Doubt, incredulity, and particles in Japanese falling interrogatives

Lukas Rieser

Kyoto University

Kyoto, Japan

lukasjrieser@gmail.com

Abstract

I propose an analysis of the particles *no*, *ka*, *yo*, and *ne* as speech act modifiers, accounting for the readings of falling interrogatives with and without particles by predicting what they convey about the speaker's belief revision and formation process. The analysis is set in a CCP-framework formalizing utterance felicity in terms of belief and evidence conditions in which speech act felicity is compositionally derived from illocutionary force, sentence final intonation, and modification by particles.

1 Japanese sentence final particles

Sentence final particles (SFPs) are a highly productive class of expressives[1] in Japanese. The empirical scope of this paper are the interrogative marker *ka* and the particles *no*, *yo*, and *ne* . While there is only a consensus to classify *yo* and *ne* as SPFs, I analyze all four particles as SFPs in the sense of speech act modifiers occurring in the sentential periphery.

SFPs in the Japanese clause Japanese is a strictly left-branching language, hence elements further right in linear order generally scope syntactically higher and enter the semantic derivation later than such further left. Therefore, layered clause models have been proposed in descriptive Japanese grammar.[2] Minami (1974), for instance, locates SFPs in the outermost layer of the clause, which encodes meta-information on the transmission of information

by the utterance. Minami's next inner layer hosts the interrogative particle *ka* and the speech act modal[3] *daroo*, which encode information on the speaker's judgment of the truth of the prejacent. The position of *daroo* is immediately preceded by that of *no*[4] in linear order, which in turn is preceded by tense morphology, as (1) below illustrates.

(1) V-T-*no*-(*daroo*)-*ka*-*yo*-*ne*

SFPs as speech-act modifiers In line with the intuitions and observations motivating layered clause models, I propose that *no*, *daroo* and *ka* modify utterance felicity conditions w.r.t. speaker belief and available evidence (subjective, related to speaker judgment), *yo* and *ne* w.r.t. speaker assumptions on addressee belief (intersubjective, related to information sharing/transmission). On my analysis, all thus modify utterance meaning on the speech act level where felicity is computed. As analyzing speech act felicity is independently necessary to account for bare (particle-less) utterances, this is a relatively parsimonious way of accounting for the contribution of Japanese sentence final expressives.

2 Japanese falling interrogatives

Falling interrogatives (FIs) occur frequently in Japanese and have uses clearly distinct form canonical, information-seeking questions. In the remainder of this section, I introduce the observations to be accounted for in the analysis.

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[1] In the sense of not contributing truth-conditional meaning.

[2] *cf.* Narrog (2009) for extensive discussion of various layered models, Davis (2011) for discussion pertaining to SFPs.

[3] *cf.* Hara and Davis (2013), Rieser (2017c) for analysis as a speech act modifier operating on a Gricean quality threshold.

[4] *cf.* Rieser (2017a) for discussion on the structural and functional distinction with the homophonous complementizer *no*.

2.1 Two readings of FIs and *no*

Davis (2011) observes a contrast in felicity between (2) with and wihtout *no* under the scenarios in (3).

(2) Tori-ga   konna tokoro-ni sum-eru (no) ka.
    birds-NOM such_a place-in   live-POT *no*   *ka*
    "Can birds live in a place like this!?"/
    "Birds can live in a place like this after all!"

(3) a. Scenario 1: S assumes birds cannot live here, but looking out the window is surprised to discover that in fact they do. She utters (2) to indicate her surprise.
    b. Scenario 2: S believes that birds cannot live here. Her friend says something that suggests they do. She utters (2) to indicate that her friend is mistaken.

In Scenario 1, the *no*-FI is preferred; in Scenario 2, only the bare FI is felicitous. Davis labels the salient reading under Scenario 2 the rhetorical question reading, similar to English rhetorical polar questions as the first translation indicates. He argues that such a reading is incompatible with *no* due to its evidential properties (which I also assume in my analysis).

I label the salient interpretation under Scenario 1 the **incredulity reading**,[5] that under Scenario 2 the **doubt reading**. In Scenario 1, the speaker revises a previous belief in light of new evidence supporting the prejacent, while in Scenario 2 the speaker rejects the prejacent as it is incompatible with a previous belief. The incredulity reading thus indicates that evidence-based belief revision is underway and the previous belief is to be discarded, the prejacent representing the *revised belief* to replace the previous belief. The doubt reading, on the other hand, indicates no belief revision takes place and the previous belief is to be retained, the prejacent representing an *unaccepted belief*.[6]

In this way, (*no*-)FIs convey information about the speaker's belief revision and formation process, *i.e.* judgment process w.r.t. the prejacent. I propose that this encoded in utterance felicity conditions characterizing admissible utterance contexts.

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[5]Thus labeled as it intuitively conveys that the speaker finds the prejacent "hard to believe" or "unbelievable".

[6]It should be noted that in many cases, in particular soliloquous uses, the doubt reading conveys suspension of judgment rather than outright rejection of the prejacent.

2.2 Incredulity, doubt and *yo* in FIs

Davis further observes that *yo*-FIs disallow what I label doubt readings and must be interpreted as assertions (note that I defend distinguishing assertions as falling declaratives from FIs). Consider (4) showing a *yo*-FI with and without *no*, adapted from Davis' data by Taniguchi (2016).

(4) Sonna mono taberu (no) ka yo.
    such thing eat   *no* *ka yo*
    "What the hell! He isn't going to eat that!"/
    "Holy shit! He's going to eat that!"

Taniguchi observes that (4) conveys "negative bias" (the speaker tends not to believe the preajcent) without *no*, but "positive bias" (the speaker tends to believe the preajcent) with *no*, as the translations suggest. While (4) without *no* conveys stronger doubt, both versions of the *yo*-FI are incredulity readings in my terminology as they indicate that the speaker at least considers revising a previous belief, in contrast to the bare FI in (2) which receives a doubt reading. Taniguchi proposes analyzing *ka-yo* utterances as update with a self-addressed question (*ka*) followed by self-corrective update (*yo*) to derive the communicative effect of *yo*-FIs.

I propose an alternative, compositional derivation of what FIs with particles mean from the effects that *ka*, *yo*, and *no* have on speech act felicity. This accounts for Davis's observation that *yo*-FIs are assertion-like as *yo* introduces (addressee) commitment like (rising) declaratives, and for Taniguchi's observations on bias, as *no* requires evidence in principle sufficient for felicitous assertion, indicating that belief revision is well underway.

2.3 Reluctant acceptance and *ne*

FIs with *ne* convey speaker doubt and seek an evaluation of the prejacent from the addressee, as in (5).

(5) Sonna mono taberu (no) ka ne.
    such thing eat   *no* *ka ne*
    "So is he actually going to eat this?"/
    "So he is actually going to eat this…"

The salient reading of the *ne*-FI in (5) without *no* is a doubt reading, in contrast to the *yo*-FI in (4), which even without *no* receives an incredulity reading. Adding *no* to (5) makes an incredulity reading available which in contrast with the mirative nuance

of (4) conveys what I label "reluctant acceptance" — that the speaker is at least considering to *also* accept the preajcent. Crucially, as suggested by the translations with "so" referring to a previous utterance of the addressee, *ne*-FIs convey a speaker assumption that the addressee believes the prejacent to be true.

I propose a compositional account of *ne*-FIs on which *ka* conveys speaker doubt, *ne* the assumption that the addressee believe the prejacent, which predicts that they occur in situations where there is a discrepancy between speaker and addressee belief.

3 Framework for speech act felicity

While the framework sketched below also covers handling rising interrogatives (canonical questions) and rising declaratives,[7] I focus on FIs to account for the observations above. The framework builds on the following assumptions: (i) Speaker commitment from assertion can be derived from satisfaction of Gricean quality maxims; (ii) in interrogatives, quality requires the speaker to *not* believe the prejacent to be true; (iii) FIs convey that the speaker *forgoes* commitment to the prejacent. In the remainder of this section, I define belief and evidence propositions as the basis to formalize felicity conditions, provide definitions for the CCP model, and implement the assumptions in (i) through (iii) above.

3.1 Belief and evidence in speech acts

Felicity conditions are captured in form of belief and evidence propositions. First, **belief propositions** of the form $B_x^w \varphi$ are defined by doxastic accessibility:[8]

(6) a. $B_x^w \varphi \rightarrow \forall w'.wR_x^{dox}w' : w' \in W^\varphi$
    b. $\neg B_x^w \varphi \rightarrow \exists w'.wR_x^{dox}w' : w' \notin W^\varphi$
    c. $B_x^w \neg \varphi \rightarrow \forall w'.wR_x^{dox}w' : w' \notin W^\varphi$

Thus, "x believes φ to be true at w" ($B_x^w \varphi$) means that *at all worlds* compatible with x's beliefs at w, φ is *true* ; "x does not believe φ to be true at w" ($\neg B_x^w \varphi$) means that *at least at one world* compatible with x's beliefs at w, φ is *false*, and "x believes φ to be false at w" ($B_x^w \neg \varphi$) means that *at no worlds* compatible with x's beliefs at w at which φ is *true* (φ is false at all worlds compatible with x's beliefs at w).

Additional assumptions such as circumstantial and stereotypical conversational backgrounds are taken to be encoded in R^{dox} for simplicity, as this issue is not central to the analysis.

Second, **evidence propositions** are defined in terms of evidence required to back up speaker commitment arising from felicitous assertion. The question of what constitutes evidence in natural language is very complex[9] and I set it aside here. Focusing on evidence-related felicity condition on assertion, I define evidence propositions of the form $EV_x^w \varphi$ relative to belief propositions in the following defeasible entailment relation.[10]

(7) a. $EV_x^w \varphi > B_x^w \varphi$
    b. $(EV_x^w \varphi > B_x^w \varphi) \wedge EV_x^w \varphi \vdash B_x^w \varphi$
    c. $(EV_x^w \varphi > B_x^w \varphi) \wedge B_x^w \neg \varphi \nvdash B_x^w \varphi$

Thus, from the premise that x has evidence supporting φ at w one can infer by (7-a) that x believes φ at w as in (7-b), unless there is an additional premise that x believes φ to be false at w as shown in (7-c).

Finally, I define the notion of **public belief** as in (8-a) to capture commitment that arises from assertion. Gunlogson (2003) and Davis (2011) employ the similar notion of public commitment, which differs in that I take public belief to be independent of private belief, *i.e.* an agent can publicly believe φ, but privately not believe φ. Furthermore, public belief is recursive as defined in (8-b).

(8) a. $PB_x^w \varphi \rightarrow B_y^w B_x^w \varphi$
    b. $PB_x^w \varphi \rightarrow PB_y^w B_x^w \varphi$

Thus, when φ is a public belief of x, all other participants (here: only y, as I assume two participants x and y for simplicity) thus believe that x believes φ. The additional stipulation in (8-b) states that other participants' beliefs as of (8-a) are also public beliefs. This is to distinguish cases of incidental shared belief from those of public belief arising from observable linguistic (or other) behavior, *i.e.* from "manifest events" in the sense of Stalnaker (2002).[11]

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[7]For details, in particular regarding *no*, see Rieser (2017a).
[8]The notation for accessibility relations follows Kaufman *et al.* (2006). W^φ is the set of worlds at which φ is true, $W^{\neg\varphi}$ the set of worlds at which φ is false, and $w \notin W^\varphi \rightarrow w \in W^{\neg\varphi}$.

[9]*cf.* McCready (2014) for discussion pertinent to Japanese.
[10]As defined by Asher and Lascarides (2003).
[11]In parallel to (8-b), I define *mutual introspection* in Rieser (2017b), to account for the publicity-sensitivity of the German particles *doch* and *ja* wich are *e.g.* not felicitous in assertions that function to publicly announce the prejacent.

3.2 CCPs, input and output conditions

I use the following definitions in the CCP-model:

$\mathcal{U}$ ... utterance (DEC or INT with $\downarrow$ or $\uparrow$)

c ... input context (world before utterance)

c' ... output context (world after utterance)

$\mathcal{B}^{\mathcal{U}}$ ... set of belief conditions $\mathcal{U}$ imposes on c

$\mathcal{E}^{\mathcal{U}}$ ... set of evidence conditions $\mathcal{U}$ imposes on c

$\mathcal{PB}^{\mathcal{U}}$ ... set of public beliefs that arise from $\mathcal{U}$ (*i.e.* set of belief propositions added in c')

(9) shows the CCP of an utterance $\mathcal{U}(\varphi)$.[12]

(9) $\quad [\![\mathcal{U}(\varphi)]\!] = \{\langle c, c' \rangle \mid$
$$\mathcal{B}^{\mathcal{U}} \subseteq c \wedge \mathcal{E}^{\mathcal{U}} \subseteq c \wedge c' = c \cup \mathcal{PB}^{\mathcal{U}}\}$$

An utterance $\mathcal{U}$ is thus a set of pairs of admissible input and output contexts, and is felicitous iff for the world w at utterance time (the set of true propositions) $\exists c \in \langle c, c' \rangle \in \mathcal{U} : c \subset w$ holds, *i.e.* all belief and evidence propositions in an admissible input context c are true at utterance time (thus w itself is an admissible context). Admissible input contexts c must contain the members of $\mathcal{B}^{\mathcal{U}}$ and $\mathcal{E}^{\mathcal{U}}$, output contexts c' those and the members of $\mathcal{PB}^{\mathcal{U}}$.

To represent conditions on input contexts (felicity conditions) and on output contexts (commitments) in a more compact notation for ease of exposition, I henceforth also write $B_x^c \varphi$ for $B_x \varphi \in \mathcal{B}^{\mathcal{U}}$, $EV_x^c \varphi$ for $EV_x \varphi \in \mathcal{E}^{\mathcal{U}}$, and $PB_x^{c'} \varphi$ for $PB_x \in \mathcal{PB}^{\mathcal{U}}$.

3.3 Felicity conditions of assertions and FIs

I derive input conditions on falling declaratives from the two Gricean maxims of quality (Grice, 1975).

QI Do not say anything you believe to be false.

QII Do not say anything for which you lack
adequate evidence.

QI states that the speaker may not believe $\neg\varphi$ in c, that is $\neg B_S^c \neg \varphi$, and must have evidence sufficient to assert φ in c, that is $EV_S^c \varphi$.

(i) Commitment from assertion The evidence rule connects the two maxims of quality by the inference shown in (10) repeated from (7-b).

(10) $\quad (EV_x^w \varphi > B_x^w \varphi) \wedge EV_x^w \varphi \vdash B_x^w \varphi$

Satisfaction of $EV_S^c \varphi$ (**QI**) ensures that the premise $EV_S^w \varphi$ is met, and satisfaction of $\neg B_S^c \neg \varphi$ (**QII**) rules out that the blocking condition $B_S^w \neg \varphi$ applies — thus, the inference in (10) goes through if an an assertion of φ by S is observed and judged felicitous, and the observer must assume that $B_S^w \varphi$ holds. Thus, commitment from assertion arises as $PB_S^{c'} \varphi$. (11) shows an according falling declarative CCP.

(11) $\quad [\![\text{DEC}(\varphi)\!\downarrow]\!] = \{\langle c, c' \rangle \mid$
$$\neg B_S^c \neg \varphi \wedge EV_S^c \varphi \wedge PB_S^{c'} \varphi\}$$

Assertion thus changes the context successfully if for utterance time w, $\neg B_S^w \neg \varphi$ and $EV_S^w \varphi$ hold, *i.e.* w is an admissible input context c. The assertion then gives rise to a public belief $PB_S^{w'} \varphi$, w' being the output context c' paired with c in $\text{DEC}(\varphi)\!\downarrow$.

(ii) Quality in interrogatives While Gricean maxims only cover assertions, (falling) interrogatives also come with belief conditions, *cf.* for instance Searle (1969). Inspired by Gricean quality, I propose a maxim **Q int** for interrogative utterances.

Q int Do not doubt what you believe to be true.

"Doubting" in **Q int** means "use in an interrogative utterance", reflecting the intuition that it is infelicitous to convey doubt over (in an FI) or ask about (in a question) something that one actually believes to be true — thus, $\neg B_S^c \varphi$ holds for interrogatives.

Recall that even when there is evidence for φ, the inference that the speaker believes φ does not go through for the if the blocking condition $B_x^w \neg \varphi$ holds, as blocked inference on the evidence rule repeated from (7-c) as (12) shows.

(12) $\quad (EV_x^w \varphi > B_x^w \varphi) \wedge B_x^w \neg \varphi \nvdash B_x^w \varphi$

FIs do not require $B_S^w \neg \varphi$ to hold, but tolerate it in contrast to assertions. I propose that adding *no* to FIs introduces a condition requiring evidence for the prejacent in the input context, compatible with an utterance world w at which $B_S^w \neg \varphi$ and $EV_S^w \varphi$ both hold, giving rise to a belief revision reading.

(iii) Forgone commitment from FIs While FIs can thus indicate that belief revision is underway, no speaker commitment arises from them by default. Furthermore, as assertion is an alternative to FIs,

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[12] I build on Davis' (2011) relational CCPs as sets of input / output context pairs, with the difference that I assume that there is a unique output context for each admissible input context.

they can give rise to a Q-implicature[13] in the form negated public belief $\neg PB_S^{c'}\varphi$ as in the CCP below, conveying that the speaker *forgoes commitment* to the prejacent.

(13) $\quad \llbracket\text{INT}(\varphi)\!\downarrow\rrbracket = \{\langle c, c'\rangle \mid \neg B_S^c\varphi \wedge \neg PB_S^{c'}\varphi\}$

Negated public belief is defined in (14).

(14) a. $\neg PB_x^w\varphi \to B_y^w\neg B_x^w\varphi$
$\quad$ b. $\neg PB_x^w\varphi \to PB_y^w\neg B_x^w\varphi$

As $\neg PB_x^{c'}\varphi$ is a conversational implicature, it can be canceled, so that $\neg B_S^c\varphi$ remains the only necessary condition on FIs. For instance, *no*-FIs indicate belief revision and $\neg PB_x^{c'}\varphi$ is canceled when the observer assumes revision is complete.

4   What particles do

I propose to analyze SFPs as paraphrased below.

no adds an input condition requiring evidence supporting φ available to both S and A.

ka marks interrogative force in Japanese utterances (with final falling intonation).[14]

yo adds an input condition $B_S^c\neg B_A\varphi$, and commits the speaker to $PB_A^{c'}\varphi$ in the output context.

ne adds an input condition $B_S^cB_A\varphi$.

That is, *ka* changes force from DEC to INT, introducing the felicity condition $\neg B_S^c\varphi$. The effects of *no*, *yo*, and *ne* on CCPs of FIs and, as a consequence, speech act felicity conditions are shown below.

4.1   *No*

As shown in (15), *no* adds a condition $EV_{\mathcal{X}}^c\varphi$ requiring evidence for the prejacent in in the input context.

(15) $\quad \llbracket\mathcal{U}(no(\varphi))\rrbracket = \{\langle c, c'\rangle \mid \mathcal{B}^{\mathcal{U}} \subseteq c \wedge$
$\quad\quad\quad [\mathcal{E}^{\mathcal{U}} \cup EV_{\mathcal{X}}\varphi] \subseteq c \wedge c' = c \cup \mathcal{PB}^{\mathcal{U}}\}$

With *no*, evidence for φ must be accessible to not only the speaker but *all participants*, written as $\mathcal{X}$. That *no* has an evidential meaning has been proposed before, also by Davis (2011), who takes *no* to introduce an evidence presupposition. On my analysis, the evidence condition that *no* introduces as a

speech act modifier is of the same type as that required by **QII**, so that *no* makes a relatively small difference in assertions, only changing the extant evidence condition $EV_S^c\varphi$ to $EV_{\mathcal{X}}^c\varphi$.[15]

In the case of (falling) interrogatives, however, *no* has a more pronounced effect as they do not have and evidence condition of their own. In combination with the belief condition $\neg B_S^c\varphi$ (which tolerates $B^w\neg\varphi$ in the input context), $EV_{\mathcal{X}}^c$ characterizes an utterance situation where the speaker does not believe φ, but there is mutually accessible evidence for φ, giving rise to the incredulity reading.

4.2   *Yo*

Next, I propose *yo* modifies both input conditions and commitment in the CCP as shown in (16).

(16) $\quad \llbracket\mathcal{U}(yo(\varphi))\rrbracket = \{\langle c, c'\rangle \mid [\mathcal{B}^{\mathcal{U}} \cup B_S\neg B_A\varphi] \subseteq c \wedge$
$\quad\quad\quad \mathcal{E}^{\mathcal{U}} \subseteq c \wedge c' = c \cup [\mathcal{PB}^{\mathcal{U}} \cup PB_SB_A\varphi]\}$

Yo introduces two changes: first, it adds an input condition $B_S^c\neg B_A\varphi$, *i.e.* that the speaker believe the addressee not to believe φ to be true. Second, it adds an output condition $PB_S^{c'}B_A\varphi$, *i.e.* speaker commitment to a belief that the addressee believe the prejacent to be true. This analysis also accounts for the "corrective" character of *yo*-assertions in a similar way as the update function STRONGASSERT (which forces addition of φ to a context set that already contains $\neg\varphi$ by non-monotonic update) proposed for *yo* by McCready (2005), who also suggests an input condition on the lines of $B_S^c\neg B_A\varphi$ independently.[16]

In FIs, this condition is added on top of $\neg B_S^c\varphi$ from *ka* (*i.e.* from INT), which conveys a speaker assumption that neither participant believes the prejacent to be true in the input context. Taken together with commitment arising from *yo*, this makes a belief revision reading (discussed in more detail in the next section) and thus an incredulity reading salient.

While the analysis of *yo* in Davis (2011) is similar in spirit, my proposal differs in two main points. First, I do not assume *yo* gives rise to $PB_S^{c'}\varphi$, *i.e.* does not commit the speaker, accounting for neg-

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[13]*i.e.* a Quantity implicature in the sense of Geurts (2010).

[14]Final rising utterances without politeness morphology are ambiguous between declaratives and interrogatives in Japanese.

atively biased readings of *yo*-FIs. Second, I do not take *yo* to occupy the same spot as final falling intonation, which I take to enter the derivation before the addition of particles. This is indirectly supported by the observation that German modal particles have similar functions as Japanese SFPs[17] but do not occur sentence-finally, which speaks against a shared position of speech act modifiers and intonation.

4.3 *Ne*

Finally, I propose *ne* modifies the CCP by adding a belief condition to the input context, as (17) shows.

(17) $\llbracket \mathcal{U}(ne(\varphi)) \rrbracket = \{\langle c, c' \rangle \mid [\mathcal{B}^{\mathcal{U}} \cup B_S B_A \varphi] \subseteq c \wedge$
$\mathcal{E}^{\mathcal{U}} \subseteq c \wedge c' = c \cup \mathcal{PB}^{\mathcal{U}}\}$

Ne adds only $B_S^c B_A \varphi$, *i.e.* the speaker is required to assume that the addressee believe the prejacent to be true. This accounts for the observation frequently encountered in the descriptive literature that *ne* is a consensus-seeking or confirming particle, as this is predicted in the case of assertion, which also give rise to speaker commitment. It also straightforwardly accounts for the markedly different effect of *ne* in FIs by the combination of $B_S^c B_A \varphi$ with $\neg B_S^c \varphi$ from *ka*, indicating discrepant beliefs of speaker and addressee in the utterance situation (discussed in more detail in the next section).

It should be noted that there is a compositionality issue with regard to *yo-ne* utterances, as assuming that *yo* and *ne* both modify the basic utterance's felicity conditions at the same time leads to contradictory belief conditions. One way out is to assume, as for instance Takubo and Kinsui (1997) do, that modification is sequential. This can be paraphrased as *yo* imposing φ on the addressee and *ne* reinforcing this. As *yo* adds a commitment $PB_S^{c'} B_A \varphi$, it changes the context much like a (rising) declarative does. This makes it plausible that *yo* performs an update of its own right, which can then be confirmed with *ne*. The present framework is not capable of modeling such incremental context change and I leave this point for further research, also as I am not concerned with combination of *yo* and *ne* here. Alternatively, the observations in Oshima (2014) suggest that *yone* might be best analyzed as an independent lexical item.

5 Belief revisions and particles in FIs

The doubt and incredulity readings of bare FIs as well as versions with particles can be located within a belief revision process. To illustrate this, I define DOX$_x$, the doxastic state of agent x, as the set of worlds compatible with x's beliefs at a world:

(18) $\text{DOX}_x(w) = \{w' \mid wR_x^{dox}w'\}$

Next, I define three types of doxastic states (DOX$^\alpha$, DOX$^\beta$, DOX$^\gamma$) by their relation to W^φ and $W^{\neg\varphi}$.[18]

(19) a. DOX$^\alpha \subseteq W^{\neg\varphi}$
      b. DOX$^\beta \not\subseteq W^{\neg\varphi} \wedge$ DOX$^\beta \not\subseteq W^\varphi$
      c. DOX$^\gamma \not\subseteq W^\varphi$

An agent in a state of type α thus believes φ to be false, an agent in a state of type γ believes φ to be true. In a state of type β, neither holds — the speaker considers both φ and $\neg\varphi$ possible. The sequence of doxastic states follows the stages of the belief revision process illustrated below.

5.1 Schema of belief revision under evidence

The schema below shows revision of $B_x \neg\varphi$ to $B_x \varphi$, *i.e.* x believes φ to be false and revises this belief.
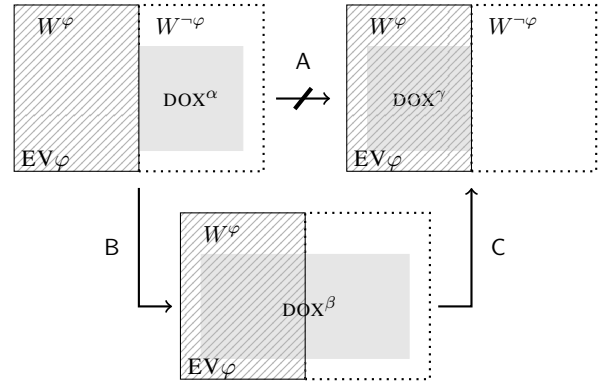
The shaded area represents evidence for φ, which can motivate belief revision from DOX$^\alpha$. Monotonic belief update, *i.e.* narrowing of DOX$^\alpha$ to DOX$^\gamma$ is not possible, as represented by the crossed-out arrow A, as there are no accessible φ-worlds in DOX$^\alpha$. Therefore, revision requires two steps — first, the DOX$^\alpha$ needs to be widened to DOX$^\beta$, represented by arrow

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B.[19] From the widened DOX$^\beta$, narrowing to DOX$^\gamma$ is possible, as represented by arrow C.

In the remainder of this section, I discuss how the proposed analysis accounts for the observations on particles in FIs, making reference to the belief revision schema where appropriate.

5.2 Doubt and incredulity: *no*

(20) Tori-ga konna tokoro-ni sum-eru (no) ka.
     birds-NOM such_a place-in live-POT *no ka*
     "Can birds live in a place like this!?"/
     "Birds can live in a place like this after all!"

The addition of *no* in (20), repeated from (2), has the effect of making evidence in support of the prejacent mandatory in the input context. The bare FI without *no*, on the other hand, merely indicates that in the input context, the speaker does not believe prejacent φ to be true (which corresponds to a doubt reading).

Recall that *no* marks evidence in principle strong enough for assertion of φ. Thus, only the bare FI can be used to reject φ, while the *no*-FI typically receives a belief revision, or incredulity reading.

Bare FIs and doubt In Davis's doubt scenario, the speaker rejects accepting a claim by the addressee. Recall that, according to the analysis proposed above, the following holds for a bare FI.

(21) context before INT$(\varphi)\downarrow$: $\neg B_S^c \varphi$

In the belief revision schema, this only excludes doxastic states of type γ, so that speaker can either be in a state of type α or type β, *i.e.* either believe φ to be false be neutral. On the doubt reading as in Davis's example, the speaker is in a state of type α, *i.e.* believes φ to be false so that $B_S^w \neg \varphi$ holds in the utterance situation, and either does not consider belief revision at all as in (non-)step A, or suspends judgment by widening a state of type α to type β as in step B. In such cases, the implicature $\neg PB^{c'}\varphi$ (forgone commitment) arises and the utterance conveys that the speaker does not believe φ to be true.

Another reading of plain FIs should be mentioned here. It frequently occurs in soliloquy and conveys that the speaker is in a process of belief formation

from a doxastic state of type β based on observed evidence, corresponding to step C in the schema. In such cases, no negative bias arises.

Summing up, bare FIs can not convey full belief revision with both widening and narrowing (steps B and C), but can convey either individually. Bare FIs thus do not have belief revision readings like *no*-FIs.

***No*-FIs and incredulity** In Davis's incredulity scenario, the speaker reacts to evidence that has just come to the her attention, but is in conflict with a previously held belief. Recall that, according to my analysis, the following holds for a felicitous *no*-FI.

(22) context before INT$(\varphi)\downarrow$: $\neg B_S^c \varphi \wedge EV_{\mathcal{X}}^c \varphi$

The *no*-FI thus conveys that the speaker's doxastic state is of type α or β, and that there is evidence for φ in principle strong enough for assertion of φ. In such an utterance situation, the speaker must take either step B, step C, or both. Note that if the speaker is in a state of type β, belief *formation* rather than *revision* happens as no widening needs to take place, as in soliloquous bare FIs mentioned above.

The crucial point to make w.r.t. the bias conveyed by *no* in FIs is that bare FIs tend to be negatively biased as they give rise to $\neg PB_S^{c'}\varphi$, while *no*-FIs are positively biased as they indicate that belief revision is underway, potentially canceling $\neg PB_S^{c'}\varphi$. This contrast comes out even more sharply with *yo*, as it directly adds commitment.

5.3 Shared doubt and incredulity: *yo*

Yo adds strong addressee orientation, as it conveys a speaker assumption that the addressee does not believe the prejacent to be true, but commits the addressee to it from the speaker's perspective.

(23) Sonna mono taberu (no) ka yo.
     such thing eat *no ka yo*
     "What the hell! He isn't going to eat that!"/
     "Holy shit! He's going to eat that!"

In (23), repeated from (4), *yo* minimally indicates that the speaker is revising her assumptions about addressee belief, while the speaker doubts φ in the input context. The utterance thus either conveys that the speaker is learning that rather than both the speaker and the addressee doubting φ, the addressee actually believes it to be true, or that a shared belief

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[19]I gloss over the question of how exactly widening, *i.e.* non-monotonic belief update works, seeking only to predict what FIs and particles convey w.r.t. stages in the schema, but *cf.* Gärdenfors (1985) and references therein for discussion.

that φ is true is in the process of formation, and both participants share doubt and incredulity. While this reading is salient in (23), changing the agent of 'eat' in (23) to the addressee ("You are going to...") foregrounds the reading on which the speaker revises an assumption about addressee belief.

For an account in the formal framework, consider belief conditions on and commitments from *yo*-FIs.

(24)   a.   before INT($yo(\varphi)$)↓: $B^c_S \neg B_A \varphi \land \neg B^c_S \varphi$
       b.   after   INT($yo(\varphi)$)↓: $PB^{c'}_S B_A \varphi$

Revision of the speaker assumption w.r.t. addressee belief is reflected in the transition from $B^c_S \neg B_A \varphi$ to $PB^{c'}_S B_A \varphi$. The second input condition $\neg B^c_S \varphi$ indicates that the speaker assumes *both* participants doubt the prejacent. On the purely addressee-oriented reading, the speaker continues not believing φ, but learns that the addressee believes it. This is the negatively biased reading of *yo*-FIs.

When *no* is added to the *yo*-FI, evidence supporting the prejacent is required in the input context. In the belief revision schema, this means that step B and potentially C are taken (*i.e.* belief revision is underway) if the speaker believes φ to be false in the utterance situation, and that step C is taken (*i.e.* belief formation is underway) if the speaker is neutral in the input context. In either case, adding *no* gives rise to a positively biased reading on which the speaker accepts, or tends to accept, φ, and the speaker's belief revision or formation process is mirrored by what is assumed regarding addressee belief.

The mirative overtones in the form of surprise over the prejacent (or the addressee's belief that the prejacent holds) are readily explained by the input conditions, requiring the speaker to assume that neither participant believes the prejacent to be true. Also note that where the utterance is interpreted as indicating full belief revision, the forgone commitment implicature $\neg PB^{c'}_S \varphi$ is canceled.

5.4   Doubt and discrepant belief: *ne*

Utterances with *ne* are addressee-oriented like those with *yo*, but do not indicate any change in speaker assumptions regarding addressee belief. In assertions, *ne* signals or seeks agreement, while in FIs is indicates discrepant belief. The *ne*-FI (25), repeated here from (5), is an expression of doubt without, and one of reluctant acceptance with *no*.

(25)   Sonna mono taberu (no) ka ne.
       such   thing   eat   *no*   *ka ne*
       "So is he actually going to eat this?"/
       "So he is actually going to eat this..."

The present analysis predicts the following conditions on and commitments from a *ne*-FI.

(26)   a.   before INT($ne(\varphi)$)↓: $B^c_S B_A \varphi \land \neg B^c_S \varphi$
       b.   after   INT($ne(\varphi)$)↓: $PB^{c'}_S B_A \varphi$.

In contrast to *yo*, *ne* only indirectly gives rise to $PB^{'c}_S B_A \varphi$ by carrying over the input condition $B^c_S B_A \varphi$. *Ne* in assertions thus indicates the speaker is confirming an assumption about addressee belief rather than attempting to convince the addressee as with *yo*. Assertions with *ne* are consensus seeking as they give rise to $PB^{'c}_S \varphi$, so that adding *ne* indicating that $B^c_S \varphi B_A \varphi$ holds indicates that φ is a shared belief. FIs, on the contrary, not only presuppose $\neg B^c_S \varphi$, but also give rise to the forgone commitment implicature $\neg PB^{'c}_S \varphi$. Thus, when *ne* occurs in FIs, it indicates a persistent discrepancy between speaker and addressee belief rather than consensus.

The salient reading of *ne*-FIs without *no* is intersubjective in that the speaker, as in assertions, seeks to confirm the status of the prejacent as a shared belief with the addressee, but carries strong negative bias — the goal is to convince the addressee of the prejacents' falsity, in sharp contrast with assertions.

Adding *no* gives rise to a reading on which the speaker, however reluctantly, considers joining the addressee in forming a shared belief based on the available evidence, that is taking step B, step C, or both. A surprise reading is unlikely as $B^c_S B_A \varphi$ makes it implausible that evidence for φ and thus the possibility that φ might be true just came up.

According to the proposed analysis, *ne*-FIs thus indicate a discrepancy between speaker and addressee belief, in stark contrast with assertions. This is compatible with the perception reported by informants that *ne*-FIs have a somewhat arrogant feel, casting doubt on the correctness of addressee belief, while *ne*-assertions, on the contrary, feel friendly. This is in line with the present proposal, but would be difficult to capture by encoding either shared belief or a status as old information in terms of hearer-newness directly into *ne*'s meaning, as would be indicated by generalizations based on assertions only.

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