i>sika</i> ^ <i>wh</i> -o)	Non-IE order (<i>wh</i> -o ^ <i>sika</i>)
No Prosody	0.96 (0.97)	1.55 (1.33)
Prosody	1.52 (1.16)	1.87 (1.44)

The two-way 2×2 ANOVA indicated that the main effect was significant for both variables — [$F(1,45) = 12.373$, $MSe = 0.831$, $p < 0.001$, $\eta_p^2 = 0.216$] for the word order, and [$F(1,45) = 10.150$, $MSe = 0.878$, $p < 0.01$, $\eta_p^2 = 0.184$] for the presence/absence of prosody. The interaction of these variables, on the other hand, was not significant [$F(1,45) = 1.177$, $MSe = 0.610$, $p = 0.284$, $\eta_p^2 = 0.025$].

More specifically, the acceptability scores for the Non-IE order were significantly higher than those for the IE order — ($M = 1.55$ vs. $M = 0.96$ without prosody) and ($M = 1.87$ vs. $M = 1.52$ with prosody). Furthermore, the acceptability scores for both word orders were significantly increased when prosody was added: $M = 0.96$ vs. $M = 1.52$ in the IE order and $M = 1.55$ vs. $M = 1.87$ in the Non-IE order.

5.2.2. sika + NP

For the stimuli with the NPI intervener *sika* ‘anyone/anything but’ in a declarative sentence, the mean acceptability scores and their standard deviations (in parentheses) averaged over the two sets are shown in Table 4: those of (17a) and (33a) (IE order) and those of (17b) and (33b) (non-IE order). (Examples (33a and b) can be found in Appendix B.)

Table 4
Means and standard deviations of acceptability scores (*sika* in a declarative sentence).

	IE order (<i>sika</i> ^ NP-o)	Non-IE order (NP-o ^ <i>sika</i>)
No Prosody	4.65 (0.55)	3.09 (1.52)
Prosody	4.72 (0.40)	3.53 (1.15)

The two-way 2×2 ANOVA indicated that the main effect was significant for both variables—[$F(1,45) = 70.874$, $MSe = 1.227$, $p < 0.001$, $\eta_p^2 = 0.612$] for the word order, and [$F(1,45) = 4.331$, $MSe = 0.693$, $p < 0.05$, $\eta_p^2 = 0.088$] for the presence/absence of prosody.

Specifically, the acceptability scores of the Non-IE order were significantly lower than those of the IE order, whether prosody was absent ($M = 3.09$ vs. $M = 4.65$) [$F(1,45) = 54.352$, $MSe = 2.073$, $p < 0.001$, $\eta_p^2 = 0.547$] or present ($M = 3.53$ vs. $M = 4.72$) [$F(1,45) = 57.906$, $MSe = 1.115$, $p < 0.001$, $\eta_p^2 = 0.563$].

The interaction of these variables was also significant [$F(1,45) = 4.533$, $MSe = 0.367$, $p < 0.05$, $\eta_p^2 = 0.092$]. Therefore, pairwise simple contrasts were conducted. Prosody significantly increased the acceptability scores for the

¹² While the notion of intervention is irrelevant in declarative sentences, we continue to use the same labels “IE” and “Non-IE” to indicate word orders for ease of reference.

Non-IE order ($M = 3.09$ vs. $M = 3.53$) [$F(1,45) = 9.136$, $MSe = 1.736$, $p < 0.05$, $\eta_p^2 = 0.105$] while it had no significant effect on the acceptability scores for the IE order ($M = 4.65$ vs. $M = 4.72$) [$F(1,45) = 0.509$, $MSe = 0.385$, $p = 0.479$, $\eta_p^2 = 0.011$].

5.3. *daremo*

5.3.1. *daremo* + *wh*

For the stimuli with the NPI intervener *daremo* 'anyone' in a *wh*-sentence, the mean acceptability scores and their standard deviations (in parentheses) averaged over the two sets are shown in Table 5: those of (15a) and (28a) (IE order) and those of (15b) and (28b) (non-IE order). (Examples (28a and b) can be found in Appendix A.)

Table 5
Means and standard deviations of acceptability scores (*daremo* in a *wh*-sentence).

	IE order (<i>daremo</i> ^ <i>wh-o</i>)	Non-IE order (<i>wh-o</i> ^ <i>daremo</i>)
No Prosody	1.39 (1.18)	2.23 (1.52)
Prosody	1.77 (1.47)	2.46 (1.73)

The two-way 2×2 ANOVA indicated a significant main effect of word order [$F(1,45) = 27.239$, $MSe = 0.978$, $p < 0.001$, $\eta_p^2 = 0.377$], but the main effect of the presence/absence of prosody was not significant [$F(1,45) = 2.659$, $MSe = 1.603$, $p = 0.110$, $\eta_p^2 = 0.056$]. The interaction of these variables was also not significant [$F(1,45) = 0.385$, $MSe = 0.691$, $p = 0.538$, $\eta_p^2 = 0.008$].

Specifically, the acceptability scores were significantly higher for the non-IE order than for the IE order with or without prosody: $M = 2.23$ vs. $M = 1.39$ without prosody and $M = 2.46$ vs. $M = 1.77$ with prosody. The absence or presence of prosody, on the other hand, did not significantly change the acceptability scores for either the IE order or the non-IE order.

5.3.2. *daremo* + *NP*

For the stimuli with the NPI intervener *daremo* 'anyone' in a declarative sentence, the mean acceptability scores and their standard deviations (in parentheses) averaged over the two sets are shown in Table 6: those of (18a) and (34a) (IE order) and those of (18b) and (34b) (non-IE order). (Examples (34a and b) can be found in Appendix B.)

Table 6
Means and standard deviations of acceptability scores (*daremo* in a declarative sentence).

	IE order (<i>daremo</i> ^ NP-o)	Non-IE order (NP-o ^ <i>daremo</i>)
No Prosody	4.99 (0.07)	4.33 (0.88)
Prosody	4.90 (0.31)	4.48 (0.89)

The two-way 2×2 ANOVA indicated that the main effect of the word order was significant [$F(1,45) = 26.978$, $MSe = 0.504$, $p < 0.001$, $\eta_p^2 = 0.375$], but the main effect of the presence/absence of prosody was not significant [$F(1,45) = 0.211$, $MSe = 0.0.232$, $p = 0.648$, $\eta_p^2 = 0.005$]. The interaction of these variables was also not significant [$F(1,45) = 3.085$, $MSe = 0.213$, $p = 0.086$, $\eta_p^2 = 0.064$].

Specifically, the acceptability scores for the non-IE order were significantly lower than those for the IE order, whether prosody was absent ($M = 4.33$ vs. $M = 4.99$) or present ($M = 4.48$ vs. $M = 4.90$). However, due to its null main effect, the presence/absence of prosody did not cause a significant difference in the acceptability scores for either word order.

6. Discussion

6.1. The dake 'only' as intervener

Two main factors were examined in this study. According to the syntactic and semantic approaches, a significant word-order effect (IE order vs. non-IE order) was predicted to be observable with all three of the interveners, *dake*, *daremo* and *sika*. Our findings indicate, however, that while the two NPIs are archetypical interveners in the sense that they showed the expected word order effects, *dake* 'only' does not show IEs in the way that the previous analyses have reported. This point is well-illustrated by the lack of any significant contrast between the two word orders (i.e., by the flat lines in Fig. 4a below).

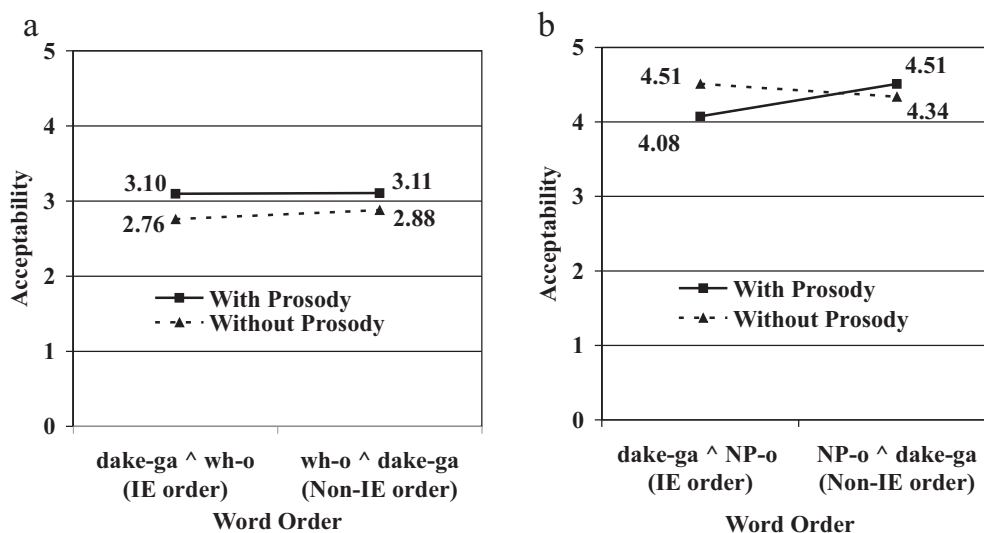


Fig. 4. Mean acceptability scores as a function of word order and prosody. (a) *dake* in a *wh*-sentence; (b) *dake* in a declarative sentence.

Tomioka (2009, 2011) described *dake* as a weak intervener, but even that terminology seems inaccurate. The lack of IEs with *dake* is particularly surprising for Beck's (2006) and Kim's (2005) analyses, which rely on the presence of non-singleton focus meaning and the structural relation (= c-command) between interveners and *wh*-phrases to capture the alleged ungrammaticality of IEs. *Dake* is a typical focus particle whose lexical meaning demands a non-singleton set, and its surface position should make a crucial difference in the judgments of these sentences.

It is important to note, however, that the overall acceptability of the *wh*-questions with *dake* hovers around the 'marginal' range ($M = 2.76\text{--}3.11$). The declaratives with *dake*, on the other hand, were judged 'clearly acceptable' in all four variants, with average ratings ranging from 4.08 to 4.51, as shown in Fig. 4b. This contrast suggests that *dake* does cause some negative effects when it interacts with a *wh*-question, but these effects cannot be identified as IEs since the signature characteristic of IEs, the improvement with scrambling, is not observed. That is, *dake* does not seem to be causing grammatical violations even in the IE construction.

As mentioned in section 1, the information-structural account of Tomioka (2007) can offer a reasonable explanation for the contrast. The overall negative effect in *wh*-questions with *dake* is due to the default interpretation of *dake*-phrases as sentence foci regardless of their structural positions. Such a construal would create a less than ideal information structure for a *wh*-question since the *dake*-phrases are less likely to be confined within the background.¹³ The ill effects that result from the imperfect information structure, however, are expected to be relatively mild since there are no syntactic or semantic constraints being violated. Under the Implicit Prosody Hypothesis, the default interpretation of the intervener as a focalized expression would impact the silent reading process in such a way that *dake*-phrases receive implicit focal prominence (as in Fig. 2) when the sentences are presented without audio-stimuli. Comparing the two types of stimuli, we detected a statistically significant improvement with prosody. The result implies that the addition of auditory stimuli as in Fig. 1a and b eliminates some of the ill effects of the implicit focal accents on *dake*-phrases.¹⁴

6.2. The NPI interveners

The outcomes concerning the two NPI interveners *sika* 'anyone/thing but' and *daremo* 'anyone' are illustrated in Figs. 5 and 6 below, and are just as expected in some respects but quite surprising in others.

As was already mentioned in connection with *dake*, the NPIs proved to be archetypical interveners: for both NPIs, the IE order was significantly less acceptable than the non-IE order with both the visual-only and the visual + audio stimuli (Figs. 5a and 6a). The two NPIs behaved differently, however, with respect to the other main effect we examined, namely the role of implicit and explicit prosody. While explicit prosody led to a robust improvement in the acceptability judgments

¹³ That is, *wh*-questions are less acceptable when something other than the *wh*-phrase is focused (either instead of the *wh*-phrase or in addition to the *wh*-phrase).

¹⁴ It is not the case, however, that addition of prosody unconditionally improves acceptability judgments of all sentences. This point is demonstrated in Fig. 4b by the contrast between the visual stimuli ($M = 4.51$) and the visual + audio stimuli ($M = 4.08$) in declarative sentences.

We can perhaps consider that *dake* and *sika* involve a ‘recessive’ lexical accent (cf. Poser, 1984), which is realized in a somewhat irregular way as focus prominence. When the host N is unaccented as in (20a), focus prominence generally shows up on the affix itself. When the N is lexically accented as in (20b), on the other hand, it may show up on the affix alone ((i)–(ii)), on the N alone ((iii)–(iv)), or on both of them ((v)–(vi)). Which of these alternative forms is accepted or preferred varies among speakers. In any case, the focus prosody of the N-*dake/sika* sequence involves an emphatic F0 boost of the form LHL. In addition, it is followed by a post-focal reduction of the elements immediately following the sequence. On the other hand, *daremo* ‘anyone’, a free-standing lexical item, lacks a lexical accent altogether. Accordingly, its focus prominence does not involve any contour from H to L. It does not involve any radical pitch range compression by post-focal reduction, either. Our speculation is that because of these differences, stimuli with prosody are more helpful for figuring out the focal status of an NP when the NP involves a lexical accent.

Though informally, we can observe such a contrast between accented and unaccented foci when we compare their pitch contours with those of non-foci. In Fig. 7, we are comparing one of our audio stimuli involving an accented focus with an almost identical sentence in which the accented focus was replaced by an accented topic.

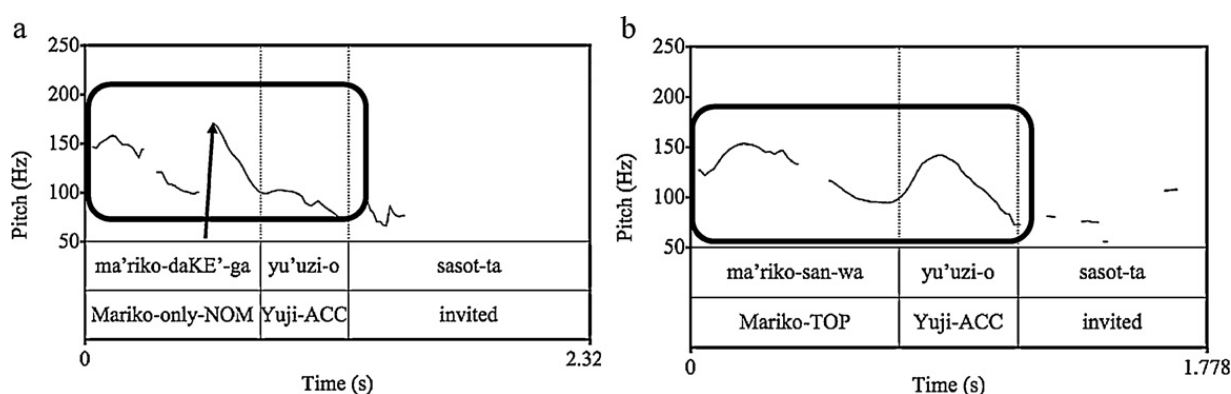


Fig. 7. Pitch-track diagrams for an accented focus and non-focus in a declarative sentence. (a) Accented focus: (=Fig. 3a above). (b) Accented non-focus.

The focus prosody involving emphatic prominence and post-focal reduction in Fig. 7a and the lack thereof in Fig. 7b provide us with quite distinct tonal contours. In Fig. 8, we are making a similar comparison with an unaccented focus (in one of our audio stimuli) and an unaccented topic.

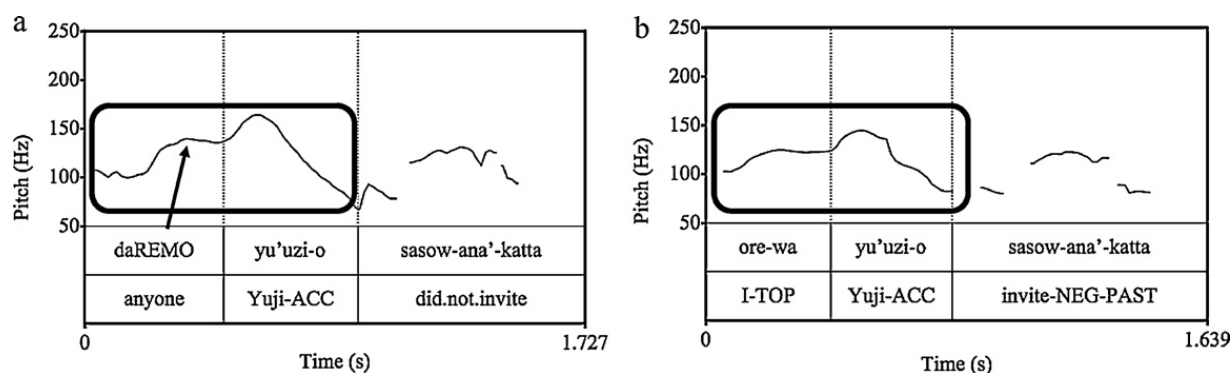


Fig. 8. Pitch-track diagrams for an unaccented focus and non-focus in a declarative sentence. (a) Unaccented focus. (b) Unaccented non-focus.

In contradistinction to the accented cases in Fig. 7, an unaccented focus and non-focus display somewhat similar tonal contours, as shown in Fig. 8a and b. We consider that such a contrast between accented and unaccented foci is likely to be at least a partial reason why in our experiment explicit prosody failed to induce a robust improvement in the acceptability judgments of *wh*-questions with the unaccented intervener *daremo* ‘anyone’. While it goes beyond the scope

of this article, further investigation of the contrast between accented and unaccented foci has great potential to influence our prosodic analyses of information packaging in general.¹⁵

To sum up, we have found effects of prosody on the acceptability of intervention sentences in two out of the three patterns that we examined. The presence of an improvement effect in those examples suggests the following scenario. The participants tend to assign focal prominence to the interveners in their silent readings of the intervention sentences. The removal of such prominence with the audio stimuli helps the participants to 'undo' this implicit prosody for the interveners with lexical accents. This led to the improvement in the acceptability judgments of the intervention sentences.

Directing our attention to the significant positive effects of the accented NPI interveners, we point out that the results are consistent with the pragmatic analysis of IEs by Tomioka (2007). The prosody employed in the audio stimuli explicitly discourages the information-structural focus interpretation for the intervener *NP-sika*, and only in the pragmatic analysis is this manipulation expected to play a positive role in the acceptability judgments. The ideal information-structural partition in a *wh*-question places the intervener in the background, and the prosody that avoids focal prominence on the intervener would certainly facilitate the realization of that partition. The semantic analysis (or any other 'structural' analysis), on the other hand, would not attend to the information-structural status of interveners. An intervener is earmarked for the semantic property of requiring a non-singleton focus meaning. Since this property is independent of whether the intervener is a sentence focus or is a part of the background, the intervention effects are expected to be invariably induced regardless of the information-structural shifts. This prediction is not supported by our experimental results.

6.2.2. Scrambling and the NPI interveners

Another surprising finding concerning the NPI interveners is the ratings of the supposedly grammatical non-IE questions. Although they show a clear improvement over the IE questions, they were hardly considered fully acceptable. The mean scores for the non-IE variant (= the *wh* ^ *NPI* order) for *daremo* 'anyone' are 2.23 (visual-only) and 2.46 (visual + audio), as shown in Fig. 6a. The scores are even lower for *sika*: 1.55 (visual only) and 1.87 (visual + audio), as shown in Fig. 5a. These ratings can perhaps be characterized as 'marginal' at best (or even worse). The overall low ratings of the non-IE sentences come as a big surprise for all the existing theories of IEs.

We have at least a partial answer to this puzzle of the unexpectedly low acceptability of non-IE sentences. The results of declarative sentences with NPI subjects show that the acceptability of the scrambled order (= the *NP-acc* ^ *NPI*) is significantly lower than that of the base order (= the *NPI* ^ *NP-acc*) in both types of stimuli (Figs. 5b and 6b). (Recall that the scrambled order corresponds to the non-IE *wh*-questions in the sense that the NPI subject follows the object.) We can then hypothesize that the scrambling of an object over an NPI subject causes some negative effects. Let us now reconsider the contrast between the IE and the non-IE orders of *wh*-questions. The non-IE order improves, but its improvement should be interpreted in the context of the negative effects of scrambling. In other words, the enhancement in the acceptability would have been more dramatic if the scrambling over the NPI subject did not have a negative impact. It should also be pointed out that the overall acceptability is higher with *daremo* than with *sika* in the declarative sentences, and the tendency is even more noticeable with the scrambled order. That is, the lowering effect of scrambling in declarative sentences is larger with *sika* than *daremo* (Fig. 5b vs. Fig. 6b) while the repair effect of scrambling in *wh*-interrogatives is weaker with *sika* than *daremo* (Figs. 5a and 6a). This inverse correlation suggests that our account is probably correct. It is still uncertain if the acceptability of the non-IE pattern would have jumped to the acceptable range were there no negative effect of scrambling, but it is highly likely that it makes a significant contribution to the generally low acceptability of *wh*-questions with NPI subjects.

At the same time, it should be noted that the main effect of word order in the declarative sentences with *dake* was non-significant, and no consistent negative effect of scrambling was observed (see Table 2 and the paragraph following it in section 5.1.2). We cannot, therefore, ascribe the observed phenomenon entirely to the general and simple processing cost associated with scrambled sentences. This leads us to conclude that the lack of IEs with *dake* in *wh*-interrogatives (Fig. 4a and Table 1) is genuine and is not masked by the negative impact of the scrambled order. At the same time, it brings out a new agenda for future research — how exactly the observed asymmetry arises between NPI and non-NPI subjects in the scrambling construction needs to be clarified with further experimental investigation.

¹⁵ See McCawley (1968), Poser (1984), Pierrehumbert and Beckman (1988), and Maekawa (1994), among others, for related discussion revolving around the hypothesis that 'dephrasing' takes place in prosodic phonology.

6.2.3. Further burdens on the NPI interveners

The NPI interveners *si'ka* and *daremo* showed clearer IEs than the non-NPI intervener *dake* in our experiment. While this result could suggest the existence of IEs as a grammatical failure, there are reasons to consider that it does not necessarily urge us to draw such a conclusion. In fact, the degree of (un)acceptability of the IE-sentences shown in Figs. 5a and 6a ($M = 1.52$ – 1.77 with prosody and $M = 0.96$ – 1.39 without) seems to be more comparable to that of the “less acceptable” fillers than the “clearly unacceptable” fillers shown in Appendices D and E, respectively.¹⁶ There may be additional extra-grammatical factors, in other words, that contribute to the degenerated status of IE-sentences involving the NPI interveners.

One such factor may be traced back to a subtle subject-object asymmetry in *wh*-questions with negative quantifiers/NPIs. (21) below involves *wh*-questioned objects with negative quantifier/polarity subjects. While they are by no means ungrammatical/unacceptable, they are noticeably more complex compared to (22), which involves *wh*-questioned subjects with negative quantifier/polarity objects.

- (21) a. **Who** did **nobody** invite?
 b. **Who** didn't **anybody** invite?
- (22) a. **Who** invited **nobody**?
 b. **Who** didn't invite **anybody**?

This presumably is because (21) needs more specialized contextual information: the list of potential invitees and that of actual invitees must be compared. Functionally speaking, the same information can be asked for in a simpler way by uttering *Who wasn't invited?* All of our test sentences in Japanese have the pattern of (21), and it is likely that their acceptability scores are negatively affected by whatever features make (21) less straightforward than (22).

Another candidate for an additional extra-grammatical IE factor for the NPI interveners is the presence of two licenser-licensee relations, “NPI-NEG” and “*wh*-COMP_Q,” within a single utterance. It is conceivable that they may impose an additional memory load in the processing of the IE sentences (de Vincenzi, 1991; Miyamoto and Takahashi, 2002). Moreover, since such dual licensing must be fulfilled in a crossing fashion in the IE sentences, some processing problem may also arise (cf. Bach et al., 1986; Nakamura and Miyamoto, 2006; Nakatani and Gibson, 2010).

In short, more exhaustive explication of the IEs involving the NPI interveners must await further examinations of multiple factors.

7. Conclusion

This paper investigated the effects of implicit prosody on the judging of intervention sentences in Japanese. The experimental results reported here showed that implicit prosody has significant effects in two of the three cases we examined. When the intervener is lexically accented, the effects of implicit prosody are significant, whereas unaccented interveners showed the same tendencies but the effects were not significant. All in all, the results argue for the Implicit Prosody Hypothesis, although the support may not be unconditional. They also imply that the notion of focus relevant to IEs is the one based on information structure, rather than semantics. *Only*, for instance, requires a non-singleton focus value for its associate, whether it has information-structural focus or not. If that property alone were responsible for IEs, no implicit prosody effects would be expected to arise. Therefore, the results reported here cannot be accommodated by a purely semantic explanation.

¹⁶ For example, one of the “less acceptable fillers” in (i) below ($M = 0.71$ with prosody and $M = 0.96$ without) involves no grammatical problems, and its marginality/awkwardness arises from the complexity of the predicate, which involves multiple negation (and more).

- (i) Kinoo-no paatii-wa omosiroku-**na**-sasugi-**masen**-desita. (= (40))
 yesterday-GEN party-TOP interesting-NEG-TOO-NEG-WAS
 ‘The party last night was not too uninteresting.’

This makes a sharp contrast with a “clearly unacceptable filler” as in (ii) ($M = 0.41/M = 0.25$), which involves violation of the well-known ‘double-*o*’ constraint.

- (ii) Sanzi-ni kodomo-**o** oyatu-**o** tabe-sase-masita. (= (41))
 3.o'clock-at child-ACC snack-ACC eat-CAUS-PAST
 ‘(I) had the child eat snacks at 3 o'clock.’

In addition to the findings on the main effect, the experiment has also revealed a few rather intriguing points. First, contrary to the previous characterization of IEs, *dake* 'only' should not be considered as an intervener. This in turn makes it necessary to re-examine other 'weak' interveners, such as *da'remo* 'everyone', *dareka* 'someone', and *A ka B* 'A or B'. Second, while the NPI interveners showed clearer IEs, the supposedly grammatical '*wh* ^ intervener' order did not meet our expectation and was still judged quite low in terms of acceptability. We speculated that this could be attributed to the general negative effects generated by the scrambling of an object over an NPI subject.

All these considerations combined with our experimental results lead us to support the approach that regards IEs not as simple ungrammaticality but as a composite acceptability-lowering phenomenon caused by heterogeneous extra-syntactic or extra-grammatical factors.

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Appendix A. The *Wh*-stimuli

A.1. <The *sasow* 'invite' set>

- (23) The *dake* 'only' + *wh* stimuli: (= (13))
- a. Ma'riko-**dake**^(v)-*ga* *dare-o* sasot-ta-no? (IE order: *Int* ^ *Wh* = Base-generated order)
 Mariko-only-NOM who-ACC invited-PAST-Q
 'Who did only Mariko invite?'
 真理子だけが 誰を 誘ったの?
- b. *dare*₁-*o* Ma'riko-**dake**^(v)-*ga* *t*₁ sasot-ta-no? (Non-IE order: *Wh* ^ *Int* = Scrambled order)
 who-ACC Mariko-only-NOM invite-PAST-Q
 誰を 真理子だけが 誘ったの?
- (24) The *sika* 'anyone but' + *wh* stimuli: (= (14))
- a. Mi'nako-**si**^(v)**ka** *dare-o* sasowa-na-kat-ta-no? (IE order: *Int* ^ *Wh*)
 Minako-anyone.but who-ACC invite-NEG-PAST-Q
 'Who didn't anyone but Minako invite?'
 美奈子しか 誰を 誘わなかったの?
- b. *dare*₁-*o* Mi'nako-**si**^(v)**ka** *t*₁ sasowa-na-kat-ta-no? (Non-IE order: *Wh* ^ *Int*)
 who-ACC Minako-anyone.but invite-NEG-PAST-Q
 誰を 美奈子しか 誘わなかったの?
- (25) The *daremo* 'anyone' + *wh* stimuli: (= (15))
- a. **daremo** *dare-o* sasowa-na-kat-ta-no? (IE order: *Int* ^ *Wh*)
 anyone who-ACC invite-NEG-PAST-Q
 'Who didn't anyone invite?'
 だれも 誰を 誘わなかったの?
- b. *dare*₁-*o* **daremo** *t*₁ sasowa-na-kat-ta-no? (Non-IE order: *Wh* ^ *Int*)
 who-ACC anyone invite-NEG-PAST-Q
 誰を だれも 誘わなかったの?

A.2. <The home 'praise' set>

(26) The *dake* 'only' + *wh* stimuli:

- a. Na'nako-**dake**⁽ⁱ⁾-*ga dare-o* home-ta-no? (IE order: *Int* ^ *Wh*)
 Nanako-only-NOM who-ACC praise-PAST-Q
 'Who did only Mariko praise?'
 奈々子だけが 誰を ほめたの?
- b. *dare*₁-*o* Na'nako-**dake**⁽ⁱ⁾-*ga t*₁ home-ta-no? (Non-IE order: *Wh* ^ *Int*)
 who-ACC Nanako-only-NOM praise-PAST-Q
 誰を 奈々子だけが ほめたの?

(27) The *-sika* 'anyone but' + *wh* stimuli:

- a. Yu'miko-**si**⁽ⁱ⁾**ka dare-o** home-**na**-kat-ta-no? (IE order: *Int* ^ *Wh*)
 Yumiko-anyone.but who-ACC praise-NEG-PAST-Q
 'Who didn't anyone but Yumiko praise?'
 由美子しか 誰を ほめなかったの?
- b. *dare*₁-*o* Yu'miko-**s**⁽ⁱ⁾**ika t**₁ home-**na**-kat-ta-no? (Non-IE order: *Wh* ^ *Int*)
 who-ACC Yumiko-anyone.but praise-NEG-PAST-Q
 誰を 由美子しか ほめなかったの?

(28) The *daremo* 'anyone' + *wh* stimuli:

- a. **dare-mo dare-o** home-**na**-kat-ta-no? (IE order: *Int* ^ *Wh*)
 anyone who-ACC praise-NEG-PAST-Q
 'Who didn't anyone praise?'
 だれも 誰を ほめなかったの?
- b. *dare*₁-*o* **daremo t**₁ home-**na**-kat-ta-no? (Non-IE order: *Wh* ^ *Int*)
 who-ACC anyone praise-NEG-PAST-Q
 誰を だれも ほめなかったの?

Appendix B. The NP-stimuli

B.1. <The sasow 'invite' set>

(29) The *dake* + NP stimuli: (= (16))

- a. Ma'riko-**dake**⁽ⁱ⁾-*ga Yuuzi-o* sasot-ta. (IE order: *Int* ^ *NP*)
 Mariko-only-NOM Yuji-ACC invite-PAST
 'Only Mariko invited Yuji'
 真理子だけが 裕二を 誘った。
- b. *Yuuzi*₁-*o* Ma'riko-**dake**⁽ⁱ⁾-*ga t*₁ sasot-ta. (Non-IE order: *NP* ^ *Int*)
 Yuji-ACC Mariko-only-NOM invite-PAST
 裕二を 真理子だけが 誘った。

(30) The *sika* + NP stimuli: (= (17)) (Non-IE order: *Int* ^ *NP*)

- a. Mi'nako-**si**⁽ⁱ⁾**ka Naoya-o** sasowa-**na**-kat-ta.
 Minako-anyone.but Naoya-ACC invite-NEG-PAST
 'Anyone but Minako didn't invite Naoya. (= No one but Minako invited Naoya.)'
 美奈子しか 直也を 誘わなかった。
- b. *Naoya*₁-*o* Mi'nako-**si**⁽ⁱ⁾**ka t**₁ sasowa-**na**-kat-ta. (IE order: *NP* ^ *Int*)
 Naoya-ACC Minako-anyone.but invite-NEG-PAST
 直也を 美奈子しか 誘わなかった。

(31) The *daremo* + NP stimuli: (= (16))

- a. **daremo** *Yuuzi-o* **sasowa-na-kat-ta.** (IE order: *Int* ^ *NP*)
 anyone *Yuji-ACC* **invite-NEG-PAST**
 'Anyone didn't invite Yuji. (= No one invited Yuji.)'
 だれも 裕二を 誘わなかった。
- b. *Yuuzi₁-o* **daremo** **t₁** **sasowa-na-kat-ta.** (Non-IE order: *NP* ^ *Int*)
Yuji-ACC anyone **invite-NEG-PAST**
 裕二を だれも 誘わなかった。

B.2. <The *home* 'praise' set>(32) The *dake* + NP stimuli:

- a. **Na'nako-dake⁽ⁱ⁾-ga** *Yuuzi-o* **home-ta.** (IE order: *Int* ^ *NP*)
 Nanako-only-NOM *Yuji-ACC* **praise-PAST**
 'Only Nanako praised Yuji'
 奈々子だけが 裕二を ほめた。
- b. *Yuuzi₁-o* **Na'nako-dake⁽ⁱ⁾-ga** **t₁** **home-ta.** (Non-IE order: *NP* ^ *Int*)
Yuji-ACC Nanako-only-NOM **praise-PAST**
 裕二を 奈々子だけが ほめた。

(33) The *sika* + NP stimuli:

- a. **Mi'nako-si⁽ⁱ⁾ka** *Naoya-o* **home-na-kat-ta.** (IE order: *Int* ^ *NP*)
 Minako-anyone.but *Naoya-ACC* **praise-NEG-PAST**
 'Anyone but Minako didn't praise Naoya. (= No one but Minako praised Naoya.)'
 美奈子しか 直也を ほめなかった。
- b. *Naoya₁-o* **Mi'nako-si⁽ⁱ⁾ka** **t₁** **home-na-kat-ta.** (Non-IE order: *NP* ^ *Int*)
Naoya-ACC Minako-anyone.but **praise-NEG-PAST**
 直也を 美奈子しか ほめなかった。

(34) The *daremo* + NP stimuli:

- a. **daremo** *Yuuzi-o* **home-na-kat-ta.** (IE order: *Int* ^ *NP*)
 anyone *Yuji-ACC* **praise-NEG-PAST**
 'Anyone didn't praise Yuji. (= No one praised Yuji.)'
 だれも 裕二を ほめなかった。
- b. *Yuuzi₁-o* **daremo** **t₁** **home-na-kat-ta.** (Non-IE order: *NP* ^ *Int*)
Yuji-ACC anyone **praise-NEG-PAST**
 裕二を だれも ほめなかった。

Appendix C. Clearly acceptable fillers

Samples of filler sentences are divided into three different groups (clearly acceptable, less acceptable, and clearly unacceptable). The mean acceptability scores from 49 to 51 participants and their standard deviations (in parentheses) are shown after each sentence.

- (35) *Boku-wa* *hikooki-yorimo* *sinkansen-noho-ga* *sukidesu.*
 I-TOP airplane-than bullet.train-choice-NOM like
 'I prefer bullet trains to airplanes.'
 僕は 飛行機よりも 新幹線の方が 好きです。

No Prosody	4.92 (0.34)
Prosody	4.90 (0.36)

- (36) Kimi-wa naze sonna-tokoro-e itta-no?
 you-TOP why such-place-to went-Q
 'Why did you go to such a place?'
 君は なぜ そんな所へ いったの？

No Prosody	4.92 (0.34)
Prosody	4.90 (0.36)

- (37) Asu-wa dokoemo dekakeru yotee-wa arimasen.
 tomorrow-TOP to.anywhere go.out plan-TOP doesn't.exist
 'I have no plan to go out anywhere tomorrow.'
 明日は どこへも でかける予定は ありません。

No Prosody	4.37 (1.22)
Prosody	4.73 (0.80)

Appendix D. Less acceptable fillers

- (38) Taro-ga kooen-e kodomo-ni ika-ase-ta.
 Taro-NOM park-to child-DAT go-CAUS-PAST
 'Taro had the child go to the park.'
 太郎が 公園へ 子供に行かせた。

No Prosody	1.75 (1.32)
Prosody	1.86 (1.28)

- (39) Boku-no koko-e kita-koto-wa naisyo-dayo.
 I-GEN here-to came-the.fact-TOP secret-it.is
 'Please keep it to yourself that I came here.'
 僕のここへ来たことは ないしょだよ。

No Prosody	1.53 (1.27)
Prosody	1.94 (1.42)

- (40) Kinoo-no paatii-wa omosiroku-na-sasugi-masen-desita.
 yesterday-GEN party-TOP interesting-NEG-too-NEG-was
 'The party last night was not too uninteresting.'
 昨日のパーティーは 面白くなさすぎませんでした。

No Prosody	0.96 (0.94)
Prosody	0.71 (0.81)

Appendix E. Clearly unacceptable fillers

- (41) Sanzi-ni kodomo-o oyatu-o tabe-sase-masita.
 3.o'clock-at child-ACC snack-ACC eat-CAUS-PAST
 '(I) had the child eat snacks at 3 o'clock.'
 3時に 子供を オヤツを 食べさせました。

No Prosody	0.25 (0.56)
Prosody	0.41 (0.67)

- (42) Nee kyoo dare-ga kita-to omow-ana-katta-yo.
 hey today who-NOM came-COMP think-NEG-PAST-I.SAY
 'Hey. Let me tell you who I didn't think had come.'
 ねえ 今日 誰が 来たと思わなかったよ。

No Prosody	0.67 (0.82)
Prosody	0.22 (0.42)

- (43) Ore kesa-kara nannimo tabeterun-daze.
 I this.morning-since anything have.eaten-I.tell.you
 'Let me tell you that I have eaten nothing since this morning.'
 俺 けさから なんにも 食べてるんだぜ。

No Prosody	0.08 (0.27)
Prosody	0.06 (0.24)

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