

ON THE INTERACTION AMONG SENTENCE TYPES, BIAS, AND INTONATION: A RATING STUDY*

Yurie Hara
City University of Hong Kong

1. Introduction

Many languages express question meanings morpho-syntactically and prosodically. In Japanese, a question particle *ka* marks a sentence as interrogative (1) with or without a rising tune ‘↑’ (L%*H*% in J_ToBi (Venditti, 2005)).

- (1) John-ga kuru *ka*
John-NOM come Q
‘Is John coming?’

A question meaning can also be expressed by a declarative sentence with a rising intonation *John-ga kuru*↑. Although all of these utterance types express some kind of question meanings, previous analyses (Gunlogson, 2003; Nilsenova, 2002, etc.) agree upon that they are not completely interchangeable. This study examines the interaction between these combinations of sentence types, and the Japanese modal particle *darou*, which sheds new light on the influence of intonation and sentence types on interpretation of sentences.

The paper is structured as follows. Section 2 summarizes introspection-based data of the distribution of *darou*-sentences in different clause types and with different boundary tones. In particular, *darou* cannot occur in a rising interrogative. Section 3 presents a rating experiment which empirically supports the observation given in Section 2. Section 4 makes three proposals regarding the *darou* morpheme and the boundary tones to account for the distributional pattern and the experimental result. *Darou* is a sentence type modifier which restricts the modal base for the prejacent proposition to the speaker’s beliefs, while a rising tune indicates that the utterance is directed at an addressee. Thus, when a rising tune is used with a *darou*-interrogative, the whole utterance performs a strange speech act which inquires the addressee about the speaker’s beliefs. Section 5 concludes the paper.

2. Basic Paradigm

Falling Declaratives When *darou* is attached to the end of a plain declarative as in (2), the whole sentence indicates that the speaker has a bias toward the prejacent proposition *John-ga kuru* ‘John is coming’.

- (2) John-ga kuru *darou*.
Jonn-Nom come DAROU
‘John is coming, I bet. ≈ Probably, John is coming.’

*The presented research is partially supported by City University of Hong Kong New Staff Start-up Grant (Project No. 7200192) and College Research Grant (Project No. 9610227). I would like to thank Yuki Hirose, Shigeto Kawahara and my research assistants, Yuli Feng and Kenji Ogawara. The work has been improved from the discussion with Christopher Davis, Magdalena Kaufmann, Satoshi Tomioka, and the audience at GLOW in Asia IX. All remaining errors are mine.

The conclusion that plain declaratives with *darou* must express “the speaker’s bias” is supported by the following observations: 1) co-occurrence with probability adverbs, and 2) obligatory wide-scope reading under *because*-clauses.

Sugimura (2004) observes that *darou* can co-occur with high-probability adverbs (3) but not with a low-probability adverb (4).

- (3) kare-wa tabun/kitto kuru darou.
 he-TOP probably/certainly come DAROU
 ‘Probably/Certainly, he will come.’
- (4) *kare-wa moshikasuruto kuru darou.
 he-TOP maybe come DAROU

(Sugimura, 2004)

This asymmetry suggests that *darou* requires some minimal degree of bias toward the prejacent proposition, which conflicts with the low degree of commitment expressed by the low probability adverb in (4). The contrast between (5-a) and (5-b) shows that the agent of this bias needs to be the speaker. In (5-a), the speaker’s assessment of the likelihood of raining is the cause of him bringing his umbrella. The infelicity of (5-b) results from the fact that the bias contributed by *darou* cannot be shifted, and so the sentence ends up meaning that the speaker’s bias toward ‘it will rain’ has caused John to bring an umbrella, instead of the intended reading according to which *John*’s assessment of the likelihood of rain causes him to bring his umbrella.

- (5) a. boku-wa ame-ga furu darou kara kasa-o mot-te it-ta
 I-TOP rain-NOM fall DAROU because umbrella-ACC have-and go-PAST
 ‘Because it will rain (I bet), I took an umbrella with me.’
- b. ??John-wa ame-ga furu darou kara kasa-o mot-te it-ta
 John-TOP rain-NOM fall DAROU because umbrella-ACC have-and go-PAST
 ‘Because it will rain (I bet), John took an umbrella with him.’

Contrasts like those above show that in falling declaratives, *darou* marks the *speaker’s bias* toward the prejacent proposition.

Rising Interrogatives Interrogatives in Japanese are marked with the sentence final particle *ka*. *Darou* cannot be used in such an interrogative construction with a final rising intonation (L%*H*% in the J_ToBI system (Venditti, 2005)). The final rise is depicted in Figure 1.

- (6) *Yurie-wa wain-o nomu darou-ka↑
 Yurie-TOP wine-ACC drink DAROU-Q

Falling Interrogatives It is not the case that *darou* is simply incompatible with interrogative constructions. If *darou* occurs within a falling interrogative, it is grammatical and interpreted as a self-addressing question, as in (7) and Figure 2.

- (7) Yurie-wa wain-o nomu darou-ka↓
 Yurie-TOP wine-ACC drink DAROU-Q
 ‘I wonder if Yurie drinks wine.’

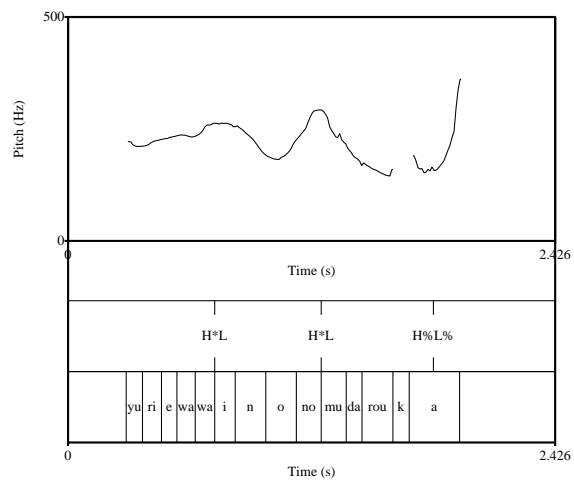


Figure 1: Rising Interrogative

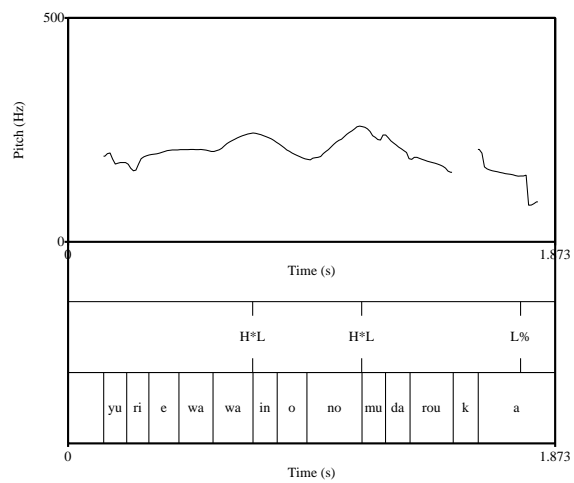


Figure 2: Falling Interrogative

Rising Declaratives (8) and Figure 3 show that *darou* is also compatible with rising declaratives, and such utterances appear to function as tag questions.

- (8) Yurie-wa wain-o nomu darou↑
 Yurie-TOP wine-ACC drink DAROU
 ‘Yurie drinks wine, right?’

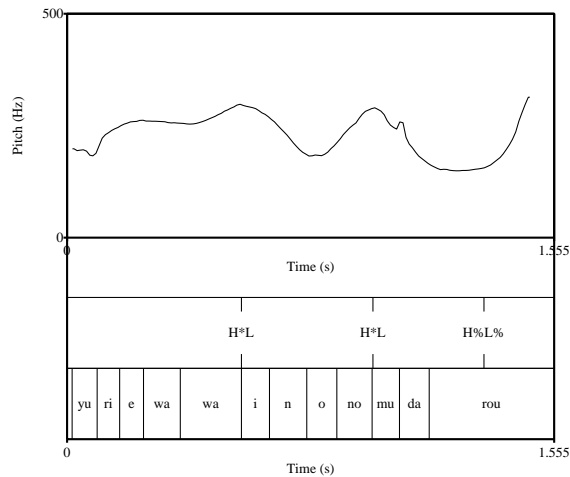


Figure 3: Rising Declarative

Summary *Darou* indicates the speaker’s bias in falling declaratives, but interpretation varies as a function of both clause type and final boundary tone, as summarized in Table 1. To confirm this observation objectively (see Schütze 1996), a rating experiment was conducted.

	Falling	Rising
Declarative	statement (‘I bet’)	tag Q (‘, right?’)
Interrogative	self-addressed Q (‘I wonder’)	*

Table 1: *Darou*-utterances

3. Experiment

The previous section gave an informal characterization of the distribution of *darou* with respect to different clause types and sentence-final intonations. A naturalness rating experiment was conducted in which native speakers of Tokyo Japanese judged the naturalness of different combinations of clause types and boundary tones. Section 2 showed that an interrogative construction with *darou* is not compatible with the rising tune. It is predicted that an interrogative with *darou* is dispreferred when it is pronounced with the rising tune.

3.1. Method

Stimuli The stimuli had two fully-crossed factors—sentence types and boundary tones, which resulted in four conditions. Each condition had 16 items, resulting in 64 target sentences (16 items * 4 conditions). 64 fillers were included.

Recording A native female speaker of Tokyo Japanese, who was naive to the purpose of the experiment, pronounced the stimuli in a sound-attenuated room at the Research Laboratory for Phonetics and Cognitive Studies of City University of Hong Kong. She produced all the stimuli in isolation, and the stimuli were presented in Japanese orthography. For each sentence, the speaker was asked to pronounce it with the rising and falling boundary tone.

Procedure The rating experiment was conducted in a sound-attenuated room in the Sound Lab at the University of Tokyo. The stimuli were presented by an assessment management software program, Perception. The participants were asked to wear headphones. The first page of the test showed the instructions.

In the main section, the participants were asked to listen to each stimulus, and then judge the naturalness of stimuli on a 5-point scale (provided in Japanese): very natural, somewhat natural, undecidable, somewhat unnatural, very unnatural. They were also reminded not to rate the naturalness in terms of the social appropriateness of the speech.

The test started with a practice session where the participants ran through five practice items, which were unique to the practice block. The main experiment was organized into four blocks separated by three break signs. Each block contained 16 items. None of the stimuli were repeated and the order of the stimuli within each block was randomized by Perception. No minimal pair sentences appeared next to each other.

Participants Fourteen native speakers of Tokyo Japanese participated in the rating experiment. They were undergraduate students recruited from the University of Tokyo and received 1000 Japanese yen as compensation.

Statistics The responses were converted to numerical values as follows: very natural=5; somewhat natural=4; undecidable=3; somewhat unnatural=2; very unnatural=1. To analyze the results, a general linear mixed model (Baayen, 2008; Baayen et al., 2008; Bates, 2005) was run using the `lme4` package (Bates et al., 2011) implemented in R (R Development Core Team, 2011). Sentence types and boundary tones were the fixed factors. Speakers and items were the random factors. The p-values were calculated by the Markov chain Monte Carlo method using the `LanguageR` package (Baayen, 2009).

If the availability of the rising tone depends on the type of the sentence, then the dependency is expected to result in a significant interaction between sentence types and boundary tones.

3.2. Results

Figure 4 shows the average naturalness ratings in each condition. Regardless of syntactic constructions, rising intonations are discouraged in general ($t = -36.28, p < .001$). There was no significant interaction between falling declarative and interrogative constructions. On the other hand, with a rising intonation, the speakers judged interrogative constructions least natural. Because of this asymmetry, the interaction between syntax and intonation was significant in the linear mixed model analysis ($t = -13.12, p < .001$).

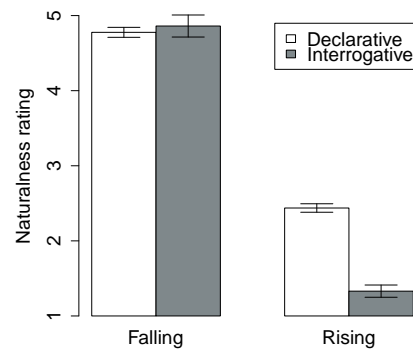


Figure 4: Average Naturalness Ratings

4. Discussion

The result of the experiment indicates that a rising intonation is generally discouraged. This result was somehow unexpected, as (8) is introspectively judged as grammatical. I speculate that this discrepancy between the introspection and the experiment is due to the fact that each experimental stimulus did not have any preceding utterance. Rising intonations presuppose the existence of the addressee, as proposed in Section 4.2. The result also confirms that a rising interrogative with *darou* is ungrammatical.

The distribution gives rise to the following questions: (i) Why is *darou-ka*↑ ungrammatical? (ii) Why is *darou-ka*↓ interpreted as a self-addressing question? In this section, I make three proposals which answer these questions.

4.1. Proposal 1

First, I propose that *darou* functions as a discourse-level modal operator and a sentence type modifier (Zimmermann, 2004; Davis, 2009). Under this analysis, *darou* restricts the speech act so that it performs an update on the belief associated to the speaker.

The following contrast shows that *darou* is a discourse-level modal. While the “normal” propositional modal *nichigainai* can occur inside embedded questions (9), *darou* cannot (10).

- (9) Emi-ga igirisu-ni itta nichigainai ka douka kiite mita.
 Emi-NOM England-DAT went must Q or.not to.ask tried
 ‘I asked whether Emi must have left for England or not.’
- (10) * Emi-ga igirisu-ni itta darou ka douka kiite mita.
 Emi-NOM England-DAT went DAROU Q or.not to.ask tried
 Intended: ‘I asked whether Emi probably left for England or not.’

The ungrammaticality of (10) shows that the combination of *darou* with interrogatives is a root phenomenon (see Hara (2006) for more arguments).

As discussed in Section 2, *darou* in a plain declarative indicates the speaker’s strong bias. When used in a falling interrogative, however, the bias meaning disappears, as seen in (11).

- (11) Ashita hareru darou ka. Zenzen wakar-anai.
 tomorrow sunny DAROU Q at.all understand-not
 ‘I wonder if it will be sunny tomorrow. I have no idea.’

This shows that the bias meaning should not be encoded in the semantics of *darou* itself. How then does the bias effect of *darou* in falling declaratives come about?

The infelicity of examples like (5-b) shows that the holder of the bias expressed by the *darou* sentence has to be the speaker. Given this, I claim that one of the effects of *darou* is to restrict the modal base for the prejacent proposition to the speaker’s beliefs. Thus, if *darou* is used in a declarative, *p-darou* indicates that the assertive update is performed on the basis of the speaker’s beliefs, and in turn the utterance indicates the speaker’s bias. In contrast, if *darou* is used in an interrogative, the utterance questions into the speaker’s beliefs, and no bias is indicated.

In formally characterizing the effects of *darou*, we use the framework of dynamic update semantics (Stalnaker, 1968; Heim, 1982), where utterances are considered as context change potentials (CCP), functions from contexts to contexts. In order to deal with the interrogatives, a context set c is defined as a set of pairs of worlds (Groenendijk, 1999; Isaacs and Rawlins, 2008). Let us take a look at the case of the assertion, i.e., the update encoded by a declarative sentence. In a classic framework of the assertion (Stalnaker, 1968), the context set is a set of worlds, thus an assertive update deletes worlds which make the propositional content false. In the current model, the context set is a set of pairs world, hence an assertive update removes all pairs a member of which makes the propositional content false.

- (12) Assertive update (\oplus) on contexts: For some context (set) c and clause ϕ :
 $c \oplus \phi = \{\langle w_1, w_2 \rangle \in c \mid \llbracket \phi \rrbracket^{w_1, c} = \llbracket \phi \rrbracket^{w_2, c} = 1\}$
 (Issacs and Rawlins’ (2008) reformulation of Groenendijk (1999))

In Japanese, there is no overt marker for declaratives. Thus, I assume that there is an empty morpheme \emptyset which marks a CCP of assertion as in ((13)). This morpheme combines with a propositional radical to encode an assertive update on the context.

- (13) $\llbracket \text{ASSERT}/\emptyset \rrbracket = \lambda p. \lambda c. c \oplus p$

My proposal is that *darou* is a modifier of the ASSERT morpheme, requiring that the update be performed on the speaker’s beliefs, i.e., a set of doxastic worlds associated with the speaker.

- (14) $\llbracket \text{darou} \rrbracket = \lambda F. \lambda q. \lambda c'. F(q)(\text{DOX}_{\text{spkr}}(c'))$

- (15) $\llbracket \text{darou} \rrbracket(\llbracket \text{ASSERT} \rrbracket) = [\lambda F. \lambda q. \lambda c'. F(q)(\text{DOX}_{\text{spkr}}(c'))](\lambda p. \lambda c. c \oplus p)$
 $= \lambda q. \lambda c'. \text{DOX}_{\text{spkr}}(c') \oplus q$

In Groenendijk’s (1999) system of context update, questions do not delete worlds, but dissociates them. A question $\phi?$ deletes pairs that are composed of worlds each of which assigns a different truth value to ϕ .

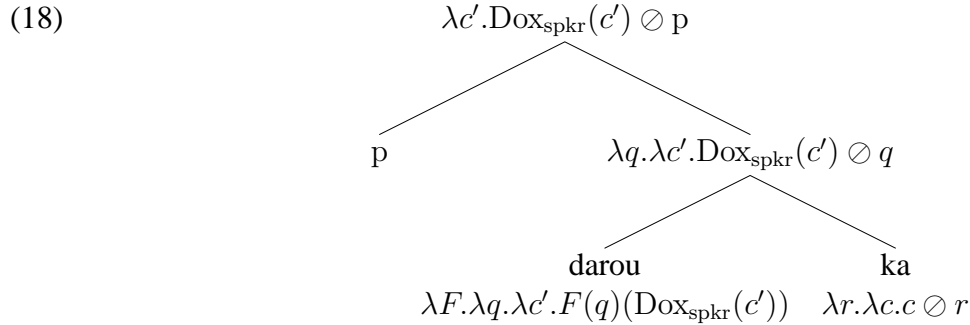
- (16) Inquisitive update (\otimes) on contexts: For some context (set) c and clause ϕ :
 $c \otimes \phi = \{\langle w_1, w_2 \rangle \in c \mid \llbracket \phi \rrbracket^{w_1, c} \neq \llbracket \phi \rrbracket^{w_2, c}\}$
 (Issacs and Rawlins’ (2008) reformulation of Groenendijk (1999))

Unlike assertive update, interrogative update in Japanese is associated with an overt morpheme, *ka*. I define *ka* as a function which takes a proposition and performs an inquisitive

update on the context with the content of p .¹

$$(17) \quad \llbracket \text{QUEST}/ka \rrbracket = \lambda p. \lambda c. c \otimes p$$

The semantic composition of ka and $darou$ is depicted in the tree structure in (18).



Now, let us go back to the contrast in the falling and rising interrogative with $darou$, repeated here as (21) and (22).

(19) Yurie-wa wain-o nomu darou-ka↓
 Yurie-TOP wine-ACC drink DAROU-Q
 ‘I wonder if Yurie drinks wine.’

(20) *Yurie-wa wain-o nomu darou-ka↑
 Yurie-TOP wine-ACC drink DAROU-Q

An interrogative performs an inquisitive update on the context as defined in (16), while $darou$ marks that the updated context is the speaker’s belief (14). As depicted in ((18)), the utterance performs an inquisitive update on the speaker’s belief $\lambda c'. \text{DOX}_{\text{spkr}}(c') \otimes p$. In case of a falling interrogative, the utterance express a self-addressing question.

4.2. Proposal 2

To address the contrast in the falling and rising interrogative with $darou$, repeated here as (21) and (22), we need to understand the semantic contribution of the final tunes ↑ / ↓.

(21) Yurie-wa wain-o nomu darou-ka↓
 Yurie-TOP wine-ACC drink DAROU-Q
 ‘I wonder if Yurie drinks wine.’

(22) *Yurie-wa wain-o nomu darou-ka↑
 Yurie-TOP wine-ACC drink DAROU-Q

Following Bartels’ (1999) work on English, I propose that the rising tune indicates that the utterance is directed at an addressee.

According to Bartels (1999), the H% tone in the sentence-final rising tune H-H% in English indicates that the utterance is directed at an addressee as in (23), and serves to emphasize the

¹As discussed by Kratzer and Shimoyama (2002), the morpheme ka can be attached to wh -words to form indefinites, e.g., $dare-ka$ ‘someone’. To unify both usages, Kratzer and Shimoyama (2002) use Hamblin’s (1973) semantics of questions which defines a question as a set of propositions. It is not clear whether Groenendijk’s (1999) system of questions can be employed to define this function of ka . Groenendijk’s (2009) recent model of inquisitive semantics define a question as a disjunction of propositions, thus it might be more promising to offer a unified account for the morpheme. I do not entertain this possibility as it is beyond the scope of this paper.

speaker's expectation that the addressee will resolve the posed question.

- (23) S: (Interested friend) So you actually got yourself a job at the embassy — I'm impressed.
Do you speak Portuguese?
H* H-H%
(Bartels, 1999, p. 152)

In contrast, a falling tune (H-L%) lacks this H% tone. Thus, an utterance with a falling tune (H-L%) is not construed as targeting the addressee in the same way; the question is merely posed as in (24).

- (24) S: (Overworked official) This form here says you're applying for jobs LB18 and LB27. I suppose you know the requirements.
Do you speak Portuguese?
H* H-L%
(Bartels, 1999, p. 152)

Going back to the Japanese tones, I propose that the boundary rising tone \uparrow (L%H%) is an intonational morpheme which indicates that the utterance is directed at an addressee and if an utterance contains a deictic expression, it shifts the deictic center to the addressee. In case of the falling interrogative with *darou*, the utterance lacks the intonational morpheme, hence no shifting occurs. Therefore, the utterance simply performs an inquisitive update on the speaker's belief.

4.3. Proposal 3

I further propose that the effect of the intonational morpheme \uparrow (L%H%) is blocked by an overt intervening force marker. In (22), the overt force marker *ka* blocks the shifting of the deictic center of *darou* to the addressee, as depicted in (25).

- (25) *
-
- $\lambda F.\lambda q.\lambda c'.F(q)(D_{\text{OX}_{\text{spkr}}}(c'))$

Because of this morphological blocking, (22) cannot be interpreted as a question which inquires into the addressee's belief, and instead gives a meaning that can be paraphrased as 'Do you know whether I believe Yurie drinks wine?' This is a strange question, since the addressee is not normally in a better position to make judgements about the speaker's beliefs than the speaker himself.

There are special circumstances where a rising interrogative with *darou* can be felicitous; for example, a quiz show situation like that in (26).

- (26) Doitsu-no shuto-wa doko deshoo ka↑
Germany-GEN capital-TOP where DAROU.POLITE Q
'Where is the capital of Germany?'

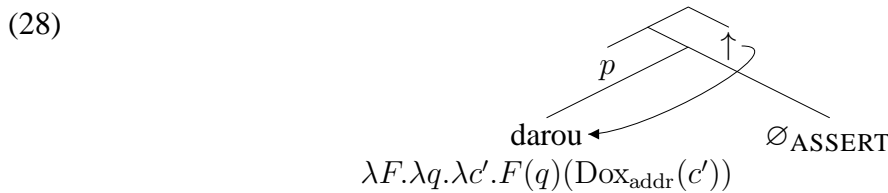
Deshoo is the polite form of *daroo*. The fact that a rising *deshoo-ka* can be naturally used in a quiz show is consistent with my analysis, because the questioner can be understood as asking

about his/her own knowledge, which the questioner must accurately answer to win the game.

Finally, recall that a rising declarative with *darou* expresses a confirmation question, repeated here as (27).

- (27) Yurie-wa wain-o nomu darou↑
 Yurie-TOP wine-ACC drink DAROU
 ‘Yurie drinks wine, right?’

As shown in the tree structure (28), the assertive force marker is the covert morpheme ‘ $\emptyset_{\text{ASSERT}}$ ’. Covert morphemes, by hypothesis, do not block deictic shifting, and so the intonational morpheme \uparrow can shift the deictic center of *darou* to the addressee. The utterance has the effect of updating the addressee’s beliefs (more precisely, the addressees’ public beliefs as modeled by Gunlogson (2003)), in a way that can be paraphrased as ‘I’m assuming that in your belief, Yurie drinks wine.’



4.4. Summary

We look at the interaction between *darou*, clause types, and boundary tones, which can be summarized as follows:

	Falling	Rising
Decl.	statement (‘I bet’)	tag Q. (‘, right?’)
Interrog.	self-address. Q. (‘I wonder’)	* OK as a quiz question

In accounting for the paradigm, I propose that *darou* is a discourse-level modal and sentence-type modifier, which restricts the speech act such that the updated context must be the speaker’s belief. Furthermore, the rising tone $\uparrow/L\%H\%$ in Japanese is an indexical shifter which shifts the deictic center to the addressee. In case of rising interrogatives, the shifting process is blocked due to the overt intervener *ka*. In case of falling declaratives, the shifting succeeds and the bias-meaning is associated to the addressee. Put another way, *darou* is a deictic expression, whose referent is set to the speaker by default and can be shifted by some operator.

5. Concluding Remarks

The experimentation reveals the intricate interplay between sentence types, particles, intonation. *Darou* is a sentence-type modifier which indicates the bias of the deictic center, i.e., the speaker. The rising intonation shifts the seat of knowledge to the addressee. My analysis correctly derives the various grammaticality judgments and discourse effects when these elements occur in different syntactic constructions.

References

- Baayen, H. R. (2008). *Analyzing linguistic data: A practical introduction to statistics using R*. Cambridge: Cambridge University Press.
- Baayen, H. R. (2009). LanguageR. R package.
- Baayen, H. R., D. Davidson, and D. M. Bates (2008). Mixed-effects modeling with crossed random effects for subjects and items. *Journal of Memory and Language* 59, 390–412.
- Bartels, C. (1999). *The intonations of English statements and questions*. Garland Publishing.
- Bates, D. (2005). Fitting linear mixed models in R. *R News* 5, 27–30.
- Bates, D., M. Maechler, and B. Bolker (2011). lme4: Linear mixed-effects models using Eigen and Eigen. R package.
- Davis, C. (2009). Decisions, dynamics and the Japanese particle *yo*. *Journal of Semantics* 26, 329–366.
- Groenendijk, J. (1999). The logic of interrogation. In T. Matthews and D. Strolovitch (Eds.), *Proceedings of SALT IX*, Ithaca, NY, pp. 109–126. Cornell University.
- Groenendijk, J. (2009). Inquisitive semantics: Two possibilities for disjunction. In P. Bosch, D. Gabelaia, and J. Lang (Eds.), *Seventh International Tbilisi Symposium on Language, Logic, and Computation*. Springer-Verlag.
- Gunlogson, C. (2003). *True to Form: Rising and Falling Declaratives as Questions in English*. New York: Routledge.
- Hamblin, C. L. (1973). Questions in Montague English. *Foundations of Language* 10, 41–53.
- Hara, Y. (2006). *Japanese Discourse Items at Interfaces*. Ph. D. thesis, University of Delaware, Newark, DE.
- Heim, I. (1982). *The Semantics of Definite and Indefinite Noun Phrases*. Ph. D. thesis, University of Massachusetts, Amherst. [Distributed by GLSA].
- Isaacs, J. and K. Rawlins (2008). Conditional questions. *Journal of Semantics* 25, 269–319.
- Kratzer, A. and J. Shimoyama (2002). Indeterminate pronouns: The view from Japanese. In Y. Otsu (Ed.), *Proceedings of the 3rd Tokyo conference on psycholinguistics*, pp. 1–25. Hitsuji Syobo.
- R Development Core Team (1993–2011). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.
- Schütze, C. (1996). *The empirical base of linguistics: Grammaticality judgments and linguistic methodology*. Chicago: University of Chicago Press.
- Stalnaker, R. (1968). A theory of conditionals. In N. Resher (Ed.), *Studies in Logical Theory*. Oxford: Blackwell.
- Sugimura, Y. (2004). Gaizensei o arawasu fukushi to bunmatsu no modality keishiki ‘adverbs of probability and sentence-final modality expressions’. *Gengo Bunka Ronshuu* 25(2).
- Venditti, J. J. (2005). The J_ToBI model of Japanese intonation. In S.-A. Jun (Ed.), *Prosodic Typology: The Phonology of Intonation and Phrasing*, pp. 172–200. Oxford University Press.
- Zimmermann, M. (2004). Discourse particles in the left periphery. In B. Shaer, W. Frey, and C. Maienborn (Eds.), *Proceedings of the Dislocated Elements Workshop, ZAS Berlin (ZAS Papers in Linguistics 35)*, Berlin, pp. 544–566. ZAS.