

Epistemic adverbs that can/cannot be embedded under imperatives

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Abstract. This paper analyzes why certain epistemic adverbs are/are not embeddable under imperatives, by adopting Kaufmann's (2012) modal analysis of imperatives and the assumption that epistemic modal bases are closed. The embeddable adverb is a modal modifier (Anand & Brasoveanu 2009) that expands the quantificational domain of the modal co-occurring with it, but the unembeddable one is a pure epistemic modal whose semantics does not involve an ordering source as in von Stechow & Gillies (2010). Imperative operators lose their contribution when they scope over the latter type adverbs because of vacuous quantification, hence violating a conversational principle proposed by Crnič (2011). The account lends support to the modal analysis of imperatives, which competes with Portner's (2007) To-Do Lists analysis.

Keywords. imperatives; epistemic adverbs; deontic modals

1. Introduction. This paper deals with an issue that has gone unnoticed in the literature: why is a certain class of epistemic adverbs embeddable under imperatives, while another class is not? Specifically, Japanese has two epistemic adverbs, *zettaini* 'definitely' and *matigainaku* 'certainly'.¹ They convey an almost identical meaning when they occur in declaratives:

- (1) Kare-wa *zettaini/matigainaku* isha-da.
 he-TOP definitely/certainly doctor-COP
 'He is definitely/absolutely a doctor.'

In (1), both adverbs are interpreted as conveying epistemic modality. However, the two adverbs differ when embedded under imperatives:

- (2) Ringo-o *zettaini/#matigainaku* taber-o.
 apple-ACC definitely/#certainly eat-IMP
 'Definitely/Certainly eat an apple!'

The *zettaini*-version is interpreted as posing a stronger command than the plain imperative (i.e., *zettaini* strengthen the command offered by the speaker), while *matigainaku* is incompatible with imperatives in the first place. How can we derive this contrast?

Our argument is that we can capture the contrast if we adopt two assumptions available in the market: the modal approach to imperatives (Kaufmann 2012) and the *closedness* of the

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¹*Matigainaku* is in fact ambiguous between its epistemic interpretation exemplified in (1) and its decompositional meaning, which roughly corresponds to 'without making mistakes'. The latter interpretation comes from the fact that *matigainaku* can be decomposed into *matigai* 'mistake' and *naku* 'NEG'. We deal only with the former interpretation throughout this paper.

context set (i.e. the epistemic modal base) (Gillies 2010 and von Stechow & Gillies 2010). We will propose that *zettaini* is a modal modifier as in Anand & Brasoveanu 2009 while *matigainaku* is a pure epistemic modal without ordering sources. The imperative operator contains the context set as its quantificational domain, and its contribution is lost when it scopes over *matigainaku*-type adverbs because of the closedness, leading to violation of a conversational principle proposed by Crnič (2011).

The rest of this paper is structured as follows. Section 2 introduces Kaufmann’s (2012) modal analysis of imperatives. Section 3 discusses the validity of the closedness of the context set. Section 4 gives observations and analyses on the semantics of *zettaini* and *matigainaku*. Section 5 illustrates how the contrast in (2) is derived, and Section 6 is the conclusion with an implication for the controversy between the modal approach to imperatives and the To-Do Lists approach proposed by Portner (2007).

2. A modal view of imperatives. Imperatives have recently been argued to belong to modality proper, in that a modal operator is responsible for their conventional link to directive speech acts (Han 1998, Grosz 2009, Kaufmann 2012, Condoravdi & Lauer 2012, Medeiros 2013, Ihara & Noguchi 2019, a.o.). Before we spell out the analysis in detail, in this section, we introduce the framework that we adopt for the analysis, which is generally known as the “modal theory” (or the “strong theory”) of imperatives developed by Kaufmann (2012).

Kaufmann’s theory relies on a version of Kratzer’s (1981) semantics for modality in possible worlds semantics. Kratzer employs conversational backgrounds, which are functions from worlds to sets of propositions that describe what is known to an agent, what is desired by an agent, what the law says, etc. Modal expressions can then be interpreted as quantifiers over the sets of possible worlds compatible with such a background (i.e. the intersection of the set of propositions that the conversational background assigns to the world of evaluation). She further proposes to individuate the domain of quantification via two conversational backgrounds that play different roles: one serves as the modal base (represented as ‘*f*’) that records ‘what is known’ or ‘what the relevant facts are’; the other one serves as the ordering source (represented as ‘*g*’) and determines which of the worlds compatible with these relevant facts are more plausible, are morally better, realize more of an agent’s goals, etc. Technically, the ordering source induces an ordering on the set of possible worlds ‘ $\preceq_{g(w)}$ ’ as in (3), which is used to single out the highest ranked worlds among those compatible with the modal base: ‘ $\text{BEST}(f)(g)(w)$ ’ are those worlds in $\bigcap f(w)$ such that no other worlds in $\bigcap f(w)$ are strictly better than they are according to $g(w)$, cf. (4).

$$(3) \quad u \preceq_{g(w)} v \text{ iff } \{p \mid p \in \bigcap g(w) \wedge v \in p\} \subseteq \{p \mid p \in \bigcap g(w) \wedge u \in p\}$$

$$(4) \quad \text{BEST}(f)(g)(w) = \{w' \mid \forall z \in \bigcap f(w)[z \preceq_{g(w)} w' \rightarrow w' \preceq_{g(w)} z]\}$$

By adopting Kratzer’s framework of modals, Kaufmann derives the meaning of imperatives from a modal layer in the semantics of imperatives, i.e., imperatives have almost the same truth-condition as sentences with deontic modals like *should* or *ought to*, which allows us to analyze imperatives on a par with deontic modals. She proposes that the relevant modal base is what is known to the conversational participants, that is, the Common Ground (*CG*),

whose intersection is the Context Set (*CS*), and that the ordering source is deontic.² The following is a simplified denotation of Kaufmann’s imperative operator, where c_A is the addressee in the context of the utterance.³

- (5) $\llbracket OP_{imp} \rrbracket = \lambda f \lambda g \lambda p \lambda w. \forall w' [w' \in \bigcap f(w) \cap \text{BEST}(f)(g)(w) \rightarrow p(w')]$,
 where $f(w) = CG(w) = \{p \mid p \text{ is known in } w\}$, and $g(w) = \{p \mid p \text{ is what is ordered to } c_A \text{ in } w\}$.

Let us briefly demonstrate how the meaning of imperatives is derived in Kaufmann’s account. Consider (6) for example.

- (6) Come to the party!
 $\llbracket \text{Come to the party!} \rrbracket = \forall w' [w' \in \bigcap f(w) \cap \text{BEST}(f)(g)(w) \rightarrow c_A \text{ comes to the party at } w']$.

The imperative (6) is true iff the addressee comes to the party at all worlds w in *CS* (that is, $\bigcap f(w')$), and ranked best in terms of what the addressee is ordered to do at w . More intuitively, (6) is true iff the speaker and the addressee know that it is possible that the addressee comes to the party, and his/her coming to the party satisfies the greatest number of orders posed on the addressee among alternatives actions such as the addressee playing soccer, the addressee cleaning the room, etc.

We do not go into further details of her model due to limitations of space, but this line of analysis, namely the ‘imperatives-as-modalized-propositions’ analysis, works well enough to explain why epistemic adverbs like *zettaini* are embeddable in imperatives while ones like *matigainaku* are not.

3. The closedness of the context set. This section briefly introduces the notion of *closedness*. This is a property of the context set, which says that the set of epistemically accessible worlds are *constant* among worlds contained in that set. Formally:

- (7) If $w' \in CS(w)$, then $CS(w') = CS(w)$.

This property is assumed by several analyses of epistemic modals (von Fintel & Gillies (2010) and Gillies (2010), to name a few), and can be derived from two other properties of the context set that are more widely assumed in the modal literature (Kaufmann et al. 2006): *realism* and *negative introspection*. The rest of this section sees the validity of these two properties and how closedness is derived from them.

²Kaufmann expresses the meaning flexibility of imperatives (e.g. COMMAND, ADVISE, PERMISSION, etc.) by assuming that the value of the ordering source g depends on contexts. Although we fix its value as COMMAND throughout this paper, the explanation we will propose is also applicable to other values.

³Kaufmann proposes that the imperative operator enforces the following presuppositions: (i) **temporal restriction**: an imperative is satisfied at or following utterance time, (ii) **authority condition**: the speaker is in an epistemically privileged position with respect to the conversational backgrounds f and g , (iii) **epistemic uncertainty**: the speaker believes that both p and $\neg p$ are possible, and (iv) **ordering source restriction**: the ordering source g must be prioritizing or speaker bouletic, in the sense of Portner (2007). The semantics introduced here also ignores several complications and contains only notions relevant to the following discussion for the sake of simplicity, which makes no difference in the following discussion. For the complete version, refer to Kaufmann (2012, Ch. 3–4).

3.1 REALISM. If the set of worlds accessible from a world w is *realistic*, w is itself contained in that set (in other words, the accessibility relation between w and its accessible worlds is *reflexive*). It is generally held that the context set, that is, the set of worlds compatible with the knowledge of the speaker (or conversational participants), has this property. Thus, we have $w \in CS(w)$. This property ensures that our world is the one where all known propositions are true. Therefore $know(p)$, which is assumed to be true at a world w if p is true in all worlds in $CS(w)$, entails the truth of p .

3.2 NEGATIVE INTROSPECTION. If a set of worlds accessible from a world w are *negative introspective*, in other words, if the accessibility relation involved is *euclidean*, that set is a subset of the set of worlds accessible from a world in that set. When $CS(w)$ has this property, we have $CS(w) \subseteq CS(w')$ for any $w' \in CS(w)$.

What if CS does not have this property? It allows the case where $w' \in CS(w)$, $w'' \in CS(w')$, and $CS(w') \not\subseteq CS(w'')$, that is, some worlds in $CS(w')$ are not contained in $CS(w'')$. This means that $CS(w)$ can contain a p -world, which leads to p *might be true*, while all worlds in $CS(w')$ are $\neg p$ -worlds, which is equivalent to *I know it is certain that p is true*, on the assumption that $might(p)$ and $it\ is\ certain(p)$ are true at w if there is a p -world in $CS(w)$ and if all worlds in $CS(w)$ are p -worlds, respectively. Thus we predict the continuation *p might be true but I know it is certain that p is not true* to be consistent, which is not.

3.3 CLOSEDNESS. The closedness is logically derived from realism and negative introspection. Following is the proof steps adapted from Gillies (2010: 7):

- (8) For any $w' \in CS(w)$,
 - (i) Since $w' \in CS(w)$, we have $CS(w) \subseteq CS(w')$ [Negative introspection].
 - (ii) Since $CS(w) \subseteq CS(w')$ and $w \in CS(w)$ [Realism], we have $w \in CS(w')$.
 - (iii) Since $w \in CS(w')$, we have $CS(w') \subseteq CS(w)$ [Euclidean].
 - (iv) Since $CS(w) \subseteq CS(w')$ and $CS(w') \subseteq CS(w)$, we have $CS(w) = CS(w')$.

Thus, for any $w' \in CS(w)$, $CS(w) = CS(w')$. Given that the two properties overviewed in the two preceding subsections are necessary to capture the behavior of epistemic modality and knowledge ascription like *know*, the closedness, which is a logical consequence of them, should be maintained.

4. Semantics of *zettaini* and *matigainaku*. This section proposes the semantics for the two adverbs *zettaini* and *matigainaku*. We analyze *zettaini* as a modal modifier (Anand & Brasoveanu 2009) which takes a modal as one of its arguments, and *matigainaku* as a pure epistemic modal which accompanies no ordering sources as in von Stechow & Gillies (2010).

4.1 *Zettaini* AS A MODAL MODIFIER. Although we call *zettaini* as an epistemic adverb, its interpretation is not strictly limited to the epistemic one. It concurs with the modal with which it is co-occurring and strengthens the modal claim. The following is one piece of evidence for that:

- (9) (At a pub, John is trying to order his and your drinks. He asks you “What do you want to drink?” You say)

- a. *Watashi-wa zettaini biiru-ga nomi-tai.*
 I-TOP definitely beer-NOM drink-want.to
 ‘I definitely want to drink beer.’
- b. #*Watashi-wa biiru-ga nomi-tai nitigainai.*
 I-TOP beer-NOM drink-want.to must_{EPISTEMIC}
 ‘I must want to drink beer.’

As in (9-b), the epistemic modal *nitigainai* ‘must’ is odd in this context because the speaker is having direct experience of her current internal state (in this case, her internal desire to drink beer), so does not have to make an inference about it. The felicity of (9-a) means that *zettaini* is not offering epistemic modality in this case; it strengthens the bouletic statement made by *-tai* ‘want.to’.

The modal flavor that *zettaini* can strengthen is not limited to the bouletic one; it goes also with volitional modality:

- (10) (Yesterday you said an inappropriate thing to a friend. You regret it and you now have firm determination not to say such a thing. You say to yourself)
- a. *Watashi-wa zettaini nidoto anna-koto-o iwa-nai.*
 I-TOP definitely again that-thing-ACC say-NEG
 ‘I will definitely not say that thing again.’
- b. #*Watashi-wa nidoto anna-koto-o iwa-nai nitigainai.*
 I-TOP again that-thing-ACC say-NEG must_{EPISTEMIC}
 ‘I must not be going to say that thing again.’

(10-b) sounds odd for the same reason as in (9-b): the speaker need not infer what her current volitional state is like, while *zettaini* concords with the volitional modality served by the predicate *yaru* as in (9-a).⁴ These facts suggest that *zettaini* flexibly concords with a wide range of modals.

We propose, in line with Anand & Brasoveanu (2009), that *zettaini* is a modal modifier that takes a modal as one of its arguments. Anand & Brasoveanu deal with the fact that sentences like (11) involve two modals, the adverb *obligatorily* and the auxiliary *must*, but convey only one modal statement (the phenomenon known as *modal concord*), and argue that deontic modal adverbs such as *obligatorily* and *legitimately* share their contextual backgrounds with the modal co-occurring with them (the ordering source is abbreviated for the sake of simplicity, and *M* is a variable over modals):

⁴In (9-a), one might find it unreasonable that the bare form *yaru* provides the volitional modality, and be tempted to claim that the modality comes from *zettaini*. However, the following shows that the bare form provides volitional-ity on its own in Japanese:

- (i) (The same context as (10))
Watashi-wa kyoo yaru.
 I-TOP today do
 ‘I will do it today.’

Therefore, we assume that Japanese bare forms serve as modals in some cases, and that (10) and (i) are examples where it gives volitional modality.

- (11) John obligatorily must be home.
- a. Structure:
[[[obligatorily must] f] p]
 - b. $\llbracket must \rrbracket = \lambda f \lambda p \lambda w. \forall w' [w' \in \bigcap f(w) \rightarrow p(w')]$
 $\llbracket obligatorily \rrbracket = \lambda M \lambda f \lambda p \lambda w: f \text{ is deontic. } M(f)(p)(w) \wedge \forall w' [w' \in \bigcap f(w) \rightarrow p(w')].$
 - c. $\llbracket (11) \rrbracket = \llbracket obligatorily \rrbracket (\llbracket must \rrbracket) (f) (p)$
 $= \lambda w. \llbracket must \rrbracket (f) (p) (w) \wedge \forall w' [w' \in \bigcap f(w) \rightarrow p(w')].$
 $= \lambda w. \forall w' [w' \in \bigcap f(w) \rightarrow p(w')] \wedge \forall w' [w' \in \bigcap f(w) \rightarrow p(w')].$
 $= \lambda w. \forall w' [w' \in \bigcap f(w) \rightarrow p(w')].$

Thus (11), which contains two modals, ends up making one modal claim, resulting in the con-
 cording effect. We will apply the same kind of analyses to *zettaini*.

In addition to multiple modals being interpreted as if there is only one modal, there is an-
 other important observation around modal concord, which is the requirement that two modals
 that enter into a concord relation must agree in their quantificational force. For example, (12-a)
 sounds odd because *must* makes universal quantification, while the quantificational force of
legitimately is existential, as represented in (12-b).

- (12) a. #John must legitimately deny your request.
 b. $\llbracket legitimately \rrbracket = \lambda M \lambda f \lambda p \lambda w: f \text{ is deontic. } \exists w' [w' \in \bigcap f(w) \wedge p(w')].$
 c. Implicature of existentials: $\neg \forall w' [w' \in \bigcap f(w) \rightarrow p(w')].$
 (Anand & Brasoveanu 2009: 24)

Anando & Brasoveanu argue that the deviance is due to the incompatibility between the uni-
 versal claim made by *must* and the implicature of the existential *legitimately*, the latter of which
 requires that not all worlds in the quantificational domain are worlds where the prejacent is
 true (non-universality implicature), as in (12-c). In (12-a), *must* requires all worlds in $\bigcap f(w)$ to
 be ones where John denies your request, which goes against the implicature of *legitimately* that
 John does not do so in at least one world in $\bigcap f(w)$. This inconsistency makes (12-a) deviant.

We have to add some twists to Anando & Brasoveanu's (2009) analysis in order to capture
 the semantics of *zettaini* properly. First, as has been mentioned, *zettaini* shows the strength-
 ening effect, which is not achieved if *zettaini* just makes a universal quantification over the
 same quantificational domain as the modal with which it co-occurs; (11-c) ends up asserting
 the same thing as *John must be home*, so if *zettaini* shared the same semantics with *obliga-*
torily, we would not expect the strengthening effect. Second, the denotation of adverbs like
 (11-b) only works when the modal auxiliary and adverb are clause-mates; otherwise, the two
 modals could not share the same contextual backgrounds. However, *zettaini* concords with a
 modal occurring in the clause embedding it:

- (13) Kono zyoo-hoo-o *zettaini* morasa-nai koto-ga gimudukera-re-teiru.
 this information-ACC definitely leak-NEG COMP-NOM obligate-PASS-PROG
 'It is obliged that you definitely should not leak this information.'

In (13), *zettaini*, which is located in the complement clause, concords with the modal *gimudukera-*
re-teiru 'be obliged', which occurs in the matrix clause. This case of concord cannot be cap-

tured with the lexical entry presented in (11-b).

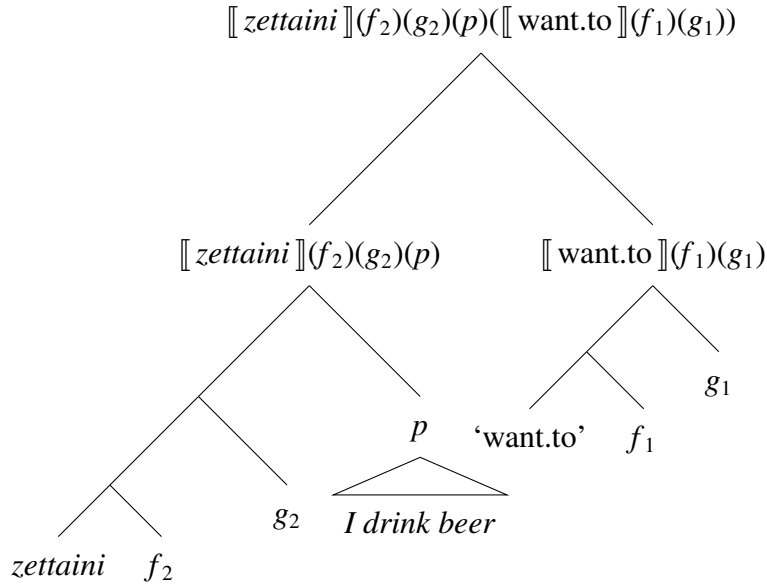
Taking these two points into consideration, we propose the following semantics for *zettaini*.⁵

$$(14) \quad \llbracket zettaini \rrbracket^a = \lambda f_2 \lambda g_2 \lambda p \lambda M \lambda w: [\lambda f \lambda g. \llbracket M \rrbracket^a \begin{smallmatrix} [f_1 \rightarrow f] \\ [g_1 \rightarrow g] \end{smallmatrix}](f_2)(g_2) \text{ is defined.} \\ \exists S[\bigcap f_2(w) \cap \text{BEST}(f_2)(g_2)(w) \subseteq S \wedge \forall w'[w' \in S \in \rightarrow p(w')]].$$

Zettaini takes its own modal base f_2 and ordering source g_2 . The presuppositional part of the denotation abstracts over M 's modal base and ordering source and requires f_2 and g_2 to fulfill the presupposition of M , which in turn ensures that *zettaini* shares the same contextual backgrounds with the original modal claim, as in Anando & Brasoveanu (2009). *Zettaini* further introduces a set of worlds S that is a superset of the set of best-ranked worlds in terms of f_2 and g_2 , and requires a universal quantification to hold over the new quantificational domain. The quantificational domain is larger than the ordinary modal claims, hence the strengthening effect being obtained.

Let us illustrate the derivation of the meaning of (9-a) as an example. We assume the LF-structure for (9-a) as in (15-a).

(15) a. LF for (9-a)



- b. $\llbracket \text{want.to} \rrbracket(f_1)(g_1)$ is defined only if f_1 is circumstantial and g_1 is bouletic.
- c. Presupposition of *zettaini*: $[\lambda f \lambda g. \llbracket \text{want.to} \rrbracket^a \begin{smallmatrix} [f_1 \rightarrow f] \\ [g_1 \rightarrow g] \end{smallmatrix}](f_1)(g_1)](f_2)(g_2)$ is defined.
 $= \llbracket \text{want.to} \rrbracket^a(f_2)(g_2)$ is defined.
 $= f_2$ is circumstantial and g_2 is bouletic.
- d. $\llbracket zettaini \rrbracket^a(f_2)(g_2)(p)(\llbracket \text{want.to} \rrbracket(f_1)(g_1))$ is...
 - (i) defined only if f_2 is circumstantial and g_2 is bouletic.
 - (ii) true iff $\exists S[\bigcap f_2(w) \cap \text{BEST}(f_2)(g_2)(w) \subseteq S \wedge \forall w'[w' \in S \in \rightarrow \text{I drink beer in}$

⁵Note that unlike Anando & Brasoveanu's (2009) notation, we treat M as the variable over modals whose slots for contextual backgrounds are already saturated.

w']].

The contextual backgrounds for the universal modal claim made by *zettaini* are of the same kind as the original ‘want.to’-claim, which means that the resulting sentence (15-d) is a bouletic-modal claim. Furthermore, the larger quantificational domain *S* makes the modal claim stronger. Thus we can capture the correct meaning of *zettaini*-sentences with the semantics in (14). Note that (14) is applicable to cases like (13), where *zettaini* and the modal it modifies are not clause-mates; as is seen in (15-a), *zettaini* does not have to occur in the sister position of the modal that is to be modified.⁶

Before proceeding to the discussion of *matigainaku*, let us address *force*-agreement. As in English modal concord, *zettaini* shows incompatibility with possibility modals:⁷

(16) #John-wa *zettaini* isha kamosirenai.

John-TOP definitely doctor might
‘John definitely might be a doctor.’

We can derive this deviance in the same way as Anando & Brasoveanu (2009). Let us assume that the possibility modal *kamosirenai* ‘might’ accompanies an implicature that the prejacent is not true at some worlds in its quantificational domain. This is incompatible with the assertion of *zettaini*, since it requires the prejacent *John is a doctor* to be true in all worlds in a superset of *kamosirenai*’s quantificational domain.

4.2 *Matigainaku* AS A PURE EPISTEMIC MODAL. This subsection proposes that unlike *zettaini*, the modal flavor of *matigainaku* is lexically determined to be epistemic, and that it does not involve ordering source (von Stechow & Gillies 2010). The pure epistemicity of *matigainaku* is seen in the following examples:

(17) a. (At a pub, John is trying to order his and your drinks. He asks you “What do you want to drink?” You say)

#Watashi-wa *matigainaku* biiru-ga nomi-tai.
I-TOP certainly beer-NOM drink-want.to
‘I definitely want to drink beer.’

b. (Yesterday you said an inappropriate thing to a friend. You regret it and you now have firm determination not to say such a thing. You say to yourself)

#Watashi-wa *matigainaku* nidoto anna-koto-o iwa-nai.
I-TOP certainly again that-thing-ACC say-NEG
‘I will certainly not say that thing again.’

Just as the epistemic auxiliary *nitigainai* is odd in these contexts, *matigainaku* also sounds awkward. This correlation indicates that *matigainaku* cannot encode modal flavors other than the epistemic one.

⁶As the reader may point out, we have to posit a covert epistemic modal in order to derive the epistemic reading of the *zettaini*-sentence in (1). This assumption is not unreasonable given that Japanese bare forms provide modality in some cases as we saw in footnote 4, and this problem is not specific to ours: how to deal with the cases where a concord adverb accompanies no modal but modality is detected is a challenge for any analyses in which concord adverbs do not have their own modal component.

⁷We thank Uli Sauerland (p.c.) for bringing out this point.

Let us move onto the lack of ordering sources. It is generally assumed that epistemic necessity modals without ordering sources encode the speaker's maximal certainty of the truth of the prejacent, because the presence of ordering sources narrows down the context set, the quantificational domain for epistemic modals, to a subset of it. English *must*, von Fintel & Gillies (2010) argue, encodes the maximal certainty and does not have ordering sources accordingly. The oddness of the following discourse is one of the observations supporting this claim:

- (18) A: It must be raining.
 B: [Opens curtains] No it isn't. You were wrong.
 A: #I was not! Look, I didn't say it WAS raining. I only said it MUST be raining.
 Stop picking on me! (von Fintel & Gillies 2010: (19))

The deviance of A's reply indicates that she cannot avoid the blame because she has maximally committed herself to the truth of *it is raining* in her first utterance. Replacing *must* with a weaker modal like *might* improves the acceptability:

- (19) A: It might be raining.
 B: [Opens curtains] No it isn't. You were wrong.
 A: I was not! Look, I didn't say it WAS raining. I only said it MIGHT be raining.
 Stop picking on me! (ibid.: (17))

The fact that the discourse sounds consistent with a weaker modal underpins the claim that the maximal certainty is at play in (18).

The same pattern holds for *matigainaku* and other weaker epistemic adverbs:

- (20) A: Ame-ga *matigainaku* futteiru.
 rain-NOM certainly falling
 'It is certainly raining.'
 B: [Opens curtains] Futtei-nai. Kimi-wa matigatteiru.
 falling-NEG you-TOP wrong
 'It is not raining. You are wrong.'
 A: #Watasi-wa *matigainaku* futteiru-to itta dake-da. Futteiru-to-wa ittei-nai.
 I-TOP certainly falling-COMP said only-COP. falling-COMP-TOP said-NEG.
 'I only said it was certainly raining. I didn't say it was raining.'

The use of a weaker adverbs like *osoraku* 'probably' rescues the discourse:

- (21) A: Ame-ga *osoraku* futteiru.
 rain-NOM probably falling
 'It is probably raining.'
 B: [Opens curtains] Futtei-nai. Kimi-wa matigatteiru.
 falling-NEG you-TOP wrong
 'It is not raining. You are wrong.'
 A: Watasi-wa *osoraku* futteiru-to itta dake-da. Futteiru-to-wa ittei-nai.
 I-TOP probably falling-COMP said only-COP. falling-COMP-TOP said-NEG.
 'I only said it was probably raining. I didn't say it was raining.'

We see from these data that *matigainaku* encodes the speaker’s maximal certainty like English *must*, so we can safely conclude that no ordering source is involved in its denotation. Thus we propose that (22) is the semantics of *matigainaku*, which is a traditional epistemic necessity modal:⁸

$$(22) \quad \llbracket \textit{matigainaku} \rrbracket = \lambda p \lambda w. \forall w' [w' \in CS(w) \rightarrow p(w')].$$

Before closing the section, comments on Lassiter (2016) are in order. Lassiter (2016) criticizes von Fintel & Gillies (2010) and argues that *must* does not encode the maximal certainty. One of his counter arguments is that modals that are strong enough, such as *99.9% certain*, are infelicitous in the same context as (18):

- (23) A: It’s 99.9% certain that it’s raining.
 B: [Opens curtains] No it isn’t. You were wrong.
 A: ??I was not! Look, I didn’t say it WAS raining. I only said it was 99.9% CERTAIN that it was. Stop picking on me! (Lassiter 2016: (55))

What this example indicates is that an epistemic modal does not have to be maximally strong to resist this context, which invalidates the claim that the oddness of (18) is evidence for *must* having the maximal certainty.

However, Lassiter’s counterargument does not impair the validity of our proposal on *matigainaku* for several reasons. First, von Fintel & Gillies (2018) are not fully certain about the oddness of (23), and they mention that setting an appropriate dialogue makes (23) sound fine:

- (24) A: It’s 99% certain that it’s raining.
 B: [Opens curtains] No it isn’t. You were wrong.
 A: Well, strictly speaking, I was not wrong. I was careful. I only said it was 99% certain that it was raining. (von Fintel & Gillies 2018: (10))

Second, in Japanese, modals like *99.9% certain* sounds felicitous in the same context as (18) without the modification done by von Fintel & Gillies (2018):

- (25) A: Ame-ga 99.9-paasento futteiru.
 rain-NOM 99.9-percent falling

⁸As von Fintel & Gillies (2010) and Matthewson (2015) argue, English *must* can only be used when the speaker’s evidence is *indirect*, i.e., the utterance *it must be raining* is infelicitous if the speaker is directly seeing rain. The same observation goes for *matigainaku*:

- (i) (Seeing falling raindrops)
 #Ame-ga *matigainaku* futteiru.
 rain-NOM certainly falling
 ‘It is certainly raining.’

In order to exclude examples like this, we have only to add the indirectness presupposition to (22) like the following:

$$(ii) \quad \llbracket \textit{matigainaku} \rrbracket = \lambda p \lambda w: p, \neg p \notin CG(w). \forall w' [w' \in CS(w) \rightarrow p(w')].$$

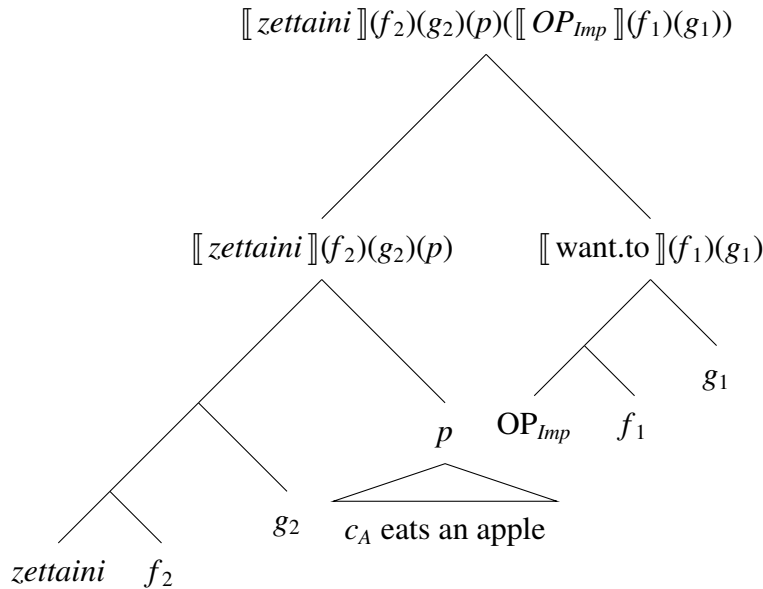
The presupposition, which is adapted from von Fintel & Gillies (2010), requires $CG(w)$ to contain neither p nor $\neg p$ as one of its members, that is, the participants to know neither that p is true or that p is false. This amounts to saying that the participants do not know the truth of p directly. This indirectness presupposition is not relevant to the discussion to come, so we will omit this part for the sake of simplicity.

- ‘It is raining with 99.9% probability.’
- B: [Opens curtains] Futtei-nai. Kimi-wa matigatteiru.
 falling-NEG you-TOP wrong
 ‘It is not raining. You are wrong.’
- A: Watasi-wa 99.9-paasento futteiru-to itta dake-da. Futteiru-to-wa ittei-nai.
 I-TOP 99.9-percent falling-COMP said only-COP. falling-COMP-TOP said-NEG.
 ‘I only said it was raining with 99.9% probability. I didn’t say it was raining.’

99.9-paasento, which is quite strong but not maximal, can be used in this discourse while *matigainaku* is not, which clearly supports the argument that *matigainaku* is maximally strong. Third, Lassiter focuses only on the English auxiliary *must*, and he observes with an experiment that the English adverb *certainly* is stronger than *must*. *Matigainaku* is an adverb akin to *certainly*, so even if his argument on *must* is correct, it does not immediately follow that *matigainaku*’s strength is also non-maximal.

5. Illustration. We are now ready to illustrate how the contrast between two adverbs in (2). The meaning of the *zettaini*-case, repeated here as (26-a), is derived in almost the same way as (15), where *zettaini* modifies the bouletic modal *-tai*:

- (26) a. Ringo-o *zettaini* taber-o.
 apple-ACC definitely eat-IMP
 ‘Definitely eat an apple!’
- b. LF for (26-a)



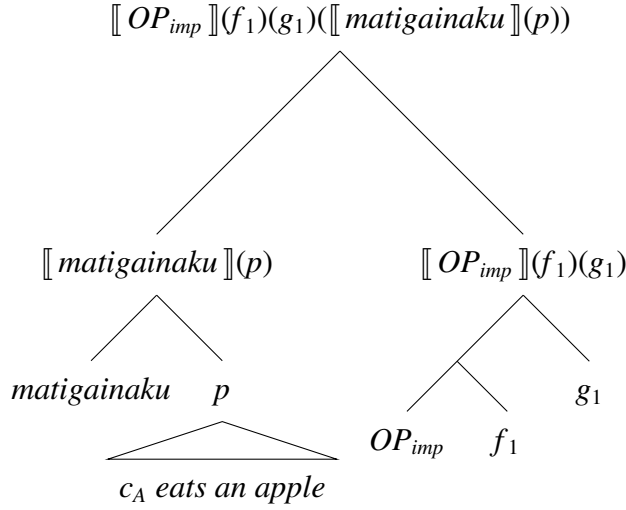
- c. $\llbracket OP_{Imp} \rrbracket(f_1)(g_1)$ is defined only if f_1 is CG and g_1 is deontic.
- d. Presupposition of *zettaini*: $[\lambda f \lambda g. \llbracket OP_{Imp} \rrbracket^a \begin{smallmatrix} f_1 \rightarrow f \\ g_1 \rightarrow g \end{smallmatrix} (f_1)(g_1)](f_2)(g_2)$ is defined.
 = $\llbracket OP_{Imp} \rrbracket^a(f_2)(g_2)$ is defined.
 = f_2 is CG and g_2 is deontic.
- e. $\llbracket zettaini \rrbracket^a(f_2)(g_2)(p)(\llbracket OP_{Imp} \rrbracket(f_1)(g_1))$ is...

- (i) defined only if f_2 is *CG* and g_2 is deontic.
- (ii) true iff $\exists S[\bigcap f_2(w) \cap \text{BEST}(f_2)(g_2)(w) \subseteq S \wedge \forall w' [w' \in S \rightarrow c_A \text{ eats an apple in } w']]$.

As in (15), the result is stronger than the plain imperative, because of the larger quantificational domain S .

Let us turn to the *matigainaku*-case, repeated here as (27-a). We assume the structure (27-b) for the LF of (27-a), and the truth-condition will be computed as in (27-c):

- (27) a. Ringo-o *matigainaku* taber-o.
apple-ACC certainly eat-IMP
'Certainly eat an apple.'
- b. LF for (27-a)



- c. $\llbracket OP_{imp} \rrbracket(f_1)(g_1)(\llbracket matigainaku \rrbracket(p))$
 $= \forall w' [w' \in \bigcap f(w) \cap \text{BEST}(f)(g)(w) \rightarrow \forall w'' [w'' \in CS(w') \rightarrow c_A \text{ eats an apple in } w'']]$
 $= \forall w' [w' \in CS(w) \cap \text{BEST}(f)(g)(w) \rightarrow \forall w'' [w'' \in CS(w') \rightarrow c_A \text{ eats an apple in } w'']]$
 $\quad (f(w) \text{ is } CG(w), \text{ so } \bigcap f(w) = CS(w))$
 $= \forall w' [w' \in CS(w) \cap \text{BEST}(f)(g)(w) \rightarrow \forall w'' [w'' \in CS(w) \rightarrow c_A \text{ eats an apple in } w'']]$
 $\quad (\text{Closedness: since } w' \in CS(w), CS(w) = CS(w'))$
 $= \forall w'' [w'' \in CS(w) \rightarrow c_A \text{ eats an apple in } w'']. \quad (\text{Vacuous quantification})$

The two context sets involved in the formula, $CS(w)$ and $CS(w')$, end up being identical because of the closedness discussed in Section 3, which makes the quantification by OP_{Imp} vacuous, since the variable w' , which is bound by the OP_{Imp} 's universal quantifier, does not appear in the second universal quantification done by *matigainaku*. As a result, the contribution of OP_{Imp} is lost (that is, $\llbracket OP_{Imp} \rrbracket(f_1)(g_2)(\llbracket matigainaku \rrbracket(p)) = \llbracket matigainaku \rrbracket(p)$), which violates the following principle:

- (28) The principle of non-vacuity (Crnič 2011: 110)
The meaning of a lexical item used in the discourse must affect the meaning of its host sentence (either its truth-conditions or its presuppositions).

Adding OP_{Imp} to $matigainaku(p)$ makes no semantic difference because the closedness leads to vacuous quantification, hence being susceptible to (28).

6. Conclusion and implication. This paper has given an account of why certain epistemic adverbs in Japanese can/cannot be embedded under imperatives. We have argued that the embeddable adverb is a modal modifier that expands the quantificational domain of the modal co-occurring with it, whereas the unembeddable one is a pure epistemic modal that ends up causing vacuous quantification and nullifies the contribution of imperative operators.

The rest of this paper shows that only the modal (or strong) theory for imperatives can capture a parallelism between imperatives and modals. As we have shown so far, the current analysis relies on a rich denotational semantics of imperatives proposed by Kaufmann (2012), according to which imperatives denote modalized propositions. As is well known in the recent studies of imperatives, however, there is a competing view proposed by Portner (2007) (See also von Stechow & Iatridou (2017)). Portner, following Hausser (1980), rather proposes the ‘minimal’ denotational semantics, namely the ‘non-modal’ semantics, according to which imperatives denote a property (rather than a proposition) that is restricted to the addressee (as in (29)), and update a context by adding the property to the discourse component called the To-Do Lists (TDLs): for every individual, the TDL contains a list of properties that the individual should make true of themselves. For Portner, then, the heavy lifting of imperatives is done in the pragmatics: the meaning of ‘necessity’ that we associate with imperatives is not encoded in the syntax-semantics but is part of the relevant discourse component.

(29) $\llbracket \text{Come to the party} \rrbracket^c = \lambda w \lambda x: x = c_A. x \text{ comes to the party at } w$

Consider now the data in (30), repeated from (13), where *matigainaku* and *zettaini* are embedded under the deontic modal *gimudukera-re-teiru* ‘(be) obliged.’ Interestingly, as in the case of imperatives, *matigainaku* cannot be embedded under the modal while *zettaini* is felicitous.

(30) Kono zyoo-hoo-o *zettaini*/#*matigainaku* morasa-nai-koto-ga *gimudukera-re-teiru*.
 this information-ACC definitely/certainly leak-NEG-COMP-NOM oblige-PASS-PROG
 ‘It is obliged that you should definitely not leak this information.’

The fact that both imperatives and performative modals can embed *zettaini* but cannot *matigainaku* constitutes a problem for any analysis of imperatives that assigns them no modals. For Portner’s minimal semantics, it is difficult to capture this parallelism between imperatives and performative modals that we have shown above, because performative modals clearly denote a proposition rather than a property (and thus cannot update the TDL). It is worth noting that it is not the case that Portner’s account of imperatives is ‘modality-free;’ he claims that the modality exists as ‘meta-modality,’ but just not in the syntax and semantics (the particular meta-modality involved in the TDL in a theory of context is explored in detail in Portner (2007)). We stress, however, that it is still unclear how certain epistemic adverbs like *matigainaku* and *zettaini* interact with imperatives within the theory of minimal semantics; the theory needs to be extended or at least say more about what the character of modality involved in

the TDL is.⁹

On the other hand, the same explanation as in the case of imperatives can be applied to (30), which lends support for the modal view of imperatives; in (30), while *zettaini* can strengthen the modal claim made by the deontic modal ‘it is obliged’ thanks to its flexibility, *matigainaku* violates the non-vacuity principle since the deontic modal embedding *matigainaku* cannot make any contribution due to vacuous quantification.

Although the present analysis supports the modal view, it does not immediately mean that we should completely reject the minimal approach. Instead, we are claiming that at least in some language, especially in Japanese, the modal approach is clearly needed. One possibility might be whether or not imperatives contain modals depends on language-specific morphological systems (cf. Medeiros 2013); that is, for instance, imperatives in Japanese may encode modals whereas in English, imperatives may denote no modality. We should thus verify whether the account in this paper can be applied to imperatives in other languages, which will be left to future research. Moreover, examining a compatibility between ‘non-canonical’ form imperatives (See von Stechow & Iatridou (2017) for Hebrew and German. See Ihara & Noguchi (2019) for Japanese) and epistemic adverbs also needs to be implemented.

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⁹In fact, there are problems with the TDL way of modeling the contextual effect of imperatives, many of which are canvassed by Condoravdi & Lauer (2012).

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