

琉球大学学術リポジトリ

認識様相スケールの形式意味論的分析：
must、should、「にちがいない」「はずだ」を中心に

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A Formal Account of the Epistemic Modal Scale: With Special Reference to *Should*, *Must* and Their Japanese Counterparts*

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1 Introduction

Epistemic modality expresses the degree of speaker's commitment to the truth of the proposition *p* represented as the logical form of 'modal (*p*).'. Syntactically, the 'modal'-part is expressed with various categories: adjectives with *that*-clause such as *it is certain/probable that...*, sentential adverbs such as *certainly/probably...*, nouns in the *there*-construction like *there is a possibility that...* and modal auxiliaries such as *must/can/may*, and so on. Of these categories, modal auxiliaries have been extensively studied with particular interests of why they are ambiguous in interpretations (i.e. epistemic and deontic use), what is a semantic difference among them, and how such a difference is derived.

Traditional or descriptive grammar has tried to describe semantic differences of them in terms of the degree of certainty/probability. For example, according to *Genius English-Japanese Dictionary* (1994²:1131), English epistemic modal auxiliaries are ordered along with the epistemic scale as in (1), where a modal auxiliary to the left of '>' expresses the speaker's stronger certainty about a proposition than the one to the right. Thus, *must* expresses the highest degree of the speaker's

* I would like to thank Luke McCarthy for acting as an informant. Needless to say, all errors are mine.

certainty about the proposition and *could* is lowest on the epistemic scale among these modals.¹

(1) must > will > would > ought to > should > can > may > might > could

This ordering is partially correct. It is understandable, for instance, that 'must (p)' is more probable than 'may (p)' or 'might (p)' with respect to the degree of the speaker's commitment to the proposition p, but it is not clear enough what kind of evidence supports the other ordering relations such as 'must > should' or 'will > would'.

In the formal semantics literature, modality is interpreted as quantification over possible worlds; *must*, *will*, *would*, *ought to*, and *should* are analyzed as universal quantifiers while *can*, *may*, *might*, and *could* as existential quantifiers over possible worlds. Roughly speaking, the former denote necessity and the latter possibility. If this approach is taken, the immediate question is how the ordering given in (1) is derived and how the differences among the necessity-denoting modals and the possibility-denoting modals are captured.

The purpose of the present paper is to give an formal semantic account of the epistemic scale in (1) in the framework proposed by Kratzer 1977, 1981 and 1991, with special attention to the semantic/pragmatic differences between *must* and *should* and their Japanese counterparts *hazu* 'should' and *nichigaina* 'must'. In Kratzer's approach, a modalized sentence is evaluated based on two types of conversational backgrounds; a modal base and an ordering source. I would like to claim that ordering sources for these four modals are different, which gives rise to distributional differences of them. I also

¹ It is noted that there is no clear distinction between *may* and *might* in recent English use.

suggest that the apparent ranking 'must > should' comes from the difference of ordering sources.

2 Variability of Interpretations of Modals

As is well-known, English modal auxiliaries (and probably those in many other languages) are ambiguous between deontic (or root) and epistemic interpretations, as shown in (2), and it has long been discussed whether they should be analyzed as polysemy or monosemy.

(2)

	Root	Epistemic
may	permission	possibility
must	obligation	logical entailment
can	ability	possibility
won't	refusal	future non-occurrence
should	obligation	supposition

(Jackendoff 1972: 100)

Jackendoff (1972: 102-5) claims that the two types of interpretation should be distinct in the lexicon, analyzing root modals as control predicates and epistemic modals as raising predicates, which means that the former assign a thematic-role to the subject while the latter do not have their own external arguments.² This approach amounts to saying that auxiliaries with root-interpretations and those with epistemic-interpretations are different lexical items.

On the other hand, Kratzer 1977 argues that the basic function of

² Jackendoff 1972 does not use terms like raising predicates, control predicates, or theta-role assignment, but what he says (1972: 102-5) can be translated as given here.

a modal is not ambiguous and the interpretative differences are derived pragmatically. More specifically, an interpretation of a modal is determined by a (hidden) phrase such as *in view of*, which she calls conversational backgrounds.

- (3) a. (In view of what we know) John must have murdered Bill.
- b. (In view of what the law provides) John must go to jail.

As shown in (3) when a conversational background like *in view of what we know* is given in a context, an epistemic reading is derived, and when a phrase like *in view of what the law provides* is given, a deontic interpretation obtains. The function of the modal *must* in (3a) and (3b) is to provide the universal quantification over a set of possible worlds, which will be discussed shortly. The point is that under Kratzer's approach, the modal auxiliaries are monosemy and the interpretations of them are determined by contexts.

Kratzer's approach is superior to Jackendoff's since we do not have to assume distinct lexical items like the epistemic *may* and the deontic *may* in the lexicon. One might argue, however, that there is a reason to assume that epistemic and deontic modals should be treated as different lexical items, as Jackendoff does, pointing out the fact that in languages like Japanese, different expressions are used for each interpretation, as shown in (4).

(4)

Root	Epistemic	English counterpart
temoi	kamoshirena	may
nakerebanarana	nichigaina	must
beki	hazu	should

Unlike English *may*, permission and possibility are expressed by *temoi* and *kamoshirena*, respectively. By the same token *nichigaina* bears only the epistemic, logical entailment interpretation, not the deontic, obligation interpretation, which is instead expressed by *nakerebanarana*. This fact seems to suggest that Jackendoff's approach is on the right track.

Nevertheless, I would like to pursue the pragmatic approach by Kratzer for two reasons. One is that Kratzer's approach is not limited to the analysis of modal auxiliaries, but can be applied to any categories which express modality. In fact, it is not clear whether Japanese modal expressions given in (4) are auxiliaries or not. Morphologically, some of them can be analyzed as complex expressions, as shown in (5).

(5) a. John-wa hashir-ana-kereba-nara-na-i.

-Top run-Neg-if-become-Neg-Pre

lit. 'As for John, it (or something) is not accomplished if he does not run.'

→ 'John has to run.'

b. John-ga Bill-o korishi-ta-ni-chigai-na-i.

-Nom -Acc kill-Past-Cop-mistake-Neg-Pre

lit. 'There is no mistake (in saying) that John killed Bill.'

→ 'John must have killed Bill.'

c. John-wa hashit-temo-i-i.

-Top run-even.if-good-Pre

lit. 'It is good even if John runs.'

→ 'John is allowed to run.'

d. John-wa paatii-ni iku-ka-mo-shir-e-na-i.

-Top party-to go-Q-also-know-can-Neg-Pre

lit. 'As for John, it cannot be known whether he goes to the party.'

→ 'John might go to the party.'

Because of the uncertain status of the syntactic category of Japanese complex modal expressions, it is not clear how to apply Jakendoff's lexicalist approach to them. On the other hand, Kratzer's pragmatic, category-free approach to interpretations of modality can be easily applied to the Japanese cases.

The other reason is that Japanese actually has modal expressions which are ambiguous between root and epistemic. The modal *deki* means ability and possibility, just like English *can*. It takes a sentential subject, which is marked with the nominative marker *-ga* as shown in (6). The affix *-e-*, which follows a stem verb and is followed by a tense inflection, also exhibits the possibility-ability ambiguity as in (7).

- (6) a. John-wa compuutaa-no senmonka-dakara kono teedo-no
-Top computer-Gen specialist-since this extent-Gen
koshoo-nara kantanni naos-u-koto-ga deki-ru.
trouble-Cond easily fix-Pre-Nominalizer-Nom can-Pre

'Since he is a computer-specialist, John is able to fix this small trouble easily.'

- b. Kimi-wa moo hatachi-o koe-tei-ru-kara
you-Top already 20.years.old-Acc exceed-Prog-Pres-since

tabako-o su-u-koto-ga deki-ru.
 tobacco-Acc smoke-Pres-Nominalizer-Nom can-Pre

'Since you are already over 20 years old, you can smoke (if you want to).'

- (7) a. John-wa mukashi suieebu-ni i-ta kara
 -Top before swimming.club-Loc be-Past since
 10 kiro yasum-azu oyog-e-ru.
 km break-Neg swim-can-Pre

'Since he belonged to a swimming club before, he is able to swim 10km without taking a rest.'

- b. Koko-wa kinen seki-ja-na-i kara,
 here-Top non.smoking seat-Cop-Neg since
 tabako-ga su-e-ru.
 tobacco-Nom smoke-can-Pre

'Since this is not a non-smoking seat, I can smoke.'

The a-examples in (6) and (7) express the subjects' ability, while the b-example express the possibility or permission to the subjects. Clearly, each interpretation is determined by the contexts; more precisely, the contents of the reason clauses give the interpretations. So, Kratzer's idea that different conversational backgrounds give different interpretations of modal expressions is applicable to Japanese too in spite of the fact that most of the modal expressions are unambiguous in the language.

3 Modal Base, Ordering Source and Graded Modality

Now let us see how Kratzer's idea is formalized. Kratzer 1981, 1991 introduces two types of conversational background, modal base and ordering source, and modalized sentences are evaluated based on these two parameters. A modal base determines the set of worlds accessible from the world of utterance. For example, a phrase like *in view of what we know* gives us a set of worlds epistemically accessible from the world of utterance. An ordering source induces an ordering on the set of worlds accessible from the world of utterance. To see the basic idea of a modal base and an ordering source, let us consider (3a) 'John must have murdered Bill.' Suppose that (3a) was uttered by a detective. He reached the conclusion that John must be the murderer based on the evidence available to him. The evidence is, for example, that the gun by which Bill was murdered is John's, John has no alibi, and so on. Suppose that there are, say, ten pieces of evidence which support that John murdered Bill. Then, these ten pieces of evidence form the modal base, and all and only worlds where the ten pieces of evidence are true are epistemically accessible from the world of utterance. Possible worlds where the gun is John's but he does have alibi are not accessible worlds. An ordering source gives an order among these possible worlds determined by the epistemic modal base. In this particular case, a stereotypical conversational background (in view of the normal course of events) plays a role of ordering source. For example, someone else might have stolen John's gun and shot Bill by it. This story might be compatible with the ten pieces of evidence. He might have come from another town. We could even make a story such that he might come from another country or another planet, which might still be compatible with the ten piece of evidence. However, when the detective made

inference, he must have rejected the story of the murder of Bill by someone from another planet, because this story is more far-fetched than the story of John's murder of Bill. The ordering source of stereotypical conversational backgrounds gives us this type of far-fetchedness.

Types of conversational background in Kratzer (1991: 649) are exemplified in (8), which gives the characteristics of each modal base and ordering source.

(8) modal base:

- epistemic (in view of the relevant facts)

In using an epistemic modal, we are interested in what else may or must be the case in our world given all the evidence available.

(i.e. epistemic modality is the modality of curious people like historians, detectives, and futurologists.)

- circumstantial (in view of the relevant facts)

In using a circumstantial modal, we are interested in the necessities implied by or the possibilities opened up by certain sorts of facts

(i.e. circumstantial modality is the modality of rational agents like gardeners, architects and engineers.)

(possibly more)

ordering source:

- deontic (in view of certain laws)
- bouletic (in view of what I want)
- stereotypical (in view of normal course of events)
- doxastic (in view of certain beliefs)

(possibly more)

Kratzer (1991: 649) says that not every kind of modal base can combine with every kind of ordering source. Epistemic modal bases take ordering sources related to information such as reports, beliefs, and so on. Circumstantial modal bases combine with ordering sources related to laws, aims, plans, wishes, and so forth. There are some modal expressions which have no restrictions concerning modal bases and ordering sources. According to Kratzer (1991: 650), German *muss* and *kann* are such examples.

With the two types of conversational background, Kratzer 1981, 1991 gives definitions of some relevant notions in the possible world semantics as follows.

Propositions

Given a set of possible worlds W , a proposition is a subset of W .

Truth of a proposition

A proposition p is true in a world $w \in W$ iff $w \in p$. Otherwise, p is false in w .

Logical consequence

A proposition p follows from a set of propositions A iff p is true in all worlds of W in which all propositions of A are true.

Consistency

A set of proposition A is consistent iff there is a world in W where all propositions of A are true.

Logical compatibility

A proposition p is compatible with a set of proposition A iff $A \cup \{p\}$ is consistent.

Conversational background (modal base and ordering source)

A conversational background f is a function from possible worlds to sets of propositions.

Ordering

For all $w, w' \in W$, for any $A \subseteq P(W)$:

$w \leq_A w'$ iff $\{p: p \in A \text{ and } w' \in p\} \subseteq \{p: p \in A \text{ and } w \in p\}$

Given these definitions, necessity and possibility are defined as follows.

A proposition p is a **necessity** in a world w with respect to a modal base f and an ordering source g iff the following condition is satisfied:

For all $u \in \bigcap f(w)$ there is a $v \in \bigcap f(w)$ such that $v \leq_{g(w)} u$ and for all $z \in \bigcap f(w)$: if $z \leq_{g(w)} v$, then $z \in p$.

A proposition p is a **possibility** in a world w with respect to a modal base f and an ordering source g iff $\neg p$ is not a necessity in w with respect to f and g .

With the definition of necessity, the interpretation of (3a) is paraphrased as in (9).

(9) John must have murdered Bill. (= (3a))

=> In all possible worlds which are accessible in view of the relevant facts, and which come closest to the ideal, John murdered Bill.

The degree between necessity and possibility also can be defined with respect to modal base and ordering source as follows.

A proposition p is a **good possibility** in a world w with respect to a modal base f and an ordering source g iff there is a world $u \in \cap f(w)$ such that for all $v \in \cap f(w)$: if $v \leq_{g(w)} u$, then $v \in p$.

A proposition p is a **possibility** in a world w with respect to a modal base f and an ordering source g iff $\neg p$ is not a necessity in w with respect to f and g .

A proposition p is **at least as good a possibility** as a proposition q in a world with respect to a modal base f and an ordering source g iff for all u such that $u \in \cap f(w)$ and $u \in q$ there is a $v \in \cap f(w)$ such that $v \leq_{g(w)} u$ and $v \in p$.

A proposition p is a **better possibility** than a proposition q in a world w with respect to a modal base f and an ordering source g iff $\neg p$ is at least as good a possibility as q but q is not at least as good a possibility as p in w with respect to f and g .

A proposition p is a **weak necessity** in a world w with respect to a modal base f and an ordering source g iff p is a better

possibility than $\neg p$ in w with respect to f and g .

A proposition p is a **slight possibility** in a world w with respect to a modal base f and an ordering source g iff $\neg p$ is a possibility and $\neg p$ is a weak necessity in w with respect to f and g .

These graded modalities are expressed by the following English phrases.

(10)

	English Lexical Items
necessity	must
weak necessity	probably
good possibility	there is a good possibility that
possibility	might
slight possibility	there is a slight possibility that
better possibility	is more likely than

Given these definitions, we can get implication relations between sentences as in (11).

- (11) a. John must be the murderer.
b. John is probably the murderer.
c. There is a good possibility that John is the murderer.
d. John might be the murderer.
e. There is a slight possibility that John is the murderer.

If modal bases and ordering sources are kept constant, the examples in (11) are ordered with respect to the degree of epistemic certainty, as in (12), where an example to the left of '>' implies the one to the right.

(12) (11a) > (11b) > (11c) > (11d) > (11e)

Let us go back to the starting point. Now it is clear that the epistemic ordering in (1) is not completely correct. The degree of certainty of two modalized sentences can be compared only if they are evaluated with respect to the same modal bases and ordering sources, and some modals take idiosyncratic modal bases and ordering sources. If two sentences have have modals which take different kinds of conversational background, it is impossible to decide which is more certain than the other. Since *must* and *might* (or *may*, see footnote 1) can be evaluated based on the same conversational backgrounds, sentences with these modal auxiliaries can be compared, and being the conversational backgrounds constant, 'must (p)' > 'might (p)' or 'may (p)', because *must* universally quantifies over the all epistemically relevant accessible possible worlds, while *might/may* functions as existential quantifier over them. Similarly, the ordering 'would (p)' > 'could (p)' stands since *would* is universal quantifier while *could* existential quantifier, and these modals take an irrealis modal base, which I do not discuss in this paper.

There is also a piece of empirical evidence against the scale in (1). According to it, 'must (p)' > 'should (p)', but let us consider the following example.³

(13) (at cashier)

This is \$15 and I gave you a \$100 bill, so the change should/??must be \$85.

³ This is an English translation of Kunihiro's (1982:98) Japanese example. The original example also will be discussed later.

In this example, *should* is more appropriate than *must*. The speaker's utterance was drawn from elementary deduction, 100 - 15, which is logical and arithmetically correct. If the ordering (1) were correct, then *must* would be used rather than *should* in (13), for the former is assumed to express the speaker's stronger certainty about the proposition than the latter. On the contrary to what the ranking predicts, however, *must* is awkward in this context. This shows that the difference between *must* and *should* is not just the matter of the degree of the speaker's epistemic commitment to the proposition, but their interpretations depend on the sorts of the modal bases for them. In what follows, I will argue against the epistemic scale in (1), focusing on the difference between *must* and *should*, and their Japanese counterparts, *nichigaina* and *hazu*.

4 The Semantics and Pragmatics of *Must*, *Should*, *Nichigaina*, and *Hazu*

For the sake of presentation, let me begin with the discussion of *nichigaina* and *hazu*, which are typical Japanese translations of *must* and *should*, respectively. Differences between them are obscure and in some contexts the preference between them is very delicate, since both modals seem to express some kind of the speaker's conviction. The distributions of the two modals, however, do not completely overlap, and in some cases, they are not interchangeable. Differences between the two modals have been observed and characterized by Japanese grammarians as follows.⁴

⁴ Since these are written in Japanese, the Japanese translations I give in text might not reflect their intentions.

(14) Kato and Fukuchi (1989:140)

Nichigaina expresses the speaker's confirmation of his own subjective guessing. *Hazu* can be used when the evidences that the speaker's inference is based on is reliable for him but it may not so reliable for everybody.

Nitta (1989:46)

Hazu expresses the speaker's inference process, while *nichigaina* expresses the very high probability of the proposition.

Masuoka and Takubo (1992:129-130)

Nichigaina expresses the speaker's intuitive judgment while *hazu* expresses the speaker's inference based on evidence.

Miyake (1992:56)

Hazu implies that the speaker's conviction is based on very reliable evidence, while *nichigaina* does not have such an implication.

Although the ways of description are different, all of these authors share the same intuition about the difference between the two modals. That is, 'haze (p)' expresses that the speaker makes logical inference of the truth of p based on evidence, while 'nichigaina (p)' is used if the evidence that the speaker's inference based on is not logical. To understand the semantic or pragmatic differences between the two modals, let us see the cases where one of them is less acceptable. (15) gives examples in which *hazu* is more appropriate than *nichigaina*.

- (15) a. Ojiisan-wa boku-ga uma-re-ru maeni shin-dei-ta to
 grandfather-Top I-Nom bare-Pass-Pres before die-Prog-Past Comp
 yu-u kara, boku-ga 2 sai-no koro-ni-wa
 say-Pres because I-Nom years.old-Gen time-Loc-Contrast
 kono yo-ni-wa i-na-katta (-hazu-da / ?-nichigaina-i).
 this world-Loc-Contrast exist-Neg-Past should-Cop.Pres must-Pres

'Because it is said that my grandfather had passed before I was born, it must be the case that he didn't exist in this world when I was 2 years old.'
 (Nitta 1989: 46)

- b. 150 yen-de 1000 yen satsu-o dasi-ta kara
 -Cop.inf bill-Acc give-Past because
 tsuri-wa 850 yen (-no -hazu-da / ??-nichigaina-i).
 change-Top -Cop.inf. should-Cop.Pres must -Pres

'Since this is 1500 yen and I gave you a 10000 yen bill, the change should be 8500 yen.'
 (Kunihiro 1982:98)

- c. Kyoo-wa hichigatsu yokka dakara, gakkoo-wa na-i
 today-Top July fourth because school-Top Neg-Pres
 {-hazu-da /*-nichigaina-i}.
 should-Cop.Pres must-Pres

'Since today is July 4th, we should have no class.'

In these examples, *hazu* is perfectly acceptable, while *nichigaina* is awkward. The less acceptability of (15a) and (15b) with *nichigaina* comes from the fact that the inference the speaker made is an

arithmetic inference, a typical logical inference. As for (15c), the speaker's inference from the fact that the date of the utterance is July 4th to the conclusion that there is no class is based on the evidence that that day is one of the national holidays in the US and the school relevant to the speaker has no class on that day. This inference is also very logical, not intuitive at all. Therefore, *hazu* but not *nichigaina* is used in this context.

In (16), on the other hand, *nichigaina* is acceptable while *hazu* makes the sentences ungrammatical or unacceptable.

- (16) a. Sukoshi netsu-ga a-ru.
 little fever-Nom exist-Pres
 Kaze-o hii-ta {*-hazu-da / -nichigaina-i}.
 cold-Acc catch-Past should-Cop.Pres must-Pres

'I have a slight fever. I must have caught cold.'

(Morita 1980: 412)

- b. OJ-wa kokujin dakara,
 -Top African American because
 yuuzai {??-no-hazu-da / -nichigaina-i}.
 guilty -Cop.inf-should-Cop.Pres must-Pres

'Since OJ is an African American, he must be guilty.'

- c. Sootaiseeriron-ga rikai-deki-ru nannte,
 theory.of.relativity-Nom understand-can-Pres what.the.hell
 kare-wa tensai {*-no-hazu-da / -nichigaina-i}.
 he-Top genius -Cop.inf-should-Cop.Pres must-Pres

'It's surprising that he can understand the theory of relativity.
He must be a genius.'

In (16a) *hazu* cannot be used since the speaker makes intuitive judgment.⁵ In (16b) the speaker makes judgment based on the racial fact of the suspect, in this case OJ, but his race cannot be regarded as evidence reliable enough to lead us to the conclusion that he is guilty. Therefore *hazu* cannot be used. In (16c), the speaker expresses his/her surprise to the fact that he understand the theory of relativity, and usually logical consequence does not make us surprised. So, the context in (16c) does not allow *hazu*.

These differences between *nichigaina* and *hazu* described above can be formally captured in terms of modal bases and ordering sources.

(17)

	Modal Base	Ordering Source
nichigaina	epistemic	doxastic
hazu	epistemic	stereotypical

⁵ Interestingly enough, even if the speaker is a medical doctor, who seems to make "logical" judgment based on his/her diagnosis, *hazu* cannot be used, as shown in (i).

- (i) Anata-wa sukoshi netsu-ga a-ru ne.
 you-Top little fever-Nom exist-Pres Prt
 Kaze-o hii-ta {*hazu-da / -nichigaina-i}.
 cold-Acc catch-Past should-Cop.Pres must-Pres

'You have a slight fever. You must have caught cold.'

Probably, no matter who makes judgment, inference from the fact that someone has a fever to the conclusion that he/she caught cold cannot be regarded as logical inference.

The modal base that these modals are evaluated on is epistemic, that is, the speaker's judgment is based on certain facts. The interpretive difference between the two modals, thus, come from their ordering sources. I propose that the ordering source for *haze* is stereotypical (i.e. in view of normal course of events), while that for *nichigaina* is doxastic (i.e. in view of certain beliefs). The 'logical' inference that the above mentioned linguists observed in sentences with *hazu* in fact can be regarded as a sub-case of stereotypical inferences. Consider (15c) again. In the US, July 4th is a national holiday and no school on that day, but it is not so strange if there is a university that has classes on that day in the US for some reasons. We can say that we have no class on July 4th only in a normal situation and in normal course of events. So, the ordering source for sentences with *hazu* is a stereotypical. On the other hand, sentences with *nichigaina* is evaluated on a doxastic ordering source. This ordering source makes possible worlds ordered based on the speaker's beliefs. The OJ sentence is a typical case.

Now let us consider *must* and *should* in English. Coates (1983:19, 26) describes the meaning of *must* and *should* as follows.

- (18) *Must* expresses the speaker's confident inference .
 (= from the evidence available I confidently infer that...)
Should expresses the speaker's tentative inference .
 (= from the evidence available I tentatively assume that...)

According to Coates, the difference between the two modals is the degree of the speaker's confident about what she/he says. This characterization corresponds to the epistemic scale 'must (p)' > 'should (p)'. As discussed above, however, it is very difficult for this approach

to account for the contrast observed in (13), where the speaker can make utterance with confidence, but the use of *must* is awkward.

Lakoff (1972:234) characterizes the semantics of the two modals as in (19).

(19) *Must* is used in the case of a likelihood based on present conjecture.

Should is used in the case of a likelihood based on future expectation.

Examples which support (19) are given in (20).

(20) a. John must be easy to talk to.

b. John should be easy to talk to. (Lakoff 1972:233)

The situation Lakoff gives for (20) is as follows: The speaker and addressee are both standing outside of John's office. The addressee has an appointment to talk to John, and is waiting his turn. He is somewhat nervous as to his reception, and the speaker is attempting to give him moral support. Under these general conditions, the speaker might appropriately use either of the sentences of (20). Lakoff further sets up two cases, (A) and (B): (A) The speaker might be near enough to John's office to hear, in a general way, what is going on inside it (while the addressee is not). He hears guffaws, indications of geniality, suggestions that John and his visitor are having a good time. (B) The speaker might not be in a position to know anything about what is going on in John's office at this moment. But he does know something about John's past history. He knows that, as a graduate student, John was severely mistreated by his instructors, who made his

life hell for him by being very hard to get along with. Hence (the speaker further knows), John has vowed he will never put obstacles like that in the path of any of his student, and consequently all reports reaching the speaker have it that he is a very affable sort. According to Lakoff, (20a) is felicitously uttered in situation (A) and (20b) in situation (B).

Clearly the evidence the speaker is based on in (A) is the one currently available, while in (B) the speaker makes future expectation based on his knowledge. This contrast can be restated in terms of modals bases and ordering sources as follows. The interpretation of (20a) in situation (A) is the pure epistemic reading, which is characterized by an epistemic modal base and an empty modal base (more specifically, the kind of ordering source is not crucial; see Kratzer (1991: 646). On the other hand, (20b) under situation (B) is interpreted in view of what the speaker knows and in view of normal course of events.

(21) Conversational Backgrounds in (19)

	Modal Base	Ordering Source
must	epistemic	empty
should	epistemic	stereotypical

If this characterization is correct, the distinctive feature between *must* and *should* is the requirement of a special kind of an ordering source for the latter, namely, a stereotypical ordering source.⁶

What happens, then, in Japanese in situations (A) and (B)? Interestingly, the contrast between *nichigaina* and *hazu* is not as sharp

⁶ The analysis presented here is basically the same as Papafragou's (2000) analysis in the framework of the relevant theory.

as that between *must* and *should* in (20). Rather it seems to me that in both situations, (A) and (B), *hazu* sounds slightly better than *nichigaina*.

(22) (in situation (A) and (B))

John sensei-wa hanashi-yasu-i (?-*nichigaina*-i/-*hazu*-da).

Prof.-Top talk-easy-Pres must-Pres should-Cop.Pres

'Prof. John must/should be easy to talk to.'

This fact, if this judgment is correct, actually follows from the semantics of *hazu* and *nichigaina* given in (17). The kinds of available evidence are different in (A) and (B). In (A), the available evidence is direct information from the situation, while in (B) the speaker's reason is based on his knowledge. But no matter what kind of evidence is available, the types of inference are the same. In both cases, the judgment is based on a normal course of events. That is, the ordering source is stereotypical, which is the reason of the preference of *hazu* over *nichigaina*. Incidentally note that it is not surprising if there are some native speakers of Japanese who accept *nichigaina* in these contexts. For them, (22) is evaluated based on the available evidence plus the speaker's belief rather than a normal course of events.

5 A Final Remark

This paper shows that Kratzer's approach can capture the difference between *must* and *should* and their Japanese counterparts. The modal base for these four modals is epistemic, but different ordering sources are selected. The ordering source for *should* and its Japanese counterpart *hazu* is stereotypical, the ordering source for *nichigaina* is

doxastic, and *must* doesn't require any type of ordering source.

The claim that the ordering source for *must* is empty or unrestricted actually gives an account of the intuitive ranking 'must (p) > should (p)'. The analysis proposed here says that *should* can be used only when the speaker's inference is based on a normal course of events, while *must* can be used in any situation as far as epistemic evidence is available. This means that *should* requires additional pieces of evidence to constitute its ordering source but what needs for *must* is just epistemic evidence for modal bases. This additional requirement gives us an impression that 'should (p)' is less certain than 'must (p)'.

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認識様相スケールの形式意味論的分析： must、should、「にちがいない」「はずだ」を中心に

論文要旨

認識的に解釈される法助動詞の意味分析として、しばしば(1)のような蓋然性のスケールが用いられる。

(1) must > will > would > ought to > should > can > may > might > could

これによると、must を含む文が話者の命題に対する確信度が最も高く、続いて will, would,...となり could がもっとも可能性が低いということになる。must (p) が might (p) より高い蓋然性を表すことは、例えば、前者が後者を含意することから分る。しかし、must (p) が should (p) より確信度が高いという分析には納得できる程の根拠はない。

本稿では、Kratzer 1981, 1991で示された形式的分析を用いて、特に、must と should の違いと日本語の「にちがいない」と「はずだ」の違いに焦点を当てて議論する。Kratzer のアプローチでは、法助動詞を含む文 'modal (p)' の真偽は、様相根拠 (modal base) と順序源 (ordering source) の2つの基準によって制限された可能世界における p の真偽で決定される。must, will, would, ought to, should を含む文は、関連する可能世界すべてにおいて命題 p が真である場合、真となり、can, may, might, could を含む文は、関連するすべての可能世界のうち、ひとつでも p が真となれば、真であると評価される。ここで問題にしているモーダル表現はすべて認識的なものであるため、それらは認識の様相根拠に基づいて解釈される。従って、must と should の違いは順序源の違いであるということになる。本稿では、前者は特に順序源に関して制限を持たないが、後者は、stereotypical な順序源（「出来事の通常の起こり方に基づけば」という意味の前提）でのみ評価されると主張する。この違いにより、一見、must > should のような印象を受けてしまうのであると考えられる。また、日本語の「はずだ」は should 同様、stereotypical な順序源で評価されるが、「にちがいない」は doxastic な順序源（「話者が思っていることに基づけば」という意味の前提）に基づいて評価されることを示す。これにより、「にちがいない」と「はずだ」の分布の違いが理論的に説明される。