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A unified semantics for the Japanese Q-particle *ka* in indefinites, questions and disjunctions

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This paper provides a compositional semantics for the Japanese Q-particle *ka* that properly accounts for its use in questions, indefinites and disjunctions in a unified fashion. Adopting the two-tier alternative semantics (Rooth 1985; Beck 2006), I will propose that the role of the *ka*-particle is *always* to project a set of alternatives introduced by the *wh*-item in the alternative-semantic dimension to the ordinary-semantic dimension (Kotek 2014). Unlike in previous analyses, I will adopt this semantics for the Q-particle not only for its clause-*final* use, but also for clause-*internal* use. Combining this with the cross-categorial existential closure, the analysis accounts for how the interpretation of a *ka*-ending phrase is conditioned by its syntactic environments. This mechanism enables an account of the previously unexplained parallelism between *wh+ka* and *ka*-disjunctions in their variability in interpretations.

1 Introduction

It is cross-linguistically common for a single particle to participate in the formation of *indefinites*, *questions* and *disjunction*. Languages in which this type of particle—henceforth the *Q-particle*—occurs at least in questions and indefinites include Sinhala (Kishimoto 1992; Hagstrom 1998; Slade 2011), Malayalam (Jayaseelan 2001), Tlingit (Cable 2010), Japanese (Kuroda 1965; Hagstrom 1998) and Shuri Okinawan (Hagstrom 1998). Table 1 from Slade (2011) summarizes the distribution of the Q-particle in these languages.

The observation that the same particle appears in at least a subset of questions, indefinites and disjunctions across languages has stimulated discussions on the proper semantic analysis of these semantic categories. More specifically, researchers have tackled the following closely related questions:

(1) a. What is shared by the semantic representations of indefinites, questions and disjunctions?

b. What is the semantic contribution of the Q-particle in indefinites, questions and disjunctions?

c. How are the different syntactic environments in which the Q-particle occurs mapped to the interpretations of indefinites, questions and disjunctions?

In the last decade or so, investigations on these questions have provided insights into the theoretical nature of the relevant semantic categories (e.g., Hagstrom 1998; Shimoyama 2006; Cable 2010; Slade 2011; Szabolcsi 2015b).

Research into these questions should also take into account the fact that not all languages in Table 1 express the five semantic categories using exactly the same particle. In

Table 1: Summary of the distribution of Q-particles from Slade (2011).

	Sinhala	Malayalam	Tlingit	Japanese
Y/N-question	də	-oo	gé	ka
***wh*-question**	də	-oo (Old Malayalam)	sá	ka
indefinite	də (aff.), hari (aff.), vat (neg.),	-oo	sá	ka
declarative disjunction	hari (aff.)	-oo	khachu	ka
	vat (neg.)			
alternative question	də	-oo	gé, gwáa	ka

particular, Sinhala and Tlingit use different particles for indefinites/questions and declarative disjunction, while Japanese and Malayalam appear to use the same particles in all categories. There are two analytic possibilities for dealing with this non-perfect parallel between languages. One is to take the Sinhala and Tlingit patterns as the starting point and analyze the Malayalam and Japanese patterns as involving homophony. The other is to analyze the different semantic categories as sharing a core compositional element, and to assume that there is a cross-linguistic variation in how this shared compositional element is lexicalized with other elements. According to the latter approach, Malayalam and Japanese lexicalize the shared element by a single particle while Sinhala and Tlingit lexicalize the element differently, depending on the presence of other elements contributing to the difference within the five semantic categories. For example, the core element contributing the semantics of disjunction could be lexicalized differently depending on whether it appears in a clause headed by the declarative complementizer or in a clause headed by the interrogative complementizer in languages like Tlingit and Sinhala (Slade 2011).

In order to investigate the feasibility of the latter approach and address the questions in (1), it is necessary as a first step to investigate whether the unified analysis of the particle is indeed possible in languages like Malayalam and Japanese. The goal of this paper is to demonstrate that this is in fact possible in the Japanese case. I will provide a comprehensive and concrete semantics for the Japanese Q-particle *ka* that properly accounts for its use in questions, indefinites and disjunctions in a unified fashion. The Japanese particle *ka* is also interesting in the context of questions (1b) and (1c) above since its interpretation is tightly connected with the syntactic environments in which it occurs. As exemplified in (2a), when *ka* directly attaches to a *wh*-item and forms a DP, it functions as an indefinite. On the other hand, as seen in (2b), when *ka* is in the final position of a clause containing a *wh*-item, the clause ending with *ka* forms a *wh*-question.
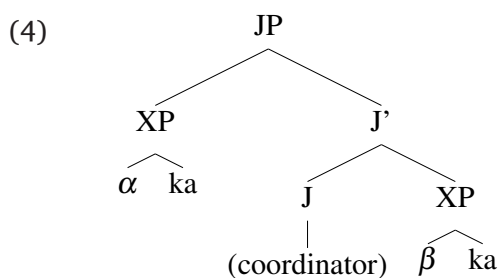
(2)   a.   [$_{DP}$ dare-**ka**] -ga   hashitta.
            who-KA   -NOM ran
            'Someone ran.'   (∃-**statement**)

       b.   [$_{CP}$ dare-ga   hashitta-**ka**] oshiete.
            who-NOM ran-KA   tell
            'Tell me who ran.'   (**Wh-Question**)

A number of proposals have been proposed to capture this pattern (e.g., Hagstrom 1998; Shimoyama 2006; Slade 2011). However, as I will argue later in the paper, none of the current compositional semantic analysis of *ka* can successfully capture the fact that the

semantic contribution of *ka* is conditioned by its syntactic position in its *disjunction use* in a way parallel to how its semantic contribution is conditioned in the *wh* + *ka* construction. That is, the form *α-ka β-ka* receives an interpretation of a disjunction without a question force (what is dubbed as *declarative disjunction* in the table above) when the *ka*-phrases are syntactically smaller than a CP. On the other hand, the form receives an interpretation of an *alternative question* (AltQ) when the *ka*-phrases themselves form a CP. This is exemplified in the following sentences.

(3)   a.   [$_{DP}$ Hanako-**ka** Jiro-**ka**]-ga   hashitta.
           Hanako-KA Jiro-KA-NOM ran.
           'Either Hanako or Jiro ran.'   **(declarative disjunction)**

      b.   [$_{CP}$ [Hanako-ga   hashitta-**ka**] [Jiro-ga   hashitta-**ka**]] oshiete.
           Hanako-NOM ran-KA   Jiro-NOM ran-KA   tell
           'Tell me which is true: It seems that Hanako ran or it seems that Jiro
           ran?'   **(AltQ)**

This paper argues that this parallel pattern straightforwardly falls out from the combination of (a) an extension of the Hamblin-semantic analysis of in-situ *wh*-questions and Q-particles (Beck 2006; Shimoyama 2006; Kotek 2014) and (b) the analysis of the disjunction structure as schematized in the following (den Dikken 2006; Mitrovič & Sauerland 2014; Szabolcsi 2015b):

(4)

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                    JP
                  /    \
               XP       J'
              /  \     /   \
            α    ka   J      XP
                      |     /  \
              (coordinator) β   ka
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Adopting a two-tier alternative semantics, I will propose that the role of the *ka*-particle is always to project a set of alternatives introduced by the *wh*-item in the "alternative-semantic" dimension to the "ordinary-semantic" dimension. This ensures that a *ka*-ending clause as in (2b) denotes a set of propositions, i.e., the semantic value of a question according to Hamblin (1973) and Karttunen (1977). This part of the proposal simply preserves the existing analysis of in-situ *wh*-questions (Beck 2006; Shimoyama 2006; Kotek 2014). What sets the current analysis apart from the existing analyses is that it maintains the same analysis of *ka* for its *clause-internal* occurrences. Thus, the ordinary-semantic meaning of *dare-ka* 'who-KA' in (2a) would be a set of individuals. I will claim that such a set in the ordinary-semantic dimension faces a type-mismatch when embedded clause-internally, and that it has to be type-shifted by a (cross-categorial) existential closure, which turns a set into an existential quantifier having the set as its domain. This provides us with the contrast in (2): (2b) is a question since there is no existential closure, and (2a) is an existential statement since the set denoted by *dare-ka* is type-shifted into an existential quantifier due to a type-mismatch.

This mechanism can be extended to the disjunction case in (3), as the structure in (4) is compositionally analyzed as denoting the set consisting of (the denotations of) *α* and *β*. When each disjunct is a clause, as in (3b), the set expresses an alternative question. On the other hand, when the whole disjunction is in a clause-internal position, as in (3a), the

set denoted by the disjunction is type-shifted into an existential quantifier, resulting in a declarative disjunctive interpretation.

The rest of the paper is structured as follows: In §2, I will review the distributions and interpretations of *ka* in *wh*+*ka* constructions and *ka*-disjunctions, and show how the semantic contribution of *ka* is conditioned by its syntactic environment both in *wh*+*ka* and *ka*-disjunctions. The empirical parallelism between *wh*+*ka* and *ka*-disjunctions that I suggested above is discussed here in detail. §3 lays out the basic analysis in terms of two-tier alternative semantics. I will begin by proposing an analysis following previous analyses of *wh*+*ka* constructions by Beck (2006); Shimoyama (2006) and Kotek (2014). I will illustrate how the proposed analysis explains the effect of the syntactic environment on the interpretation of *ka* by (a) maintaining the analysis of Q-particles sentence-inter-nally, and (b) adopting the mechanism of (cross-categorial) existential closure as a repair of type-mismatch. This analysis is then extended to *ka*-disjunctions, employing the syntax for disjunctions following den Dikken (2006). In §4, I will discuss a potential problem of the proposal concerning the (im)possibility of existential closure at the clausal level. A solution to this problem is proposed on the basis of the observation that *wh*+*ka* construc-tions trigger existential presuppositions. §5 is a brief note on how the particle *mo*—which has been treated as the universal counterpart of the existential *ka* in the previous literature (Shimoyama 2006)—would fit in the picture. Three prominent compositional-semantic analyses of *ka*, i.e., Hagstrom (1998), Shimoyama (2006) and Yatsushiro (2009), are dis-cussed in §6, where it will be argued that the parallel between *wh-ka* and *ka*-disjunctions cannot be correctly accounted for under these analyses, even with plausible extensions to disjunctions, employing recent theories such as Slade (2011). The paper concludes by discussing implications for the cross-linguistic semantics of Q-particles.

2 The position of *ka* and its semantic contribution

2.1 *wh+ka*

As discussed in the introduction, the interpretation of a Japanese sentences involving a *wh*-item and *ka* depends on the syntactic position of *ka* (Kuroda 1965; Hagstrom 1998). When *ka* directly attaches to the *wh*-phrase, the *wh-ka* complex functions as an indefinite. On the other hand, when *ka* is in a sentence-final position, the sentence constitutes a *wh*-question. This can be seen in the following examples:

(5)   a.   [$_{DP}$ Dare-**ka**] -ga   hashitta.
             who-KA   -NOM ran
             'Someone ran.'   **($\exists$-statement)**

    b.   [$_{CP}$ Dare-ga   hashitta-**ka**] (oshiete).
             who-NOM ran-KA   tell
             '(Tell me) who ran.'   **(Wh-Question)**

(6)   a.   Taro-ga   [$_{DP}$ nani-**ka**] -o   mita.
             Taro-NOM   what-KA -ACC saw
             'Taro saw something.'   **($\exists$-statement)**

    b.   [$_{CP}$ Taro-ga   nani-o   mita-**ka**] (oshiete).
             Taro-NOM what-ACC saw-KA   tell
             '(Tell me) who ran?'   **(Wh-Question)**

Here, the embedding verb *oshiete* 'tell me' is added in (5b) since the clause-final *ka* is most natural in embedded contexts for stylistic reasons. In an unembedded clause, *no* is used

instead of *ka* in informal speech.[1] In an unembedded formal speech, *ka* is attached to the polite form of the verbal complex (*mi-mas-ita* 'see-POL-PAST' in the case of *mita* 'saw').

For some speakers, the *wh*-item and *ka* can be separated within a DP that functions as an indefinite. The following example from Yatsushiro (2009) illustrates this:

(7)   [Dare-o   hihanshita gakusei]-**ka**-ga   taihosareta.
          who-ACC criticized   student -KA-NOM be.arrested
        'A student or other who had criticize someone was arrested.'

In this example, *ka* is separated from the *wh*-item *dare* itself, and the subject DP ending with *ka* receives an interpretation as an existential quantifier over students who criticized someone.

It is also observed in the literature that *wh* + *ka* indefinites behave like *epistemic indefinites* like German *irgendein* and Spanish *algún* (Sudo 2010; Kaneko 2011; Alonso-Ovalle & Shimoyama 2014). That is, they convey the speaker's ignorance about the identity of the individual serving as the witness of the existential statement. For example, (5a) conveys that the speaker does not know who ran. The semantic and pragmatic nature of this implication is still under debate, but evidence suggests that they can be treated as an implicature, as argued by Alonso-Ovalle & Shimoyama (2014). As shown below, the ignorance implication disappears in a downward-entailing environment (a conditional antecedent in (8a)). Also, it is compatible with both cancellation of the ignorance implication (as in (8b)) and can be non-redundantly followed up by an explicit statement of the ignorance (as in (8c)).

(8)   a. Dare-ka-ga   hashitta-ra oshie-masu.
            who-KA-NOM ran-COND   tell-POL
            'I will tell you if anyone runs.'
          *'I will tell you if someone runs but I don't know who.'

        b. Dare-ka-ga   hashitta. Sorede, boku-wa sore-ga dare-da-ka   shitteiru.
            who-KA-NOM ran.   And,   I-TOP   it-NOM who-COP-KA know
            'Someone ran, and I know who that is.'

        c. Dare-ka-ga   hashitta. Sorede, boku-wa sore-ga dare-da-ka   shira-nai.
            who-KA-NOM ran.   And,   I-TO   it-NOM who-COP-KA know-NEG
            'Someone ran, and I don't know who that is.'

These data suggest that the ignorance implication is an implicature rather than an entailment (see Alonso-Ovalle & Shimoyama (2014) for further arguments for the implicature

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[1] In contrast to *ka*, the particle *no* cannot directly attach to a *wh*-phrase and form an indefinite:

(i) *Dare-**no**-ga   hashitta.
     who-NO-NOM ran
     'Someone ran.'

There can be two different explanations for this. One possibility is to follow the descriptive grammar (e.g., Masuoka & Takubo 1992: 136) and analyze *no* as a nominalizer rather than a question particle. According to this view, a matrix question ending with *no* is a result of the deletion of *ka* in the sentence-final *no-ka* 'NMNL-KA' sequence. Since a nominalizer can only attach to a verbal element, it cannot attach to a *wh*-phrase as in (i) for syntactic reasons. The other possibility is to assimilate the ungrammaticality of *no* in (i) with its ungrammaticality in an embedded clause as in (ii).

(ii) *Watashi-wa [dare-ga   hashitta-**no**] shitteiru.
      I-TOP   who-NOM ran-NO   know
      'I know who ran.'

In this view, *no* is a sentence-final particle that is always associated with an interrogative speech act (unlike *ka* which is devoid of a speech act force by itself). Thus, it cannot appear in a non-sentence-final position as in (i) or in an embedded position as in (ii).

analysis). Since I will focus on the *semantic* aspect of the *wh + ka* constructions and their compositional derivation in this paper, I will leave aside their characteristics as epistemic indefinites in the rest of the paper.[2]

2.2 *ka-disjunctions*

Another empirical domain in which *ka* appears is disjunction. Example (9) shows that *ka* can attach to each disjunct in a disjunction (optionally to the second disjunct).[3] I will call this construction *ka-disjunction*. In *ka*-disjunctions, an additional coordinator (in this case *matawa*) can be inserted between the two disjuncts marked by *ka*.

(9)　　Taro-ga　[_{DP} Hanako-**ka** (matawa) Jiro-**ka**]-o　mita.
　　　Taro-NOM　　Hanako-KA　or　　　Jiro-KA-ACC　saw
　　　'Taro saw Hanako or Jiro.'

I will discuss more on the additional coordinator between *ka*-phrases in the Section 2.4. Unless noted otherwise, the data I describe in this section and the following sections are that of *ka*-disjunctions with a phonologically null coordinator. Later, the description will be made more precise by taking into account the role of different phonologically explicit coordinators.

　One of the empirical contributions of this paper is to establish that the interpretation of *ka* in *ka*-disjunctions is similarly dependent on the syntactic position of *ka* in each disjunct. In fact, it turns out that we can state a unified generalization that applies to both *wh + ka* construction and *ka*-disjunctions. The generalization that I am going to submit is stated in the following:

(10)　　**Generalization:** When the *ka*-phrase is syntactically smaller than a CP, its semantic contribution is an existential quantifier (without the question force); when it syntactically forms a CP, its semantic contribution is to form a question involving alternatives expressed by the *wh*-item/disjunction.

Table 2 summarizes how this generalization is instantiated in the *wh + ka* construction and *α-ka β-ka* construction. Below, I elaborate this empirical claim in some detail.

　First of all, the dependence of the interpretation of *wh + ka* on the syntactic position of *ka*, exemplified in (5) above, can be described as in the first row of Table 2. The syntactic category of the *wh + ka* phrase is a *DP* in (5a), where *ka* attaches to the *wh*-phrase *dare* directly and *dare-ka* serves as the subject of the verb *hashitta* 'ran'. This *wh-ka* phrase functions as an indefinite/existential quantifier. On the other hand, the *wh + ka* phrase in (5b) is a whole CP which by itself expresses a question (modulo stylistic anomaly) and can be

Table 2: The dependence of the interpretation of a *ka*-phrase on its syntactic size.

the *ka*-phrase is…	smaller than a CP	CP
wh+ka	existential quantifier	*wh*-question
α-ka β-ka	declarative disjunction	alternative question

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[2] See also Kang (2015) for an analysis of the ignorance implication and anti-specificity of Korean *wh*-indeterminates and disjunctions.

[3] I will assume that the presence and absence of the second *ka* does not have a semantic consequence, unlike the contrast between simplex and complex disjunctions in French (e.g., Spector 2014). This is confirmed by informal judgment reports by native speakers. Furthermore, controlled experiments by Sauerland & Yatsushiro (2016) and Sauerland et al. (2017) have not revealed any significant difference in judgment patterns between the single-*ka* and the double-*ka* disjunctions.

embedded under clause-embedding predicates such as *oshiete* 'tell me'. In this case, the *wh*-phrase functions as a *wh*-word in a *wh*-question.

Turning now to *ka*-disjunctions, it is known that *ka*-disjunctions can coordinate (at least) DPs, TPs as well as CPs (Kishimoto 2013; Uegaki 2014; Miyama 2015), as exemplified below.[4] Each of the examples also indicates whether the sentence has a reading as a disjunctive statement (∨-statement) or an alternative question (AltQ).

(11)   [$_{DP}$ Hanako-ka Jiro-ka]-ga   hashitta.
        Hanako-KA Jiro-KA-NOM ran
        'Either Hanako or Jiro ran.'   **(✓∨-statement)**
        *'Which is true: Hanako ran or Jiro ran?'   **(*AltQ)**

(12)   a.   [$_{TP}$ [Hanako-ga   hashitta-**ka**] [Jiro-ga   hashitta-**ka**]] mitai-da.
              Hanako-NOM ran-KA   Jiro-NOM ran-KA   seem-COP
              'It seems that Hanako ran or Jiro ran.'   **(✓∨-statement)**
              *'Which seems to be true: Hanako ran or Jiro ran?'   **(*AltQ)**

        b.   [$_{TP}$ [Hanako-ga   hashitta-**ka**] [Jiro-ga   hashitta-**ka**]] daroo.
              Hanako-NOM ran-KA   Jiro-NOM ran-KA   may.well.be
              'It might well be that Hanako ran or Jiro ran.'   **(✓∨-statement)**
              *'Which might well be true: Hanako ran or Jiro ran?'   **(*AltQ)**

(13)   a.   [$_{CP}$ [Hanako-ga   hashitta-mitai-**ka**] [Jiro-ga   hashitta-mitai-**ka**]] (oshiete).
              Hanako-NOM ran-seem-KA   Jiro-NOM ran-seem-KA   tell
              '(Tell me) which is true: It seems that Hanako ran or it
              seems that Jiro ran?'   **(✓AltQ)**
              *'(Tell me) it seems that Hanako ran or it seems that Jiro
              ran.'   **(*∨-statement)**

        b.   [$_{CP}$ [Hanako-ga   hashitta-daroo-**ka**] [Jiro-ga   hashitta-daroo-**ka**]]
              Hanako-NOM ran-may.well.be-KA Jiro-NOM ran-may.well.be-KA
              (oshiete).
              tell
              '(Tell me) which is true: Hanako might well have run or
              Jiro might well have run.'   **(✓AltQ)**
              *'(Tell me) Hanako might well have run or Jiro might well
              have run.'   **(*∨-statement)**

Following Kishimoto (2013), I take the positioning of mood items such as *mitai* 'seem' and *daroo* 'might well', which are in functional projections outside TPs, as indicating the syntactic category of *ka*-disjunctions. When the mood is outside the *ka*-disjunction involving tensed predicates, as in (12), its syntactic category is TP. On the other hand, when the mood is inside the *ka*-disjunction, as in (13), or when there is no overt mood item in the sentence as in (14) below, its syntactic category is CP.

(14)   [$_{CP}$ [Hanako-ga   hashitta-**ka**] [Jiro-ga   hashitta-**ka**]] oshiete.
        Hanako-NOM ran-KA   Jiro-NOM ran-KA   tell
        'Tell me which is true: Hanako ran or Jiro ran?'   **(✓AltQ)**

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[4] Kishimoto (2013) discusses cases where *ka*-disjunctions apparently coordinate vPs in the surface, but concludes that they are in fact TP disjunctions based on evidence pertaining to scope with respect to negation. The current paper also assumes Uegaki's (2014) analysis of Japanese alternative questions, where an alternative question whose surface structure appear to involve a disjunction of *ka*-ending VPs is underlyingly a disjunction of CPs.

Crucially, the interpretation of a *ka*-disjunction is a disjunctive statement in both (11) and (12) whereas it is an AltQ in (13) and (14). In other words, α-*ka* β-*ka* becomes a question with α and β as alternatives only when it is a CP coordination. That sub-CP *ka*-disjunction does not introduce alternatives remains to be true even when an additional *ka* as a question particle is added to the sentence-final position (Uegaki 2014). This is shown in the following examples:

(15)   [[$_{DP}$ Hanako-**ka** Jiro-**ka**]-ga   hashitta-**ka**] oshiete.
              Hanako-KA Jiro-KA-NOM ran-KA   tell.
              'Tell me whether or not Hanako ran or Jiro ran.'   (✓**YNQ**)
            *'Tell me which is true: Hanako ran or Jiro ran.'   (*****AltQ**)

(16)   [[$_{TP}$ [Hanako-ga   hashitta-**ka**] [Jiro-ga   hashitta-**ka**]] mitai-**ka**] (oshiete).
              Hanako-NOM ran-KA   Jiro-NOM ran-KA   seem-KA   tell
              'Tell me whether or not it seems to be that Hanako or Jiro ran.'   (✓**YNQ**)
            *'Tell me which is true: Taro saw Hanako or he saw Jiro.'   (*****AltQ**)

The only interpretation (15–16) can get is the Yes/No Question (YNQ) interpretation which embeds a disjunctive statement, i.e., the question of whether or not 'Taro saw Hanako or Taro saw Jiro' is true. Establishing the unavailability of the AltQ reading in (15–16) is not so straightforward since the possible answers to the AltQ, i.e., 'Hanako (ran)' and 'Jiro (ran)' would also be (over-informative but) acceptable answers to the YNQ. The following examples, however, make it clear that the AltQ interpretation is indeed unavailable.

(17)   (Context: I know that either Hanako or Jiro ran, but I don't know which.)
              Watashi-wa [[$_{DP}$ Hanako-**ka** Jiro-**ka**]-ga   hashitta-**ka**] shir-anai.
              I-TOP   Hanako-KA Jiro-KA-NOM ran-KA   know-NEG
              'I don't know whether or not either Hanako or Jiro ran.'   (✓ **YNQ**)
              'I don't know which is true: Hanako ran or Jiro ran.'   (*****AltQ**)

(18)   (Context: I know that it seems that either Hanako or Jiro ran, but I don't know which.)
              Watashi-wa [$_{TP}$ [Hanako-ga   hashitta-**ka**] [Jiro-ga   hashitta-**ka**]] mitai-**ka**]
              I-TOP   Hanako-NOM ran-KA   Jiro-NOM ran-KA   seem-KA
              shir-anai.
              know-NEG
              'I don't know whether or not it seems that either Hanako or Jiro ran.'   (✓**YNQ**)
              'I don't know which seems to be true: Hanako ran or Jiro ran.'   (*****AltQ**)

The examples would be true under the given context if the embedded clauses had the AltQ interpretation although they would be false in the YNQ interpretation. Intuitively, the sentences sound false in the context. This indicates that the AltQ interpretation is unavailable for these sentences.

    This fact is in parallel with the behavior of a *wh-ka* DP in a *ka*-clause, which only serves as an indefinite and not as a *wh*-phrase introducing alternatives. For example, the embedded clause in the following sentence involving *dare-ka* can only have a YNQ interpretation, and not a *wh*-question interpretation.

(19)   (Context: I know that Taro met someone, but I don't know who.)
Watashi-wa [Taro-ga   [$_{DP}$ dare-**ka**]-o   mita-**ka**] shira-nai.
I-TOP   Taro-NOM   who-KA-ACC saw-KA   know-NEG
'I don't know whether Taro saw someone.'   (✓ **YNQ**)
'I don't know whom Taro saw.'   (*****whQ**)

The fact that the embedded clause in (19) lacks a *wh*-question interpretation is evidenced by the fact that the sentence is intuitively false under the given context.

In contrast to *ka*-disjunctions with sub-CP disjuncts, *ka*-disjunctions with CP disjuncts are interpreted as AltQs and not as disjunctive statements, as shown in (13) above. This is confirmed in the following example under the context similar to the ones in (17–18). (Note that (17–18) involve negation in the matrix clause whereas the following example doesn't).

(20)   (Context: I know that either it seems that Hanako ran or it seems that Jiro ran, but I don't know which.)
Watashi-wa [$_{CP}$ [Hanako-ga   hashitta-mitai-na-no-**ka**] [Jiro-ga
I-TOP   Hanako-NOM ran-seem-COP-GEN-KA   Jiro-NOM
hashitta-mitai-na-no-**ka**]] shitteiru.
ran-seem-COP-GEN-KA   know
'I know which is true: it seems that Hanako ran or it seems that
Jiro ran.'   (✓**AltQ**)
'I know that it seems that Hanako ran or it seems that Jiro ran.' (*∨-**statement**)

This sentence would be true if the embedded clause had an interpretation as a disjunctive statement. However, the sentence is intuitively false. In fact, it would be true only if I know which of Hanako and Jiro ran. This means that the embedded clause in (20) only has an AltQ interpretation. Again, this is in parallel with the behavior of *wh* + *ka*. The *wh* + *ka* phrase as a CP only receives an interpretation as a *wh*-question and not as an existential statement.

In sum, *ka*-disjunctions are interpreted as disjunctions without the question force when they are sub-CP-coordinations while they are interpreted as AltQs with each disjunct as alternatives when they are CP-coordinations. This parallels the behavior of *wh* + *ka* constructions as summarized in Table 2. In section §3, I will propose a unified semantics of *ka* in *wh* + *ka* and disjunctions which can naturally account for these data in a compositional fashion.

2.3 CP-sized ka-disjunctions are syntactically coordinations

In this subsection, I address a potential worry about the nature of CP-coordination sentences in (13, 20). One might wonder if *ka*-disjunctions with CP-disjuncts should be analyzed as sequences of two speech acts rather than a single question involving coordinated CPs (see e.g., Kishimoto 2013 for this view). However, there are at least three reasons to believe that the sentences can be analyzed as involving a single question. The first reason concerns the embedding of the CP-disjunction under clause-embedding predicates, something that we have already seen in (20). Embedding under a clause-embedding predicate would be impossible if the two clauses didn't have a single clausal status. The second reason is that there can be an across-the-board (ATB) extraction (Williams 1978) from inside each disjunct, suggesting that the structure as a whole is a coordination. This is exemplified in the ATB extraction of the constituent *sono paati-e-wa* 'to the party' in the following examples:

(21) a. [Sono paati-e-wa   [Hanako-ga   _____ itta-mitai-na-no-ka]
           the   party-to-TOP Hanako-NOM   went-seem-COP-GEN-KA
           [Jiro-ga   _____ itta-mitai-na-no-ka]]   (oshiete).
           Jiro-NOM   went-seem-COP-GEN-KA   tell
           'Tell me which is true: it seems that Hanako went to the party or it seems
           that Jiro went to the party.'

      b. [Sono paati-e-wa   [Hanako-ga   _____ itta-daroo-ka]
           the   party-to-TOP Hanako-NOM   went-may.well.be-KA
           [Jiro-ga   _____ itta-daroo-ka]]   (watashi-ni-wa wakara-nai).
           Jiro-NOM   went-may.well.be-KA I-DAT-TOP   know-NEG
           'I don't know which is true: Hanako may well have gone to the party or Jiro
           may well have gone to the party.'

Finally, *ka*-disjunctions with CP disjuncts are associated with an exclusivity presupposition typically associated with AltQs. It is well known that English AltQs are associated with the presupposition that only one of the alternatives is true (Karttunen 1977; Biezma & Rawlins 2012). For example, the following AltQ presupposes that Hanako or Jiro went to the party, but not both.

(22)   Is it Hanako or Jiro who went to the party?

The same presupposition is observed in AltQs in the embedded clauses in (21). They presuppose that only one of 'it {seems/may well be} that Hanako went to the party' and 'it {seems/may well be} that Jiro went to the party' is true. This presupposition is unexpected if the two clauses are independent question speech acts. For, a sequence of two questions wouldn't have such a presupposition. For instance, the following sequence of two YNQs is compatible with situations where neither or both Hanako and Jiro went to the party.

(23)   Did Hanako go to the party? Did Jiro go to the party?

2.4 *The coordinator between ka-marked disjuncts*

Before finishing the section, I note on different coordinators that can appear between *ka*-marked disjuncts. There are at least four such coordinators in Japanese: *soretomo, matawa, soreka* and the phonologically null ∅. They differ in syntactic distributions as summarized below:

(24) **Distributions of different coordinators**
      a. *soretomo*: appears only in CP-sized *ka*-disjunctions.
      b. *matawa*: appears in sub-CP-sized *ka*-disjunctions. Also, it appears in CP-sized *ka*-disjunctions when the disjunction is embedded under the sentence-final copula particle *da*.
      c. *soreka*: no restriction.
      d. ∅: no restriction.

If we disregard the role of the copula *da* for now, the first two coordinators *soretomo* and *matawa* are in complementary distribution with each other. The other two coordinators,

soreka and ∅, have no restriction on their occurrences. These syntactic distributions are exemplified in the following examples:

(25)   Taro-ga   [_DP Hanako-ka **{matawa/*soretomo/soreka/∅}**
         Taro-NOM   Hanako-KA   or
         Jiro-ka   ]-o   mita.
         Jiro-KA   -ACC saw.
         'Taro saw Hanako or Jiro.'

(26)   [_TP [Hanako-ga   hashitta-ka] **{matawa/*soretomo/soreka/∅}**
             Hanako-NOM ran-KA   or
         [Jiro-ga   hashitta-ka]] mitai-da.
          Jiro-NOM ran-KA   seem-COP
         'It seems that Hanako ran or Jiro ran.'

(27)   [_CP [Hanako-ga   hashitta-mitai-**ka**] **{*matawa/soretomo/soreka/∅}**
             Hanako-NOM ran-seem-KA   or
         [Jiro-ga   hashitta-mitai-**ka**]].
          Jiro-NOM ran-seem-KA
         'Which is true: It seems that Hanako ran or it seems that Jiro ran?'

In other words, the environments in which *matawa* and *soretomo* can appear mirror the ones in which a *ka*-disjunction with the null coordinator is interpreted as a declarative disjunction and an AltQ.

   The situation is a bit different when a *ka*-disjunction with CP disjuncts are embedded under the copula *da*. This is shown in the following example:

(28)   [[Hanako-ga   hashitta-mitai-**ka**] **matawa** [Jiro-ga   hashitta-mitai-**ka**] -da].
             Hanako-NOM ran-seem-KA   or   Jiro-NOM ran-seem-KA   COP
         'It seems that Hanako ran or it seems that Jiro ran.'   (∨-**statement**)

The coordinator *matawa* is possible in this environment, and is interpreted as a declarative disjunction. Although this special behavior of the copula *da* will be taken up again in later sections, the analysis proposed in this paper will focus on cases where *da* is *absent*, and the extension of the analysis to the cases where *da* is present will have to be left for future studies.

   The three phonologically explicit markers are in fact morphologically complex. Both *soretomo* and *soreka* consist of the third person inanimate pronoun *sore* and one or more additional particles. The other marker *matawa* is possibly a combination of the conjunctive marker *mata* and the topic marker *wa*. However, here I will not try to derive the semantic functions and syntactic distributions of these particles from their morphological parts since finding out the correct morphological analysis of these items is beyond the scope of the current paper.

   This being said, *soreka* has a plausible morphological analysis that explains its syntactic distribution: *soreka* can be analyzed as an additional (redundant) *ka*-disjunct involving a pronoun referring back to the first disjunct. If this is the case, *α-ka sore-ka β-ka* is syntactically a three-way disjunction involving the null marker ∅. This analysis would then reduce the syntactic distribution of *soreka* to that of ∅, explaining the fact that they share

the distributional property. In the following, I will treat *ka*-disjunctions with *soreka* as a sub-case of *ka*-disjunctions with the null coordinator.

3 An analysis in two-tier alternative semantics

Our proposal employs two-tier alternative semantics (Rooth 1985) for in-situ *wh*-questions (Beck 2006; Kotek 2014). The gist of the analysis is the following: *ka* introduces *a set of alternatives* in its ordinary-semantic value, but only specific predicates—which I will call *set-compatible predicates*—semantically combine with such a set. Set-compatible predicates include predicates embedding interrogative CPs, such as *oshier* 'tell', and the disjunctive coordinators ∅ and *soretomo*. As a result, a semantic composition of a *ka*-phrase and a set-incompatible predicate requires that the set denoted by the former be "flattened" into an *existential meaning*. This is what happens when *ka* is introduced below CPs. A predicate or operator embedding a *ka*-phrase below the CP level are always set-incompatible except for the disjunctive coordinators. Thus, when *ka*-phrases are smaller than CPs, they are "trapped" inside a set-incompatible predicate and receive an existential meaning. Formally, the flattening effect is implemented with a cross-categorial existential closure ∃.

3.1 wh+ka

Below, I illustrate this system using a simple fragment that captures the basic data discussed in the previous section. First, let us consider the case of the *wh* + *ka* construction, repeated below.

(5)　　a.　[$_{DP}$ dare-**ka**]-ga　　hashitta.
　　　　　　who-KA-NOM　ran.
　　　　　　'Taro saw someone.'　　　　　　　　　　　　　　　　　　　**(∃-statement)**

　　　　b.　[$_{CP}$ dare-ga　　hashitta-**ka**].
　　　　　　who-NOM　ran-KA
　　　　　　'(Tell me) who ran?'　　　　　　　　　　　　　　　　　　　**(Wh-Question)**

In the two-tier alternative-semantic analysis of in-situ *wh*-questions developed by Beck (2006) and Kotek (2014), lexical items have *ordinary* and *alternative-semantic values* (hereafter *o-values* and *alt-values*). For instance, the semantic values of *ka*, *dare* 'who' and *hashitta* 'ran' look like the following:

(29)　　a.　$[\![\alpha\ \text{ka}]\!]^o = [\![\alpha]\!]^{alt}$
　　　　b.　$[\![\alpha\ \text{ka}]\!]^{alt} = \{[\![\alpha]\!]^{alt}\}$

(30)　　a.　$[\![\text{dare}]\!]^o = $ undefined
　　　　b.　$[\![\text{dare}]\!]^{alt} = \{x \mid x \in \textbf{human}\}$

(31)　　a.　$[\![\text{hashitta}]\!]^o = \lambda x_e \lambda w_s.\textbf{ran}(x,w)$
　　　　b.　$[\![\text{hashitta}]\!]^{alt} = \{\lambda x_e \lambda w_s.\textbf{ran}(x,w)\}$

Here, *ka* is defined as an operator that simply "copies" the alt-value of its prejacent to the o-value. A *wh*-item like *dare* has an undefined o-value while it introduces a set of alternatives in the alt-value.[5] A set-incompatible predicate like *hashitta* has a standard denota-

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[5] It should be acknowledged that the analysis of *wh*-items here inherits the potential problems of the Beck-style analysis of *wh*-items. In particular, if the alt-value of an item is equated with its focus-semantic value, the semantics for *wh*-items in (30) would not be able to deal with non-focused *wh*-words, such as in German and Sinhala (Eckardt 2007; Slade 2011). Furthermore, distinguishing ordinary *wh*-words and contrastively focused *wh*-words would not be straightforward (Slade 2011). I have to leave open how these problems can be addressed within the Beck-style analysis of *wh*-items.
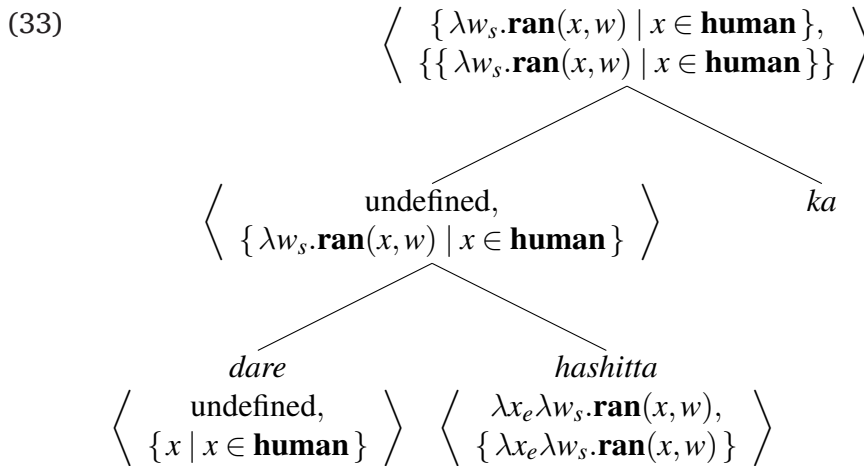
tion as a function from individuals to truth values in the o-value while its alt-value is the singleton set consisting of the o-value.

Except for *ka*, which has a syncategorematic definition, semantic values are composed according to either one of the following two rules, depending on whether it is an o-value or an alt-value:

(32) a. **Functional Application (FA)**
          If the node α has $\{\beta,\gamma\}$ as the set of its daughters and $[\![\beta]\!]^o \in D_\sigma$ and $[\![\gamma]\!]^o$ $\in D_{\langle\sigma,\tau\rangle}$, then $[\![\alpha]\!]^o$ is defined only if both $[\![\alpha]\!]^o$ and $[\![\beta]\!]^o$ are. In this case, $[\![\alpha]\!]^o = [\![\gamma]\!]^o([\![\beta]\!]^o)$.

      b. **Point-wise Functional Application (PWFA)** (Hamblin 1973)
          If the node α has $\{\beta,\gamma\}$ as the set of its daughters and $[\![\beta]\!]^{alt} \subseteq D_\sigma$ and $[\![\gamma]\!]^{alt}$ $\subseteq D_{\langle\sigma,\tau\rangle}$, then $[\![\alpha]\!]^{alt} = \{a \mid \exists f \in [\![\gamma]\!]^{alt} \exists b \in [\![\beta]\!]^{alt} [a = f(b)]\}$.

3.1.1 *Wh*-questions

Given this setup adopted from Beck (2006) and Kotek (2014),[6] we can already account for the interpretation of the *wh*-question in (5b). Below is a simplified LF tree for (5b) with annotation of the two kinds of semantic values for each node. The notation $\langle a,b\rangle$ indicates that the node's o-value is a while its alt-value is b.

(33)

$$\left\langle \begin{array}{l} \{\lambda w_s.\mathbf{ran}(x,w) \mid x \in \mathbf{human}\}, \\ \{\{\lambda w_s.\mathbf{ran}(x,w) \mid x \in \mathbf{human}\}\} \end{array} \right\rangle$$

$$\left\langle \begin{array}{l} \text{undefined,} \\ \{\lambda w_s.\mathbf{ran}(x,w) \mid x \in \mathbf{human}\} \end{array} \right\rangle \qquad ka$$

dare
$$\left\langle \begin{array}{l} \text{undefined,} \\ \{x \mid x \in \mathbf{human}\} \end{array} \right\rangle$$

hashitta
$$\left\langle \begin{array}{l} \lambda x_e \lambda w_s.\mathbf{ran}(x,w), \\ \{\lambda x_e \lambda w_s.\mathbf{ran}(x,w)\} \end{array} \right\rangle$$

What is crucial above is that the alternatives introduced by *dare* is passed up via an application of PWFA in the alternative-semantic dimension, until the top-level *ka* returns it as the o-value (Beck 2006). As a result, the sentence receives the standard proposition-set denotation for *wh*-questions (Hamblin 1973; Karttunen 1977) as its o-value.

3.1.2 Excursion: Yes/No-questions and the semantics of complementizers

It is important to note at this point that *ka* defined in (29) is also the one that appears as the sentence-final particle in Yes/No-questions (YNQs), as exemplified below.

(34)   Hanako-ga   hashitta-ka?
        Hanako-NOM   ran-KA
        'Did Hanako come?'

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[6] More precisely, I here adopt Kotek's (2014) definition of the Q-particle, instead of that by Beck (2006), who defines the alt-value of α *ka* as equivalent to its o-value. See Kotek (2014) for independent motivations for adopting this particular definition in relation to the treatment of multiple *wh*-questions in English. For the purpose of this paper, adopting Kotek's (2014) definition enables a simpler compositional system.

The analysis predicts the following o-value for the YNQ in (34) above.

(35) $[\![(34)]\!]^o = \{\lambda w.\mathbf{ran}(\mathbf{h},w)\}$

The singleton-set denotation for YNQs as exemplified above is different from the more standard bipolar denotation (Hamblin 1973; Karttunen 1977), which would be the following two-membered set in the case of (34).

(36) $\{\lambda w.\mathbf{ran}(\mathbf{h},w), \lambda w.\neg\mathbf{ran}(\mathbf{h},w)\}$

Versions of the singleton analysis of the semantics of YNQs are maintained by authors such as Roberts (1996/2012); Abels (2006); Pruitt & Roelofsen (2011); Biezma & Rawlins (2012); Roelofsen & Farkas (2015), and its empirical motivations come from biased polar questions, the interpretation of response particles and the selectional property of dubitative predicates, among others. In many of these analyses, the singleton denotation is mapped to the corresponding bipolar denotation by an extra operation in order to capture the fact that polar questions license negative responses. In this paper, I formulate the mapping using the following type-shifting operator, similar to the polar-question operator in Hamblin (1973: 50) and the non-informative closure in Ciardelli et al. (2015).

(37) $[\![?]\!]^o := \lambda Q_{\{p\}}.Q \cup \{\neg\cup Q\}$ (Hamblin 1973: 50)

(38) $[\![?]\!]^o([\![(34)]\!]^o) = \{\lambda w.\mathbf{ran}(\mathbf{h},w), \lambda w.\neg\mathbf{ran}(\mathbf{h},w)\}$

An issue that comes with positing an operator like (37) is that its application has to be somehow constrained to avoid unwanted consequences of its application to *wh*-questions. For example, when (37) is applied to the o-value of the *wh*-question *dono gakusei-ga hashitta-ka* 'Which student ran?', we get the following denotation:

(39) $[\![?]\!]^o(\{\lambda w_s.\mathbf{ran}(x,w) \mid x \in \mathbf{student}\})$
        $= \{\lambda w_s.\mathbf{ran}(x,w) \mid x \in \mathbf{human}\} \cup \{\lambda w'_s.\neg\exists x[x \in \mathbf{student} \wedge \mathbf{ran}(x,w'_s)]\}$

This is problematic since, empirically, 'No student ran' is not a possible response to the question. In fact, the intuition is that the question *presupposes* that some student ran (see §4.1 for the analysis of the existential presupposition in *wh*-questions). Thus, we need a way to constrain the application of (37) so that it does not apply to *wh*-questions.

   As a solution to this problem, I argue that the application of the type-shifting operation in (37) is possible only in cases where the LF without the operator would result in uninterpretability. That is, I posit the following constraint:

(40)   **Application of ? as a repair strategy**
        Let φ be an LF containing **?** and φ' be an LF just like φ except that it does not contain **?**. Then, φ is licensed only if φ' is uninterpretable.

This account assumes that a *ka*-ending non-*wh* clause without the **?**-operator is uninterpretable while a *ka*-ending *wh*-clause without the the **?**-operator is interpretable. If we mark uninterpretability with #, the situation can be exemplified below:

(41)   Interpretability without **?**
        a. #Hanako-ga   hashitta-ka.
             Hanako-NOM ran-KA

        b. ✓Dare-ga   hashitta-ka.
             who-NOM ran-KA

Why, then, is there such a contrast between polar questions and *wh*-questions? Intuitively, it is because (41a) without the **?**-operator would denote a "defective" question with only a single possible answer while (41b) without the **?**-operator would denote a non-defective question with multiple answers. The requirement for multiple alternatives in an interrogative clause is implemented in the denotation of the interrogative complementizer as a presupposition, as in (42):

(42) $[\![C_{int}]\!]^o = \lambda Q_{\{p\}} : |Q| > 1.Q$ (cf. Biezma & Rawlins 2012: 392)

Given that the interrogative complementizer requires multiple alternatives, (41a) without the **?**-operator would necessarily result in a presupposition failure. This situation is avoided by the insertion of the **?**-operator. On the other hand, (41b) without the **?**-operator already satisfies the presupposition encoded by (42).[7,8]

A *ka*-ending non-wh-clause is uninterpretable also as a *declarative* clause since the declarative complementizer selects for a proposition, as given below:

(43) $[\![C_{decl}]\!]^o = \lambda p_p.p$

Since type-mismatch results in uninterpretability, (41a) without **?** would be uninterpretable even as a declarative clause.

It is worth noting at this point that the type-shifter ∃ to be introduced in the next section would not cause a problem for this account. The type-shifter would convert a singleton set of a proposition into the unique proposition in the singleton set. Although it might appear that the presence of this type-shifter would make a *ka*-ending non-*wh*-clause compatible with C_{decl} in the structure exemplified in (44a), such a structure would be blocked by a simple declarative clause without *ka*, as in (44b), which would have an equivalent interpretation.[9]

(44)   a.   [[[Hanako-ga hashitta-**ka**] ∃] C_{decl}].
        b.   [[Hanako-ga hashitta] C_{decl}].

3.1.3 Indefinites

Let us now turn to how we derive the existential statement in (5a). The first thing to note is that, without any additional mechanisms, the semantic composition does not go through due to type-mismatch. This is so since neither FA nor PWFA can combine the

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[7] This account assumes that a *wh*-phrase with a necessarily singleton domain, such as *who among John* is ill-formed for different reasons.

[8] The way the application of the **?**-operator is constrained here is very similar to the coercion-based account by Biezma & Rawlins (2012). In their account, a coercion mechanism brings about the effect of our **?**-operator. Given the nature of coercions in general, it applies only when the composition fails without it. Thus, the constraint on the operation we have in (40) also follows in their account.
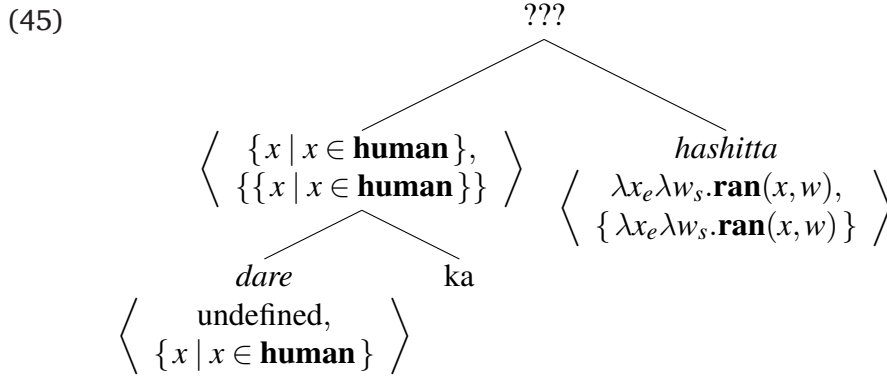
   Another way to constrain the application of the polar-question operator is to adopt Roelofsen & Farkas's (2015) operator ⟨?⟩, whose role is to *ensure* multiplicity of alternatives. The semantics of this operator looks like the following:

(i) $[\![⟨?⟩]\!]^o = \lambda Q_{\{p\}}.$
        • Q if $|Q| > 1$
        • $Q \cup \{\neg \cup Q\}$ if $|Q| = 1$

   Applying this operator to (34), we get a bipolar denotation. The operator does not have an effect when it applies to *wh*-questions that already involve multiple alternatives.

[9] Empirically, a *ka*-ending non-*wh*-clause is acceptable with an exclamative interpretation (with a sentence-final falling intonation). This is not a problem for the account, either. Whatever the semantic mechanism behind the exclamative interpretation may be, the exclamative sentence is not equivalent to the simple declarative counterpart without *ka*, and thus the blocking mechanism does not apply.
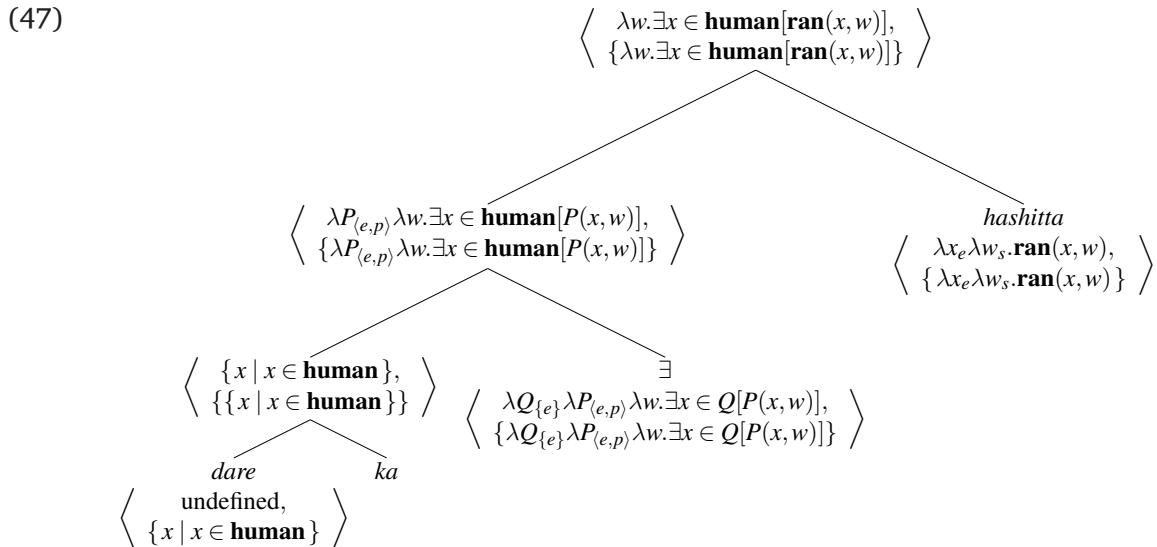
semantic values of *hashitta* with the semantic values of *dare-ka*. This can be seen in the following uninterpretable LF tree.

(45)

$$\left\langle \begin{array}{c} \{x \mid x \in \textbf{human}\}, \\ \{\{x \mid x \in \textbf{human}\}\} \end{array} \right\rangle \qquad \begin{array}{c} \textit{hashitta} \\ \left\langle \begin{array}{c} \lambda x_e \lambda w_s.\textbf{ran}(x,w), \\ \{\lambda x_e \lambda w_s.\textbf{ran}(x,w)\} \end{array} \right\rangle \end{array}$$

dare   ka

$$\left\langle \begin{array}{c} \text{undefined}, \\ \{x \mid x \in \textbf{human}\} \end{array} \right\rangle$$

Here, the operation of existential closure that I mentioned above comes into play. Specifically, I propose that there is a following operator that turns a set in the o-value dimension into the corresponding existential quantifier.[10]

(46)   a. $[\![\exists]\!]^o = \lambda Q_{\{\sigma\}}.$
- $\lambda w_s.\exists p \in Q[p(w)]$ if $\sigma = p$ $(p := \langle s,t \rangle)$
- $\lambda P_{\langle \sigma,p \rangle}\lambda w_s.\exists x \in Q[P(x)(w)]$ otherwise

    b. $[\![\exists]\!]^{alt} = \{[\![\exists]\!]^o\}$

    c. σ is any type, and $\{\sigma\}$ is the type for the set of σ-type objects. I assume a formal distinction between sets and characteristic functions. Thus, $\{\sigma\}$ is a distinct type from $\langle \sigma,t \rangle$.[11]

This operator can be applied to *dare-ka* in (45). As a result, we derive the existential statement as in the following LF:

(47)

$$\left\langle \begin{array}{c} \lambda w.\exists x \in \textbf{human}[\textbf{ran}(x,w)], \\ \{\lambda w.\exists x \in \textbf{human}[\textbf{ran}(x,w)]\} \end{array} \right\rangle$$

$$\left\langle \begin{array}{c} \lambda P_{\langle e,p \rangle}\lambda w.\exists x \in \textbf{human}[P(x,w)], \\ \{\lambda P_{\langle e,p \rangle}\lambda w.\exists x \in \textbf{human}[P(x,w)]\} \end{array} \right\rangle \qquad \begin{array}{c} \textit{hashitta} \\ \left\langle \begin{array}{c} \lambda x_e \lambda w_s.\textbf{ran}(x,w), \\ \{\lambda x_e \lambda w_s.\textbf{ran}(x,w)\} \end{array} \right\rangle \end{array}$$

$$\left\langle \begin{array}{c} \{x \mid x \in \textbf{human}\}, \\ \{\{x \mid x \in \textbf{human}\}\} \end{array} \right\rangle \qquad \begin{array}{c} \exists \\ \left\langle \begin{array}{c} \lambda Q_{\{e\}}\lambda P_{\langle e,p \rangle}\lambda w.\exists x \in Q[P(x,w)], \\ \{\lambda Q_{\{e\}}\lambda P_{\langle e,p \rangle}\lambda w.\exists x \in Q[P(x,w)]\} \end{array} \right\rangle \end{array}$$

dare   ka

$$\left\langle \begin{array}{c} \text{undefined}, \\ \{x \mid x \in \textbf{human}\} \end{array} \right\rangle$$

Thus, we can capture the fact that (5a) is an existential statement rather than a *wh*-question. The only way in which the semantic composition of *dare-ka* 'who-KA' and *hashitta*

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[10] The operation of existential closure is employed in alternative semantics by Kratzer & Shimoyama (2002) and Biezma & Rawlins (2012) (among others) although the operation always applies at the clausal level. Here, $\exists$ is defined as a cross-categorial operator which can apply clause-internally.

[11] Yatsushiro (2009) uses the notation $\langle \sigma \backslash t \rangle$ to denote the same type.

'ran' goes through is to turn the the o-value of the former into an existential quantifier by ∃. The same mechanism applies to other cases where a set-incompatible predicate combines with a *ka*-phrase.[12]

Note, however, that the introduction of ∃ creates a potential problem. The *wh*-question interpretation of (5b) itself could now be turned into an existential statement if ∃ is freely available and applied to the whole sentence. This problem can be straightforwardly solved once we assume that the constraint on the application of **?** posited in (40) above also applies to ∃. The assumption is that the application of ∃ is subject to the following slightly generalized version of (40):

(48) **Application of ? and ∃ as a repair strategy**
      Let O be a type-shifting operator ? or ∃. Also, let φ be an LF containing O and φ' be an LF just like φ except that it does not contain O. Then, φ is licensed only if φ' is uninterpretable.

This generalized version of the constraint on type-shift prohibits the application of ∃ to the whole sentence of (5b). Since the LF (33) of (5b) does not involve any type-mismatch and is interpretable, unlike the uninterpretable (45), the application of ∃ is disallowed. Hence, the sentence lacks an interpretation as the existential statement.

This analysis also extends to cases where (5b) is embedded under question-embedding predicates since there would be no type-mismatch between question-embedding predicates and (5b). I analyze all question-embedding predicates as a set-compatible predicate, i.e., as selecting for a set of propositions, both in the o-value and in the alt-value. For instance, the semantic values of *oshier(u)* 'tell/teach' look like the following:

(49) a. $\llbracket \text{oshier} \rrbracket^o = \lambda Q_{\{p\}}\, \lambda x \lambda w.\mathbf{tell}(x,Q,w)$
      b. $\llbracket \text{oshier} \rrbracket^{alt} = \{\lambda Q_{\{p\}}\, \lambda x \lambda w.\mathbf{tell}(x,Q,w)\}$

Thus, the set of propositions in the o-value and the alt-value of an interrogative CP can be combined with the question-embedding predicate via FA and PWFA. Hence, there is no type-mismatch and the existential closure by ∃ does not occur. I claim that there is no set-compatible predicate in Japanese other than interrogative-CP-embedding predicates like (49), disjunctive coordinators such as *soretomo* (which I will discuss in detail below)

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[12] It is known that *wh*-indefinites function as interveners in Japanese (Hoji 1985; Hagstrom 1998; Tomioka 2007). This is exemplified in the unacceptability of the following example:

(i) ??Dare-ka-ga   nani-o   tabe-mashita ka?
        who-KA-NOM what-ACC eat-POL.PAST KA
        'What did someone eat?' (intended)

The semantics of *wh*-indefinites and *wh*-questions developed here does not by itself predict this effect. This is not necessarily a problem since, as Tomioka (2007) argues, it is plausible that intervention effects in Japanese can receive an explanation in terms of information structure. That is, an intervener such as *wh*-indefinites is an "anti-topical" item, which is dispreferred in an intonational domain preceding a *wh* phrase. According to Tomioka (2007), an account of Japanese intervention effects in terms of information structures is *preferred* over a syntactic/semantic account because of subtlety of native-speaker judgments about the relevant effects and the non-homogeneity of syntactic and semantic properties of possible interveners. Thus, I will not attempt to offer an account of the intervention effect in the current paper, whose focus is the compositional semantic analysis of *wh* + *ka* constructions and *ka*-disjunctions.

and ∃ itself.[13] Thus, any case in which a *ka*-phrase combines with items other than these operators at LF involves existential closure.

Thus, the constraint in (48) seems to account for the lack of existential interpretation for *ka*-ending *wh*-clauses in both matrix and embedded contexts. However, it does not account for the behavior of *ka*-ending *wh*-clauses when they are embedded under *proposition*-embedding predicates, such as *shinjiteiru* 'believe' or *mitai* 'seem'. Empirically, *ka*-ending *wh*-clauses are ungrammatical under these predicates, as exemplified below:

(50) a. *Hanako-wa [dare-ga   hashitta-**ka** (da) -to] shinjiteiru.
          Hanako-TOP   who-NOM ran-KA   COP C$_{decl}$ believe
          Intended: 'Hanako believes that someone ran.'

      b. *[dare-ga   hashitta-**ka**] mitai da.
            who-NOM ran-KA   seem COP
          Intended: 'It seems that someone ran.'

This is unexpected in the account described above since (48) predicts that ∃ would be *allowed* in (50), which would otherwise involve a type-mismatch between the proposition-embedding (set-incompatible) predicates and the set of propositions denoted by the complements. Therefore, the constraint in (48) cannot account for all of the relevant data. In §4 below, I will revisit this problem and propose an account of the ungrammaticality of examples in (50), based on the analysis of presuppositions inherent in the *wh* + *ka* construction, whether it is clausal or not.

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[13] I cannot give a principled theoretical explanation for why this should be so, but an empirical argument can be made in terms of cross-linguistic empirical patterns. Cross-linguistically, there seems to be no sub-clausal predicate or operator (other than disjunction particles and the *ka/mo*-type quantificational particles; Szabolcsi 2015b) that *selects for* a constituent containing a *wh*-word. On the other hand, there are clause-embedding predicates that select for a *wh*-clause. This suggests that set-compatible predicates are cross-linguistically limited to clause-embedding predicates (in addition to disjunction and *ka/mo*-type particles).

One might wonder where the focus particles fit in this picture. Unlike question-taking predicates, a focus-sensitive operator operates on the *alt-semantic* value of its prejacent. This is illustrated in the following schematic denotations of a focus-sensitive particle Op, which performs the operation *f* to the alt-value of its prejacent.

(i) a. $[\![\text{Op } \varphi]\!]^o = f([\![\varphi]\!]^{alt})$
     b. $[\![\text{Op } \varphi]\!]^{alt} = \{[\![\text{Op } \varphi]\!]^o\}$

Here, *f* performs some operation on a set consisting of non-sets, say exhaustification over a set of individuals. Thus, Op can apply to a focused DP like *[Taro]$_F$*, as in the following tree. (I only annotate semantic types in the two tiers.)

(ii)
```
        ╱‾‾‾╲
   Op      [Taro]_F
           ⟨  e,  ⟩
           ⟨ {e}  ⟩
```
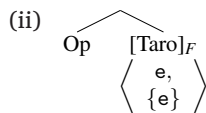
However, it cannot apply to *dare-ka*, which denotes *a (singleton) set of a set of individuals* in the alt-value, without a type-mismatch.

(iii)   ???
```
        ╱‾‾‾╲
   Op      dare-ka
           ⟨ {e},  ⟩
           ⟨ {{e}} ⟩
```
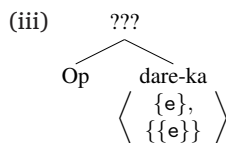
Thus, ∃ is needed for a focus-sensitive operator and *dare-ka* to combine, just as in the case where a set-incompatible verb and a *dare-ka* to combine. In this sense, a focus-sensitive operator behaves like a set-incompatible predicate in the current system.

Summing up the section, the system can be described in the following way. One can conceive of the o-value dimension as the "foreground" and the alt-value dimension as the "background". A *wh*-word like *dare* introduces a set of alternatives in the background. As long as these alternatives are kept in the background, they can be semantically combined with alt-values of other constituents via PWFA. The job of *ka* is to bring the alternatives in the background into the foreground. Once this is done, the situation differs depending on whether the constituent combining with the *ka*-phrase (if there is any) is compatible with a set or not. If it is, or if the *ka*-phrase is the matrix CP, there is no existential closure. Otherwise, the set of alternatives would have to be flattened into an existential meaning.

This system captures the fact that the position of *ka* conditions the interpretation of a *wh* + *ka* construction that we saw in the previous section. When the *ka*-phrase together with C_{int} form a whole CP, it would receive the interpretation as a set of propositions, i.e., a question, whether or not it is embedded by a question-embedding predicate. For, there would be no type-mismatch in the semantic composition. On the other hand, when the *ka*-phrase forms a DP, the set of alternatives it denotes in the o-value cannot participate in the semantic composition unless it is flattened into a non-set. For, as I claimed above, there is no set-compatible predicate that can syntactically combine with a DP.

3.2 *ka*-disjunctions

In this section, I will argue that the generalization about the effect of the position of *ka* on the interpretation of *ka*-disjunctions can be captured as a natural extension of the system outlined above, once we take into account an appropriate syntax for disjunctions. Following the structure of complex coordinations adopted in the literature on the cross-linguistic syntax and semantics of coordinations (den Dikken 2006; Slade 2011; Mitrovič & Sauerland 2014; Szabolcsi 2015b) I assume that *ka*-disjunctions involve a Junction head (hereafter J) with *ka*-phrases both in its internal argument position and in the specifier. The structure is schematized as follows:

(51)
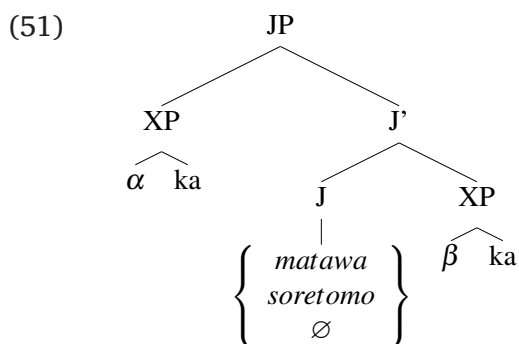
The disjunctive J head is realized either as *matawa* or *soretomo,* or is phonologically null. In the following, I will define a uniform semantics for the J head, based on the behavior of the phonologically null coordinator. In the next section, we will extend the treatment to phonologically explicit coordinators by adding assumptions about their syntactic features. I treat the coordinator head J as denoting the set-union operation in the o-value, as given in (52a) below, while its alt-value is defined in terms of generalized disjunction (Partee & Rooth 1983).

(52)   a. $[\![J]\!]^o = \lambda X_{\{\sigma\}}\lambda Y_{\{\sigma\}}.X\cup Y$
       b. $[\![J]\!]^{alt} = \{\lambda X_{\{\sigma\}}\lambda Y_{\{\sigma\}}.\{\iota X \sqcup \iota Y\}\}$[14]
       c. ιX is defined only if X is a singleton set. If defined, ιX is the unique member of X.
       d. $X \sqcup Y =$
            - $X \vee Y$ if X and Y are of type t
            - $\lambda Z_\sigma.X(Z) \vee Y(Z)$ if X and Y are of type $\langle\sigma,t\rangle$

As concrete examples, we have the following semantic derivations of two *ka*-disjunctions: the DP disjunction *Hanako-ka Jiro-ka* and the clausal disjunction *Hanako-ga hashitta-ka Jiro-ga hashitta-ka*. As one can see from the following LFs, the analysis derives two-membered sets consisting of (the o-values of) its disjuncts (i.e., α and β in the schema in (51)) as the semantic values of a *ka*-disjunction as a whole.[15]

(53)   a.

$$\left\langle \begin{array}{l} \{\lambda P.P(\mathbf{j}), \lambda P.P(\mathbf{h})\}, \\ \{\{\lambda P.P(\mathbf{j}) \vee P(\mathbf{h})\}\} \end{array} \right\rangle$$

$$\left\langle \begin{array}{l} \{\lambda P.P(\mathbf{h})\}, \\ \{\{\lambda P.P(\mathbf{h})\}\} \end{array} \right\rangle \qquad \left\langle \begin{array}{l} \lambda Y.\{\lambda P.P(\mathbf{j})\}\cup Y, \\ \{\lambda Y.\{\lambda P.P(\mathbf{j})\sqcup \iota Y\}\} \end{array} \right\rangle$$

Hanako   ka

$$J \mid \varnothing \qquad \left\langle \begin{array}{l} \{\lambda P.P(\mathbf{j})\}, \\ \{\{\lambda P.P(\mathbf{j})\}\} \end{array} \right\rangle$$

Jiro   ka

b.

$$\left\langle \begin{array}{l} \{\lambda w.\mathbf{ran}(\mathbf{j}, w), \lambda w.\mathbf{ran}(\mathbf{h}, w)\}, \\ \{\{\lambda w.\mathbf{ran}(\mathbf{j}, w) \vee \mathbf{ran}(\mathbf{h}, w)\}\} \end{array} \right\rangle$$

$$\left\langle \begin{array}{l} \{\lambda w.\mathbf{ran}(\mathbf{h}, w)\}, \\ \{\{\lambda w.\mathbf{ran}(\mathbf{h}, w)\}\} \end{array} \right\rangle \qquad \left\langle \begin{array}{l} \lambda Y.\{\lambda w.\mathbf{ran}(\mathbf{j}, w)\}\cup Y, \\ \{\lambda Y.\{\lambda w.\mathbf{ran}(\mathbf{j}, w) \vee \iota Y\}\} \end{array} \right\rangle$$

$$\left\langle \begin{array}{l} \lambda w.\mathbf{ran}(\mathbf{h}, w), \\ \{\lambda w.\mathbf{ran}(\mathbf{h}, w)\} \end{array} \right\rangle \quad ka$$

Hanako-ga hashitta

$$J \mid \varnothing \qquad \left\langle \begin{array}{l} \{\lambda w.\mathbf{ran}(\mathbf{j}, w)\}, \\ \{\{\lambda w.\mathbf{ran}(\mathbf{j}, w)\}\} \end{array} \right\rangle$$

$$\left\langle \begin{array}{l} \lambda w.\mathbf{ran}(\mathbf{j}, w), \\ \{\lambda w.\mathbf{ran}(\mathbf{j}, w)\} \end{array} \right\rangle \quad ka$$

Jiro-ga hashitta

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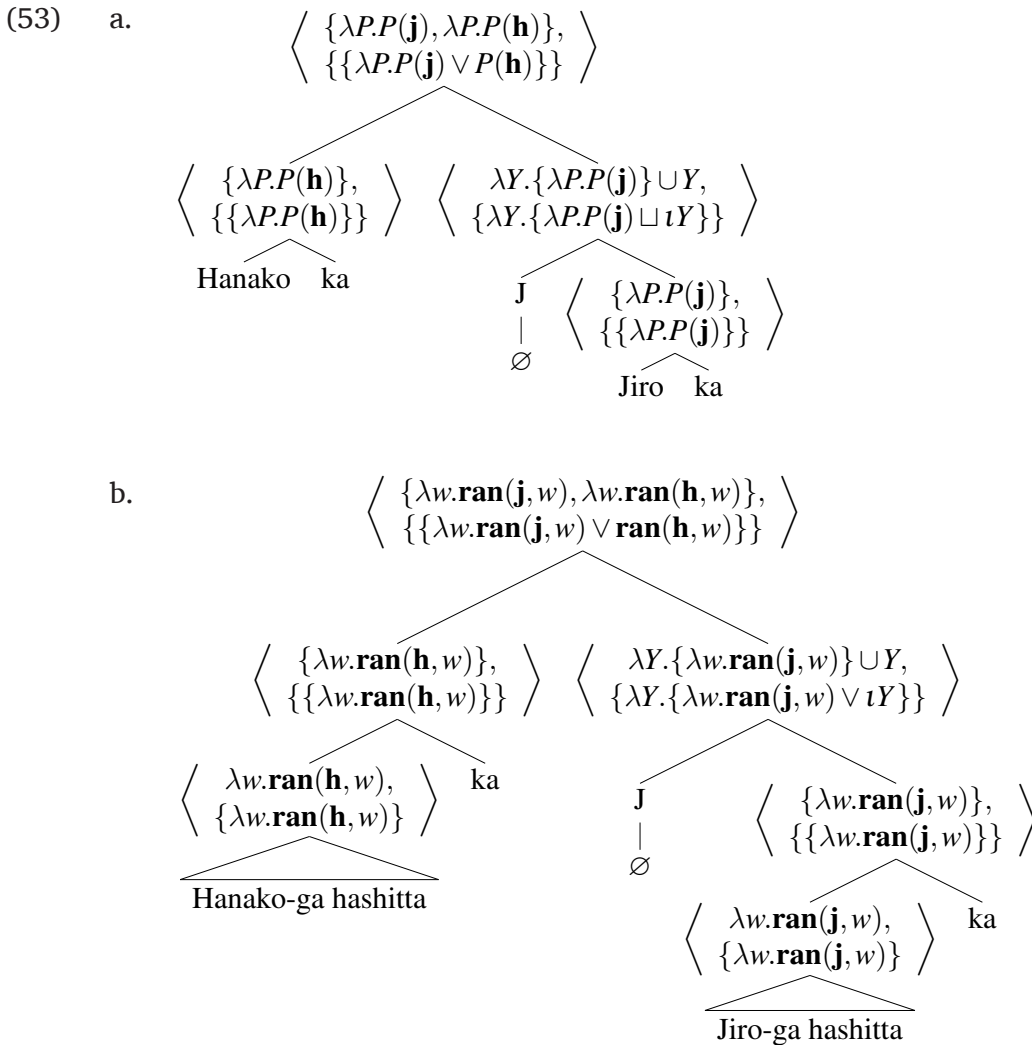
[14] The alt-value of J is defined this way so that the alternatives in the alt-value do not involve the same alternatives as in the o-value, but rather is "reset" to a singleton. This is empirically necessary because clause-final *ka* above a *ka*-disjunction cannot project an alternative question, but rather an Y/N-question:

(i)   [Hanako-**ka**   Jiro-**ka**]-ga   hashitta-**ka** oshiete.
      Hanako-KA   Jiro-KA -NOM   ran-KA   tell
      'Tell me whether or not either Hanako or Jiro ran.'   (Y/NQ)

[15] I assume that a type-lifting from type σ to type $\langle\langle\sigma, p\rangle, p\rangle$ is available. The type-lifting applies to the denotations of *Hanako* and *Jiro* in (53a) for them to be coordinated by $\varnothing$ (Partee & Rooth 1983).
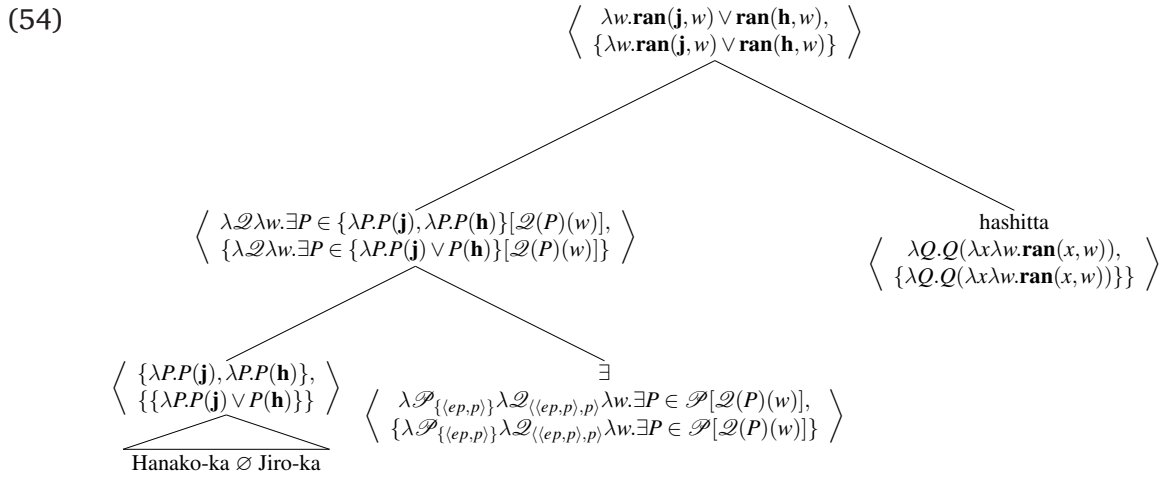
We have now already accounted for the AltQ interpretation for clausal *ka*-disjunctions. As can be seen in (53b), a clausal *ka*-disjunction receives as its o-value a set of two propositions, each contributed by the clausal disjuncts. This is precisely the standard semantic denotation for AltQs (Karttunen 1977; Biezma & Rawlins 2012).[16] In other words, the AltQ interpretation is analyzed as the union of the singleton interpretations of the question nucleus of two YNQs (Uegaki 2014). Similar analyses of AltQs are maintained by Pruitt & Roelofsen (2011) for English, Gračanin-Yuksek (2016) for Turkish and Mayr & Zuchewicz (2015) for Polish.

Furthermore, given the mechanism of semantic composition and the repair of the type-mismatch in terms of ∃, described in the previous section, we can also account for the fact that *ka*-disjunctions syntactically smaller than the complement of C[17] end up receiving an existential/declarative disjunctive interpretation. The explanation is exactly parallel to that of the existential interpretation of *wh* + *ka*. The gist is the following: when a *ka*-disjunction is smaller than the complement of C, it has to be semantically combined with a sub-CP predicate/operator. Given the assumption that any such sub-CP operator (other than the J head and ∃) is set-incompatible, the o-value of a *ka*-disjunction cannot be directly combined with them. It would result in a type-mismatch.

For example, when the DP-disjunction in (53a) appears in a sentence such as the following repeated from the previous section, ∃ repairs the type-mismatch between the disjunction and the verb *hashitta*.

(11)   [$_{DP}$ Hanako-ka   Jiro-ka]-ga   hashitta.
        Hanako-KA   Jiro-KA-NOM   ran
        'Either Hanako or Jiro ran.'

Below is the LF structure of this example illustrating how the existential/disjunctive interpretation is derived:

(54)

$$\left\langle \begin{array}{l} \lambda w.\mathbf{ran}(\mathbf{j},w) \vee \mathbf{ran}(\mathbf{h},w), \\ \{\lambda w.\mathbf{ran}(\mathbf{j},w) \vee \mathbf{ran}(\mathbf{h},w)\} \end{array} \right\rangle$$

$$\left\langle \begin{array}{l} \lambda \mathcal{Q}\lambda w.\exists P \in \{\lambda P.P(\mathbf{j}), \lambda P.P(\mathbf{h})\}[\mathcal{Q}(P)(w)], \\ \{\lambda \mathcal{Q}\lambda w.\exists P \in \{\lambda P.P(\mathbf{j}) \vee P(\mathbf{h})\}[\mathcal{Q}(P)(w)]\} \end{array} \right\rangle$$

hashitta
$$\left\langle \begin{array}{l} \lambda Q.Q(\lambda x\lambda w.\mathbf{ran}(x,w)), \\ \{\lambda Q.Q(\lambda x\lambda w.\mathbf{ran}(x,w))\}\} \end{array} \right\rangle$$

$$\left\langle \begin{array}{l} \{\lambda P.P(\mathbf{j}), \lambda P.P(\mathbf{h})\}, \\ \{\{\lambda P.P(\mathbf{j}) \vee P(\mathbf{h})\}\} \end{array} \right\rangle$$

∃
$$\left\langle \begin{array}{l} \lambda \mathcal{P}_{\{\langle ep,p\rangle\}}\lambda \mathcal{Q}_{\langle\langle ep,p\rangle,p\rangle}\lambda w.\exists P \in \mathcal{P}[\mathcal{Q}(P)(w)], \\ \{\lambda \mathcal{P}_{\{\langle ep,p\rangle\}}\lambda \mathcal{Q}_{\langle\langle ep,p\rangle,p\rangle}\lambda w.\exists P \in \mathcal{P}[\mathcal{Q}(P)(w)]\} \end{array} \right\rangle$$

Hanako-ka ∅ Jiro-ka

Finally, it is also a natural consequence of the current system that when *ka* attaches to a sentence containing a sub-clausal *ka*-disjunction, it receives an interpretation as a YNQ

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[16] I assume that the exclusivity presupposition of AltQs—the presupposition that only one of the alternatives is true—is guaranteed by an additional operator, following Pruitt & Roelofsen (2011) and Biezma & Rawlins (2012). In the current setup, it can be added to the contribution of the interrogative complementizer C_{int}.

[17] Here, I say "complement of C" instead of "CP" because I assume an existence of the complementizer above a clausal JP (see §3.1.2). That is, a clausal JP would have the following structure in an interrogative CP.

(i)   [$_{CP}$ [$_{JP}$ [α-ka] [J [β-ka]]] C_{int}]

embedding a declarative disjunction, not as an AltQ. This is the case in the following examples again repeated from the data section.

(15) [[$_{DP}$ Hanako-**ka** Jiro-**ka**]-ga   hashitta-**ka**] (oshiete).
      Hanako-KA Jiro-KA-NOM ran-KA   tell
      'Tell me whether or not Hanako ran or Jiro ran.'   (✓**YNQ**)
      *'Tell me which is true: Hanako ran or Jiro ran.'   (***AltQ**)

(16) [[$_{TP}$ [Hanako-ga   hashitta-**ka**] [Jiro-ga   hashitta-**ka**]] mitai-**ka**] (oshiete).
      Hanako-NOM ran-KA   Jiro-NOM ran-KA   seem-KA   tell
      'Tell me whether or not it seems to be that Hanako or Jiro ran.'   (✓**YNQ**)
      *'Tell me which is true: Taro saw Hanako or he saw Jiro.'   (***AltQ**)

In these examples, *ka* operates on the disjunctive statement derived in the above LF (54). Since *ka* is defined as returning the alt-value of its prejacent, the analysis predicts the following semantic value for (15).

(55) $[\![(15)]\!]^o = \{\lambda w.\mathbf{ran}(\mathbf{j},w) \lor \mathbf{ran}(\mathbf{h},w)\}$

Thus, the analysis predicts that (15–16) denote a singleton set consisting of a proposition. These denotations are mapped to bipolar denotations of polar questions by the **?**-operator, defined in (37).

4 Existential closure at the clausal level?

As discussed in previous sections, one of the predictions of the analysis developed so far is that clauses ending with *ka* would receive an existential meaning under proposition-embedding predicates, as the existential closure would kick in to rescue the type-mismatch. In fact, this is not what we see empirically. Clauses ending with *ka* are ungrammatical under proposition-embedding predicates like *shinjiru* 'believe' and *mitai* 'seem', as previewed in §3.1.3. In this section, I will detail the data of *ka*-ending clauses embedded under proposition-embedding predicates, and offer an explanation of the pattern based on a presuppositional behavior of *ka*-ending constituents.

The analysis presented up to this point has problems with the following examples, where clauses (specifically CPs and TPs) ending with *ka* are embedded under the proposition-taking predicate *shinjiru* 'believe' and *mitai* 'seem'. The sentences are ungrammatical although the analysis predicts an existential interpretation of the complements.[18]

(56) a. *Hanako-wa [dare-ga   hashitta-**ka** (da) -to/∅   ] shinjiteiru.
          Hanako-TOP who-NOM ran-KA   COP C$_{decl}$/C$_{int}$ believe
          Intended: 'Hanako believes that someone ran.'

      b. *[dare-ga   hashitta-**ka**] mitai da.
          who-NOM ran-KA   seem COP
          Intended: 'It seems that someone ran.'

What makes the problem puzzling is the fact that the following sentence is grammatical with the same existential interpretation as predicted for (56).

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[18] The exact location of the existential closure in (56a) would be different depending on the type of the complementizer. If the complementizer is the declarative complementizer C$_{decl}$, it would be applied right below the complementizer since it denotes the identity function over propositions (see (43)). On the other hand, if the complementizer is the interrogative complementizer C$_{int}$ defined in (42), the existential closure would be applied right above the complementizer. Either way, the predicted meaning would be equivalent to that of (57a), modulo the existential presuppositions, which will be discussed below.

(57) a. Hanako-wa [dare-**ka**-ga   hashitta-to] shinjiteiru.
          Hanako-TOP who-KA-NOM ran-C$_{decl}$ believe
          'Hanako believes that someone ran.'

      b. [dare-**ka**-ga   hashitta] mitai da.
            who-KA-NOM ran   seem COP
          'It seems that someone ran.'

The only difference would be when the existential closure is applied. In (57a), it is at the DP level while in (56a), it is at the CP/TP level.

A possible solution to this issue can be given by invoking the notion of economy, as suggested by Takahashi (2002) and pursued in an earlier version of this paper (Uegaki 2016). Takahashi (2002) argues that particles *ka* and *mo* are base-generated in the sister position of a *wh*-word and undergo head-movement to the surface position, which also determines their scope position. Crucially, according to Takahashi, this movement is constrained by scope economy (Fox 2000). That is, the movement of *ka/mo* is allowed only if it results in an interpretation that differs from what is predicted by the particles' original position. If we follow this story, the ungrammaticality of (56) can be accounted for. The sentences in (56) are analyzed as being derived from (57), but the movement of *ka* in (56) violates the scope economy since the sentences would have the same interpretations as (57).

Although our account is not based on the overt movement of *ka*, the economy-based explanation can be adapted to it, along the following lines: (a) the lowest position is the default position for *ka*; (b) *ka* cannot be placed in a non-default position unless it leads to a distinct interpretation from what is predicted by its default position. Uegaki (2016) implements this idea employing the notion of blocking (e.g., Aronoff 1976; Atlas & Levinson 1981; Horn 1984).

This economy-based analysis however faces an empirical problem. It predicts that a *ka*-ending clause can be embedded by a proposition-embedding operator, such as *shinjiteiru* 'believe', if there is an intervening operator between the *wh*-word and the proposition-embedding operator, so that there would be a difference between the interpretations resulting from the two positions of *ka*. This prediction is not borne out, as shown in the following:

(58) a. Hanako-wa [dare-**ka**-ga   hashira-**nakerebanaranai**-to] shinjiteiru.
          Hanako-TOP who-KA-NOM run-must$_{deon}$-C$_{decl}$ believe
          'Hanako believes that someone must run.'

      b. *Hanako-wa [dare-ga   hashira-**nakerebanaranai**-ka (da) -to/∅]
          Hanako-TOP who-NOM ran-must$_{deon}$-KA   COP C$_{decl}$/C$_{int}$
          shinjiteiru.
          believe
          Intended: 'Hanako believes that there is someone who must run.'

In these sentences, the deontic necessity modal *nakerebanaranai* intervenes between the *wh*-word and the proposition-embedding predicate *shinjiteiru* 'believe'. The economy-based account thus predicts that (58b) would be grammatical as it would lead an interpretation where the existential closure takes scope over the modal, which is distinct from the interpretation of (58a). Despite this prediction, (58b) is ungrammatical.

I take this to be a strong argument against the economy-based account of the unacceptability of *ka*-ending clauses embedded by proposition-embedding operators. Below, I propose an alternative solution to this issue.

4.1 An account based on the existential presupposition

The key to the solution of the problem described above lies in the *existential presupposition* of *wh + ka* constructions, which can be observed whether it is clausal or clause-internal. The gist of the solution is the following. A *wh + ka* clause presupposes that there exists a true proposition in the set of proposition that *ka* projects. When the existential closure ∃ is applied to such a clause, we end up with a meaning that asserts exactly what is presupposed, i.e., that there exists a true proposition in the set of alternatives. This systematic triviality leads to ungrammaticality (Gajewski 2002). Below, I empirically demonstrate the presence of the existential presupposition in *wh + ka* constructions, and provide a formal implementation of it. The solution to the problem of existential closure at the clausal level will then be illustrated using the formal implementation of the presupposition.

A number of authors, including Karttunen & Peters (1979); Comorovski (1989) and Dayal (1996), have argued that English *wh*-questions presuppose existence of a true answer in their Hamblin denotation, as exemplified in the following:

(59)   a.   Who ran?   ⇒ **(presupposes)** Someone ran.
      b.   Which student ran?   ⇒ **(presupposes)** Some student ran.

The same judgment holds for Japanese *wh*-questions:

(60)   a.   Dare-ga   hashitta-no-desu-ka?
           who-NOM   ran-NMNL-POL-KA?
           'Who ran?'   ⇒ **(presupposes)** Someone ran.

      b.   Dono gakusei-ga   hashitta-no-desu-ka?
           which student-NOM   ran-NMNL-POL-KA?
           'Which student ran?'   ⇒ **(presupposes)** Some student ran.

In the current setup, there are at least two ways to analyze the source of this presupposition in the Japanese case. One is to associate it with the interrogative complementizer, C_{int} (see §3.1.3), and the other is to associate it with *wh + ka*-constructions in general, whether it is a question or not.

The presuppositional behavior of *wh + ka* indefinites suggests that the existential presupposition is a phenomenon general to *wh + ka* constructions, and thus the latter approach is more suitable. The existential presupposition of *wh + ka* indefinites can be observed in the following examples, where the presence of a *wh + ka* indefinite in a conditional antecedent or a polar question leads to infelicity if the context allows the domain of the indefinites to be empty.

(61)   Context: One of Taro's books is missing. It is not known by the interlocutors whether Taro misplaced it himself or someone stole it.
      a. #Dono-hannin-ka-o   mitsuke-tara oshiete kudasai.
         which-culprit-KA-ACC find-if   tell   POL
         'If you find a culprit, please tell us.' (Intended)
      b. #Dono-hannin-ka-ga   gakusei-no   naka-ni   i-masu-ka?
         which-culprit-KA-NOM students-GEN among-LOC be-POL-KA
         'Is there a culprit among the students?' (Intended)

(62)   Context: the same as (61).
        a. #[Sono hon-o   nusunda] dare-ka-o   mitsuke-tara oshiete kudasai.
              the   book-ACC steal   who-KA-ACC find-if   tell   POL
            'If you find a person who stole the book, please tell us.' (Intended)

        b. #[Sono hon-o   nusunda] dare-ka-ga   gakusei-no   naka-ni
              the   book-ACC steal   who-KA-NOM students-GEN among-LOC
            i-masu-ka?
            be-POL-KA
            'Is there anyone who stole the book among the students?' (Intended)

The above Japanese examples are infelicitous in the given context, unlike the English translations. This indicates that existence of a culprit who stole the book is presupposed by the sentences. This fact suggests that the *wh* + *ka* indefinites presuppose existence of an individual in the relevant domain.

The existential presupposition of *wh* + *ka* constructions in general can be analyzed as resulting from a semantic contribution of *ka*. Roughly speaking, it presupposes that the alt-value of its prejacent has a non-empty extension. This can be formally implemented in the following revised entry for *ka*:[19]

(63)   a. $[\![\alpha \text{ ka}]\!]^o$
             $= \{\lambda w: [\exists a' \in [\![\alpha]\!]^{alt}[a'(w) \text{ is defined} \wedge a'(w) \neq 0]].a(w)\mid a \in [\![\alpha]\!]^{alt}\}$

        b. $[\![\alpha \text{ ka}]\!]^{alt} = \{[\![\alpha]\!]^{alt}\}$

The existential presupposition of *ka* is implemented as partiality of each proposition in the o-value of *α-ka*. Below, I illustrate how this analysis of *ka* interacts with other elements in the semantic composition. We first look at the case where the prejacent of *ka* is clausal, and then move on to the case where the prejacent is non-clausal.

In the case where the prejacent of *ka* is clausal, $[\![\alpha\text{-}ka]\!]^o$ effectively presupposes that some of the propositions in $[\![\alpha]\!]^{alt}$ is true. Suppose that the alt-value of the *wh*-clause *dare-ga hashitta* 'who ran' is $\{p_1, p_2,...,p_n\}$. Then, we have the following o-value for *dare-ga hashitta-ka*:

(64) $[\![\text{dare-ga hashitta ka}]\!]^o$
        $= \{\lambda w: [\exists p' \in \{p_1, p_2,..., p_n\} [p'(w) \text{ is defined} \wedge p'(w) \neq 0]].p(w)$
        $\qquad\qquad\qquad\qquad\qquad\qquad\qquad \mid p \in \{p_1, p_2,...,p_n\}\}$

All propositions in this denotation have the same presupposition: that at least one of $\{p_1, p_2,...,p_n\}$ is true. Thus, at an evaluation world *w*, the possible answers to this question have truth values only if the presupposition is satisfied in *w*, i.e., that at least one of $\{p_1, p_2,...,p_n\}$ is true in *w*. This is how the existential presupposition of a *wh* + *ka* question described above is captured.

Crucially, we derive a trivial statement if we apply the existential closure ∃ to (64). The definition of ∃ is repeated below:

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[19] The conjunct $a'(w) \neq 0$ in the presupposition is true iff $a'(w) = 1$ or $a'(w)$ is not a truth value. Thus, the presupposition is designed to be met whenever the extension of a' is not a truth value, i.e., whenever the prejacent of *ka* is non-clausal.

(46)   a. $[\![\exists]\!]^o = \lambda Q_{\{\sigma\}}.$
            - $\lambda w_s.\exists p \in Q[p(w)]$ if $\sigma = p$
            - $\lambda P_{\langle \sigma, p \rangle} \lambda w_s.\exists x \in Q[P(x)(w)]$ otherwise

       b. $[\![\exists]\!]^{alt} = \{[\![\exists]\!]^o\}$

In (65) below, we see the result of applying (46a) to (64). As one can see, the presupposition of the resulting proposition is equivalent to its assertive content, assuming existential presupposition projection out of a existential quantification/disjunction (Beaver 2001; Chemla 2009).[20] This means that the proposition in (65) is true whenever its presupposition is satisfied.

(65) $[\![[\text{dare-ga hashitta ka}] \exists]\!]^o$
       $= \lambda w.\exists p \in$
       $\{\lambda w': [\exists p' \in \{p_1, p_2,..., p_n\}[p'(w') = 1]]. p(w') \mid p \in \{p_1, p_2,..., p_n\}\}\, [p(w)]$
       $\equiv \lambda w.(\quad [\lambda w' : [p_1(w') \vee p_2(w') \vee...\vee p_n(w')].p_1(w')](w)$
       $\qquad\quad \vee\, [\lambda w' : [p_1(w') \vee p_2(w') \vee...\vee p_n(w')].p_2(w')](w)$
       $\qquad\quad \vee...$
       $\qquad\quad \vee\, [\lambda w' : [p_1(w') \vee p_2(w') \vee...\vee p_n(w')].p_n(w')](w))$
       $\equiv \lambda w : \quad [p_1(w) \vee p_2(w) \vee...\vee p_n(w)].p_1(w) \vee p_2(w) \vee...\vee p_n(w)$
       $\qquad\qquad$ (Given the existential presupposition projection out of disjunction)

Hence, applying the existential closure to a *wh* + *ka* clause results in a trivial statement that can only be true if it is defined at all. Following Barwise & Cooper (1981) and Gajewski (2002), I assume that systematic triviality arising from logical vocabulary results in ungrammaticality. This accounts for the ungrammaticality of *wh* + *ka* clauses under proposition-embedding predicates, as in (56) above. The type-mismatch between a set-incompatible predicate and a *wh* + *ka* clause forces existential closure to the embedded clause, but it would necessarily result in triviality, which in turn would lead to ungrammaticality.[21]

Next, let us look at the case where *wh* + *ka* is non-clausal, as in (61–62). As we will see, our presuppositional denotation for *ka* in (63) accounts for the existential presupposition, but the resulting sentential meaning involving the existential closure $\exists$ is *non-trivial*, unlike the clausal case. I will show this by compositionally deriving the denotation of the sentence *dono hannin-ka-ga hashitta* 'which-culprit-KA ran'.

First, the alt-value of a *wh*-phrase with a restriction like *dono hannin* 'which culprit' is analyzed as a set of individual concepts that presuppose that the individual satisfies the restriction, as follows:[22]

(66)   a. $[\![\text{dono hannin}]\!]^o = $ undefined
       b. $[\![\text{dono hannin}]\!]^{alt} = \{\lambda w: \mathbf{culprit}(x)(w). x \mid x \in D_e\}$

---

[20] At this point, it is not crucial that the presupposition triggered by *ka* projects *existentially* as opposed to *universally* out of an existential quantification since the presupposition of all disjuncts in (65) are equivalent. The assumption of existential presupposition projection becomes crucial when we deal with *ka*-disjunctions below.

[21] See Theiler et al. (2016) and Mayr (2017) for similar recent accounts of the ungrammaticality of interrogative complements under *anti-rogative* predicates such as *believe* and *think* in English. Their analysis, too, is based on triviality with respect to a presupposition. Only, the source of the presupposition for them is the neg-raising property of the embedding predicate whereas it is $\exists$ in the current analysis.

[22] This means that the denotations of *dare* 'who' in (30) is also modified as follows:

(i)   a. $[\![\text{dare}]\!]^o = $ undefined
      b. $[\![\text{dare}]\!]^{alt} = \{\lambda w: \mathbf{human}(x)(w). x \mid x \in D_e\}$

Applying the presuppositional version of *ka* to (66) gives us the following denotation in (67) as the o-value. The denotation is simplified, with the assumption that $D_e = \{d_1, d_2, \ldots, d_n\}$.[23]

(67)　　$[\![\text{[dono hannin] ka}]\!]^o =$
　　　　$\{\lambda w\colon [\exists c \in \{\lambda w'\colon \mathbf{culp}(x)(w').\, x \mid x \in D_e\}[c(w') \text{ is def.} \wedge c(w') \neq 0]].\, c'(w)$
　　　　　　　　　　　　　$\mid c' \in \{\lambda w''\colon \mathbf{culp}(x')(w'').\, x' \mid x' \in D_e\}\}$
　　　　$\equiv \{\lambda w'\colon \mathbf{culp}(d_1)(w').\, d_1, \lambda w'\colon \mathbf{culp}(d_2)(w').d_2, \ldots, \lambda w'\colon \mathbf{culp}(d_n)(w').\, d_n\}$

Applying the existential closure in (46) to this set of individual concepts gives us (68), which can then be applied to the revised denotation of the verb in (69) to derive the (partial) propositional denotation in (70).

(68)　　$[\![\text{[[dono hannin] ka] } \exists]\!]^o$
　　　　$= \lambda P_{\langle se, p\rangle} \lambda w.(P(\lambda w'\colon \mathbf{culp}(d_1)(w').d_1)(w) \vee$
　　　　　　　　$P(\lambda w'\colon \mathbf{culp}(d_2)(w').d_2)(w) \vee$
　　　　　　　　$\ldots \vee$
　　　　　　　　$P(\lambda w'\colon \mathbf{culp}(d_3)(w').d_3)(w))$

(69)　　$[\![\text{hashitta}]\!]^o = \lambda c_{\langle s,e\rangle}\, \lambda w.\mathbf{ran}(c(w))(w)$

(70)　　$[\![\text{[[[dono hannin] ka } \exists] \text{ hashitta}]\!]^o$
　　　　$= \lambda w.(\mathbf{ran}([\lambda w'\colon \mathbf{culp}(d_1)(w').d_1](w))(w) \vee$
　　　　　　$\mathbf{ran}([\lambda w'\colon \mathbf{culp}(d_2)(w').d_2](w))(w) \vee$
　　　　　　$\ldots \vee$
　　　　　　$\mathbf{ran}([\lambda w'\colon \mathbf{culp}(d_n)(w').d_n](w))(w))$

The resulting proposition in (70) is defined for w only if there is some culprit (of the relevant incident) in w (again assuming the existential presupposition projection), and asserts that at least one of the culprits in w ran. Thus, this analysis captures the existential presupposition for the non-clausal *wh + ka* observed above. Furthermore, unlike the clausal case, the resulting sentential meaning including the existential closure $\exists$ is non-trivial since the presupposition states the non-emptiness of the restriction (the set of culprits) while the assertion states the non-emptiness of the intersection of the restriction and the scope (the set of culprits who ran). This captures the grammaticality of non-clausal *wh + ka*.

4.2　ka-disjunction under proposition-taking predicates

The account for the ungrammaticality of *ka*-ending clauses under proposition-embedding predicates discussed above also applies to *ka*-disjunctions. For example, the ungrammaticality of (71) is accounted for as the result of the triviality arising from the combination of the existential presupposition of the *wh + ka* clauses and the existential closure.

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[23] In (67), each proposition in the set looks like the following:

(i)　$\lambda w'\colon$
　　　$[\exists c \in \{\lambda w\colon \mathbf{culp}(d_1)(w).d_1, \lambda w\colon \mathbf{culp}(d_2)(w).d_2, \ldots, \lambda w\colon \mathbf{culp}(d_n)(w).d_n\}[c(w') \text{ is def.}]].$
　　　　　　　　　　　　　　　　　　　　　　　$[\lambda w''\colon \mathbf{culp}(d_i)(w'').d_i](w')$

A part of the presupposition of this proposition contributed by $\exists c \in \{\lambda w\colon \mathbf{culp}(d_1)(w).d_1, \lambda w\colon \mathbf{culp}(d_2)(w). d_2, \ldots, \lambda w\colon \mathbf{culp}(d_n)(w).d_n\}[c(w') \text{ is def.}]$ is always satisfied if the presupposition contributed by $\mathbf{culp}(d_i)(w')$ is satisfied. Thus (i) can be simplified as follows.

(ii)　$\lambda w'\colon\mathbf{culp}(d_i)(w').d_i$

(71) *Taro-wa [Hanako-ga   hashitta-ka ∅ Jiro-ga   hashitta-ka C$_{int}$ ∃] shinjiteiru.
      Taro-TOP Hanako-NOM ran-KA   or Jiro-NOM ran-KA   believe
      Intended: 'Taro believes that either Hanako ran or Jiro ran.'

Given the presuppositional denotation of *ka* in (63), the o-value of the embedded alternative question in (71) would look like the following:

(72) ⟦[Hanako-ga hashitta-ka ∅ Jiro-ga hashitta-ka] C$_{int}$⟧^{o}
      $= \{\lambda w : \mathbf{ran}(\mathbf{h})(w).\mathbf{ran}(\mathbf{h})(w), \lambda w : \mathbf{ran}(\mathbf{j})(w).\mathbf{ran}(\mathbf{j})(w)\}$

Applying the existential closure to (72) results in the following proposition, again, assuming the existential presupposition projection.

(73) ⟦[Hanako-ga hashitta-ka ∅ Jiro-ga hashitta-ka] C$_{int}$ ∃⟧^{o}
      $= \lambda w : [\mathbf{ran}(\mathbf{h})(w) \vee \mathbf{ran}(\mathbf{j})(w)].$
      $\exists p \in \{\lambda w : \mathbf{ran}(\mathbf{h})(w').\mathbf{ran}(\mathbf{h})(w'), \lambda w : \mathbf{ran}(\mathbf{j})(w').\mathbf{ran}(\mathbf{j})(w')\}[p(w)]$

Just as in the *wh* + *ka* case, this proposition is true whenever its presupposition is met. Thus, we have systematic logical triviality leading to ungrammaticality.[24]

On the other hand, when the existential closure is applied at the non-clausal level, we get a non-trivial meaning, as exemplified in the following.[25]

(74) a. ⟦[Hanako-ka ∅ Jiro-ka]⟧$^o = \{\lambda w'.\mathbf{h}, \lambda w'.\mathbf{j}\}$
      b. ⟦[Hanako-ka ∅ Jiro-ka] ∃⟧$^o = \lambda P_{\langle se,st\rangle}\lambda w.[P(\lambda w'.\mathbf{h})(w) \vee P(\lambda w'.\mathbf{j})(w)]$
      c. ⟦[[Hanako-ka ∅ Jiro-ka] ∃] hashitta⟧$^o = \lambda w.[\mathbf{ran}(\mathbf{h})(w) \vee \mathbf{ran}(\mathbf{j})(w)]$

Thus, the parallelism between *wh* + *ka* and *ka*-disjunctions manifests itself here as well.

4.3 Accounting for the behavior of coordinators

In §2.4 above, I introduced phonologically explicit disjunctive coordinators that can appear between *ka*-phrases. In particular, I discussed the restricted distributions of *matawa* and *soretomo*. Below is the summary of the behaviors of these two coordinators.

(75) a. *matawa* appears in sub-clausal *ka*-disjunctions. It also appears in clausal
          ka-disjunctions when embedded under the copula *da*. A *ka*-disjunction with
          matawa is always interpreted as a declarative disjunction.
      b. *soretomo* appears only in clausal *ka*-disjunctions. A *ka*-disjunction with
          soretomo is always interpreted as an AltQ.

We now have necessary ingredients to account for these different behaviors of coordinators, except for the case involving the copula *da*. Given the current analysis, they can be accounted for as consequences of different *syntactic features* of these operators while they share the semantics of the J-head introduced in the previous section, i.e., (52) repeated below.

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[24] One might wonder if the question denotation in (72) already results in triviality as each of its members are trivial, thus incorrectly predicting the ungrammaticality of an AltQ (without the existential closure). This apparent problem can be resolved by clarifying the conditions of triviality in assertions and questions in the following way:

(i) a. An assertion *A* is trivial iff ⟦*A*⟧ is necessarily true if it is defined or necessarily false if it is defined.
     b. A question *Q* is trivial iff ⟦*Q*⟧ is necessarily resolved if it is defined.

According to this, the question in (72) is non-trivial since it is not necessarily resolved even if its presupposition, $\mathbf{ran}(\mathbf{h})(w) \vee \mathbf{ran}(\mathbf{j})(w)$, is met.

[25] Here, it is assumed that the intension of a proper name is a constant individual concept.

(52) a. $[\![J]\!]^o = \lambda X_{\{\sigma\}} \lambda Y_{\{\sigma\}}.X \cup Y$
      b. $[\![J]\!]^{alt} = \{\lambda X_{\{\sigma\}} \lambda Y_{\{\sigma\}}.\{\iota X \sqcup \iota Y\}\}$

Specifically, I will treat *matawa* as requiring an agreement with the declarative complementizer C_{decl} while *soretomo* as requiring an agreement with the interrogative complementizer C_{int}.[26] What is also crucial in the account is the semantic denotations of the declarative and interrogative complementizers, repeated below from Section 3.1.2:

(76) a. $[\![C_{decl}]\!]^o = \lambda p_p.p$
      b. $[\![C_{int}]\!]^o = \lambda Q_{\{p\}}: |Q| > 1.Q$

In the following, I will illustrate how these assumptions lead to an account of the behaviors of the coordinators summarized in (75).

First, the fact that *soretomo* can only appear in clausal *ka*-disjunctions follows from the requirement that it has to agree with C_{int}. Since C_{int} selects for a set of propositions in the o-value, a clause involving a *ka*-disjunction with *soretomo* has to denote a set of proposition. Given the mechanism of existential closure introduced in the previous section, this can only happen when the *ka*-disjunction is clausal. Also, it is a natural consequence of this that a *ka*-disjunction with *soretomo* denotes an AltQ.[27]

If we set aside the copula *da* for now, the fact that *matawa* only appears in sub-clausal *ka*-disjunctions is also expected from the agreement requirement. The agreement ensures that a *ka*-disjunction with *matawa* is in a CP headed by C_{decl}, which requires its complement to denote a proposition. This requirement is satisfied by an application of $\exists$ to the set of alternatives denoted by the *ka*-disjunction. If the disjunction has a sub-clausal size, then $\exists$ is applied before it is combined with a set-incompatible predicate. If the disjunction is clausal, then $\exists$ has to be applied at the clausal level before it is combined with C_{decl}. However, the latter is impossible due to the reasons described in the previous subsections. Therefore, the fact that the interpretation of a *ka*-disjunction with *matawa* is always that of declarative disjunction follows from the need for the existential closure.

As for the phonologically null coordinator $\varnothing$, I will treat it as having an underspecified agreement specification. Thus, it can appear in CPs headed by C_{decl} or C_{int}. In the former case, an existential closure is required somewhere in the sub-clausal domain, and this leads to a declarative disjunction interpretation. The latter case leads to an AltQ interpretation with clausal disjunction.

As discussed in §2.4, the empirical pattern is in fact more involved if we look closely at the case where the copula *da* is present in the sentence-final position. For example, we find cases where a clausal *ka*-disjunction with *matawa* functions as a declarative disjunction when there is a sentence-final copula *da*:

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[26] The exact syntactic implementation of the agreement is not essential to the account, but an example of the implementation following the minimalist treatment of agreement between *wh*-word and the interrogative complementizer (Chomsky 2000; Kratzer & Shimoyama 2002) would look like the following:

  (i) C_{int} has an uninterpretable feature [iQ], and *soretomo* has a corresponding interpretable feature [iQ].

[27] A *wh*-question cannot be disjoined with $\varnothing$ or *soretomo*:

  (i) *Dare-ga   kuruma-o motteru-ka $\varnothing$/soretomo doko-de kuruma-o kari-rareru-ka oshiete
        who-NOM car-ACC   have-KA   or   where-in car-ACC rent-can-KA   tell
        Intended: 'Who has a car, or where can we rent a car?'

  As the English translations (adopted from an example in Ciardelli et al. 2015) suggest, there is no semantic or pragmatic anomaly with the semantic content itself (contra e.g., Szabolcsi 2015a). This suggests that the unacceptability of (i) should be explained in terms of the lexical property of $\varnothing$/*soretomo*, e.g., the restriction that the input sets must be singletons.

(77) Hanako-ga   hashitta-ka **matawa** Jiro-ga   hashitta-ka *(**da**).
      Hanako-NOM ran-KA   or   Jiro-NOM ran-KA   COP
      'Hanako ran or Jiro ran.'

The particular behavior of *da* in (77) can be accounted for if *da* involves a presupposition accommodation operator $\mathbb{A}$ (Beaver & Krahmer 2001), as in the following:

(78) After Beaver & Krahmer (2001)
      $⟦da⟧^o = \lambda p_p. \mathbb{A}(p)$
      where $\mathbb{A}(p) := \lambda w_s.1$ iff $p(w)$ is defined $\wedge p(w) = 1$

Given the accommodation of the presupposition, the triviality predicted by the application of $\exists$ to the clause embedded by *da* in (77) is obviated, and the interpretation of the sentence comes out as a simple disjunctive statement:

(79) $⟦da⟧^o$ ($⟦$Hanako-ga hashitta-ka **matawa** Jiro-ga hashitta-ka $\exists⟧^o$)
      $= \lambda w.\mathbf{ran}(\mathbf{h})(w) \vee \mathbf{ran}(\mathbf{j})(w)$

Nevertheless, this account does not explain why a *ka*-ending *wh*-clause with *da* at the end of the sentence is ungrammatical as an existential statement.[28]

(80) *Dare-ga   hashitta-ka da.
       who-NOM   ran-KA   COP
      'Someone ran.' (Intended)

Thus, the cases involving the copula *da* remains to be a puzzle, and addressing this puzzle will probably require a more thorough investigation of the semantics of *da* in contexts other than *wh* + *ka* constructions and *ka*-disjunction, which might lead us too far afield. In order to keep the scope of the current paper manageable, I would like to leave this issue for future studies.

4.4 Apparent existential interpretation of wh+ka clausal adjuncts

In an earlier version of this paper (Uegaki 2016), it was claimed that there are cases where clausal adjuncts involving *wh* + *ka* can receive existential interpretations, and that they have to be analyzed as involving existential closure at the clausal level. The relevant examples are the following:

(81) a. [Dare-ga   kita-kara-**ka**   ] Taro-wa   yorokondeita.
              who-NOM   came-because-KA   Taro-TOP   was.happy
          'For some person *x*, because *x* came, Taro was happy, but I don't know who it is.'

      b. [Dare-ni   au-tame-**ka**   ] Taro-wa   hayaku daigaku-ni   kita.
              who-DAT   meet-in.order.to-KA   Taro-TOP early   university-GOAL came
          'For some person *x*, to meet *x*, Taro came, but I don't know who it is.'

---

[28] It is grammatical as a predicate of a copula construction with an implicit subject, as in the following example:

(i)   A: 'What is the problem?'
      B: pro dare-ga   hashitta-ka da.
             who-NOM   ran-KA   COP
         'It is the question of who ran.'

However, this is not the interpretation we are after in (80).

In the present paper, I instead follow Tomioka & Kim (2014) and treat these data as involving a *wh-question* rather than an existential statement in the adjunct position. That is, the adjuncts in (81) do not involve existential closure. One piece of evidence for the fact that we are dealing with questions rather than existential statements in (81) is that the examples have obligatory ignorance implication. This is in contrast to examples with clear *wh*-indefinites such as those in (82), which constitute minimal pairs with (81).

(82) a. [Dare-**ka**-ga   kita-kara   ] Taro-wa   yorokondeita.
           who-KA-NOM came-because   Taro-TOP   was.happy
           'Because someone came, Taro was happy.'
           ⇏ The speaker does not know who made Taro happy.

      b. [Dare-**ka**-ni   au-tame   ] Taro-wa   hayaku daigaku-ni   kita.
           who-KA-DAT meet-in.order.to   Taro-TOP   early   university-GOAL came
           'John came early to the university to meet someone."
           ⇏ The speaker does not know who Taro came early to see.

The obligatory ignorance implication in (81) is straightforwardly accounted for under Tomioka & Kim's (2014) analysis, which treats the *wh + ka* clauses in (81) as conventionally implicating an unembedded *wh*-questions. On the other hand, the data call for further explanation if the *wh + ka* clauses are existential statements on a par with those in (82). The existential import in (81), on the other hand, can be accounted for in terms of the existential presupposition of the conventionally implicated *wh*-questions.

Thus, I conclude that the cases in (81) do not pose a challenge to the claim made in the previous sections, i.e., that existential closure at the clausal level is impossible. This does not mean that the current account is already equipped with necessary ingredients for a proper compositional analysis of (81). In particular, it remains to be seen how the *wh*-question in the adjunct position can be semantically combined with the main clause in the current setup. Although I would like to leave this question for future research, I expect no principled obstacle in incorporating Tomioka & Kim's (2014) compositional analysis in terms of (a modification of) Potts's (2005) *Comma* into the current setup.

4.5 Summary

To summarize §4, existential closure at the clausal level is impossible because the combination of the existential presupposition associated with a *wh + ka clause* and the existential closure would result in necessary triviality, which in turn would lead to ungrammaticality. The same problem does not arise in the case of *non-clausal wh + ka* since the existential presupposition and the statement resulting from existential closure would be distinct: existential presupposition amounts to non-emptiness of the restriction of the *wh*-phrase while the existential closure amounts to non-emptiness of the intersection of the restriction and the scope. The existential presupposition of *ka* also accounts for the ungrammaticality of existential closure of clausal *ka*-disjunctions. Finally, although there are cases where *ka*-ending clausal adjuncts appear to have existential interpretation, they are more straightforwardly accounted for as *wh*-questions, following Tomioka & Kim (2014).

The reader might have noticed that the presupposition-based account of the impossibility of existential closure at the clausal level proposed in this section obviates the need to call for the constraint in (48) discussed in §3.1.3, which states that ∃ is allowed only if it is necessary to resolve grammatical conflicts like a type-mismatch. This is so since the presupposition-based account explains the impossibility of existential closure at the clausal level *in general* while the account based on (48) only explains the impossibility in

an *unembedded* clause. It is an open question whether there are independent motivations for the constraint in (48).

5 Note on mo

In the literature on Japanese indeterminate pronouns, *wh* + *mo* has often been discussed in parallel to *wh* + *ka*. In Shimoyama (2006), in particular, *mo* is treated as a universal quantifier over the alternatives introduced by the *wh*-item, forming a dual with the local *ka*, which is treated as an existential quantifier. This analysis of *mo* can be preserved in the current account. That is, we have the following denotations for *mo*.

(83) a. $[\![\alpha \, \text{mo}]\!]^o = \lambda P_{\langle e,t \rangle}.\forall x \in [\![\alpha]\!]^{alt} [P(x)]$
      b. $[\![\alpha \, \text{mo}]\!]^{alt} = \{\lambda P_{\langle e,t \rangle}.\forall x \in [\![\alpha]\!]^{alt}[P(x)]\}$

An interesting consequence of this analysis is that *mo* now wouldn't be a dual with *ka*: *mo* is a universal quantifier while *ka* is an operator that copies the alt-value to the o-value. It is worth noting that a non-parallel analysis of *mo* and *ka* has already been proposed by Yatsushiro (2009), based on detailed distributional differences between the two particles.

   The particle *mo* can also be used in a coordination structure with a conjunctive interpretation, as in the following example.

(84)   Taro-mo   Jiro-mo   hashitta.
        Taro-MO   Jiro-MO   ran
        'Both Taro and Jiro ran.'

Also, when used in isolation, it functions as an additive particle:

(85)   Taro-mo   hashitta.
        Taro-MO   ran
        'Taro ran, too.'

In the literature, it is debated whether the *mo* in universal *wh* + *mo* construction is the same morpheme as the *mo* in (84–85). Hagstrom (1998) argues that the fact that *mo* is used both as a universal quantifier and an additive particle is a case of accidental homophony. On the other hand, Mitrovič & Sauerland (2014) provide evidence for the view that *mo* in two constructions are identical. In this paper, I will limit the focus to the semantics of *ka*, and stand neutral with respect to whether and how the analysis in (83) should be extended to the coordination and the additive use. See Mitrovič & Sauerland (2014) for a unified semantics for all of the uses of *mo* based on the Shimoyama-style analysis in (83), employing the Junction structure and exhaustification.

6 Problems for previous accounts

In this section, I review three previous analyses of *wh* + *ka* in the previous literature: a choice-functional analysis by Hagstrom (1998) and Slade (2011), a Hamblin-semantic analysis by Shimoyama (2006) and another choice-functional analysis by Yatsushiro (2009). I have already pointed out that the existential interpretations of *ka*-ending clauses are problematic for these analyses since they associate clause-final *ka* with a question interpretation. In this section, I focus on how the analyses deal with the other empirical focus of the current paper: the parallel between *wh* + *ka* and *ka*-disjunctions.

6.1 ka as an existential quantifier over choice-functions (Hagstrom 1998; Slade 2011)

Hagstrom (1998) analyzes *wh* + *ka* in Japanese, Sinhala and other related languages, employing the idea that *ka* is an existential quantifier over choice-functions (Reinhart 1997). According to this analysis, *ka* in *wh-ka* is always base-generated in the sister

position of the *wh*-word. Both in *wh*-questions and *wh*-indefinite constructions, this *ka* undergoes either overt or covert movement to the periphery of C, as a result of which the choice-functional variable left in the base position of *ka* is existentially bound. Here, the choice-functional variable (given an assignment) simply picks out a member of the denotation of the *wh*-word in its sister position, e.g., **people** in the case of *dare*. More specifically, when the (phonologically null) C has the feature [+int], *ka* overtly moves and forms a complex C. Due to the denotation of $C_{[+int]}$[29] and the existential quantification over the choice-functional variable, we derive the following Karttunen-style denotation for the *wh*-question *dare-ga hashitta-**ka***.

(86)　　$[\![\ [\ [\ \text{dare}\ t_i\ ]\ \text{hashitta}\ ]\ [\ C_{[+int]}\ ka_i\ ]\ ]\!] = \{p \mid \exists f\ [p = \mathbf{ran}(f\,(\mathbf{people}))]\}$

On the other hand, a non-interrogative C does not attract *ka*. However, *ka* still has to be moved covertly in order to resolve the type-mismatch. As a result, we derive an existential interpretation for the declarative sentence *dare-**ka**-ga hashitta*, as follows:

(87)　　$[\![\ [\ [\ [\ [\ \text{dare}\ t_i\ ]\ \text{hashitta}\ ]\ C_{[-int]}\ ]\ ka_i\ ]\ ]\!] \Leftrightarrow \exists f\ [\mathbf{ran}(f\,(\mathbf{people}))]$

In sum, Hagstrom (1998) attributes the difference in interpretations between a *wh*-questions and *wh*-indefinite constructions in terms of the different syntactic and semantic properties of C. The difference in the overt syntactic position of *ka* is another consequence of the different properties of C: when C is [+int], *ka* moves overtly moves to the sentence-final position; when C is [–int], *ka* covertly moves, but stays in the base-position in the overt syntax. In other words, there is no direct relationship between the position of *ka* and interpretations; the two are distinct consequences of the different properties of C. This is in contrast to my analysis, where the position of *ka* directly influences the interpretation of the sentence assigned by the compositional semantic derivation.

　Although Hagstrom (1998) does not offer an analysis of *ka*-disjunctions, Slade (2011) extends the choice-function analysis to a similar disjunctive construction in Sinhala, having the form *α-də β-də*. According to Slade (2011), a disjunction involving *α* and *β* as disjuncts have the following structure, involving multiple adjunctions to JP:

(88)
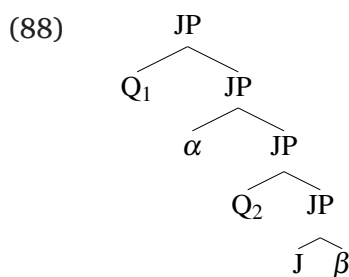
Here, Q_1 and Q_2 are Q-particles such as the Japanese *ka* and the Sinhala *də*, and are interpreted as variables over choice functions, which would be bound by existential quantifiers introduced by C. It is also assumed that the clitic alignment mechanism called Lowering appends a Q-particles to each disjunct at PF. In Sinhala, *də* surfaces in the base position both in *wh*-indeterminates and disjunctions. This fact is captured in Slade

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[29] The denotation of $C_{[+int]}$ is defined as in (i) (*c* is a type for choice functions). Since *ka* denotes a type $\langle ct, t\rangle$ existential quantifier over choice functions, we derive the meaning in (ii) for the complex complementizer $C_{[+int]}+$ka.

(i)　$[\![C_{[+int]}]\!] = \lambda Q_{\langle ct,t\rangle}\lambda P_{\langle c,t\rangle}\{p \mid Q(\lambda f_c.p = P(f)\}$

(ii)　$[\![C_{[+int]}+ka]\!] = \lambda P_{\langle c,t\rangle}\{p \mid \exists f[p = P(f)]\}$

(2011) by the fact that *də* itself (rather than its trace, as in Hagstrom 1998) denotes the choice functional variable, which would eventually be bound by C. In AltQs, the binding of the choice functions by $C_{[+\text{int}]}$ results in the Karttunen-style denotation, i.e., the set of alternative propositions.

As we extend this analysis to Japanese *ka*-disjunctions, the null hypothesis would be that the *ka* and $C_{[\pm\text{int}]}$ behave in the same way as in *wh* + *ka*. That is to say that *kas* in a disjunction are attracted by $C_{[+\text{int}]}$ and undergoes an overt movement while they undergo a covert movement under $C_{[-\text{int}]}$. It is furthermore natural to assume that the movement of *kas* is an ATB movement since a sentence with multiple occurrences of *ka* in a sentence-final position is ungrammatical:

(89)　*[Hanako matawa Jiro]-ga　hashitta-**ka-ka**.
　　　　Hanako or　　　Jiro -NOM ran-KA-KA
　　　'Hanako or Jiro ran.'

This analysis correctly captures the disjunctive interpretation of the declarative sentence in (90), which would be derived by the covert ATB movement of *ka*. However, the problem arises with (91), which would be derived by the overt ATB movement of *ka*.

(90)　[Hanako-ka (matawa) Jiro-ka]-ga　hashitta.
　　　　Hanako-KA or　　　Jiro-KA -NOM　ran
　　　'Hanako or Jiro ran.'

(91)　[Hanako (matawa) Jiro]-ga　hashitta-**ka**.
　　　　Hanako or　　　Jiro -NOM ran-KA
　　　'Is it the case that either Hanako or Jiro ran?'

The problem is that the analysis predicts an AltQ interpretation for (91), i.e., {**ran**(**h**), **ran**(**j**)}, despite the observation that the sentence only receives a YNQ interpretation.

The problem persists even if *ka* in *ka*-disjunctions do not overtly move, i.e., *ka*-disjunctions behave in the same way as *də*-disjunctions in Sinhala. In this case, there wouldn't be a problem with (91) since it wouldn't be analyzed as being derived by the overt ATB movement of *ka*. However, the problem arises with (90). We would expect (90) to allow an AltQ reading since it can involve $C_{[+\text{int}]}$, which is phonologically null, and does not attract the overt movement of *ka* by assumption. This is contrary to fact: (90) cannot be interpreted as an AltQ however it is pronounced.

6.2 Hamblin-semantic analysis (Shimoyama 2006; Beck and Kim 2006)

Another influential analysis of *wh*-indeterminates in Japanese is the Hamblin-semantic analysis offered by Shimoyama (2006). The analysis proposed in this paper, too, is an extension of Shimoyama's (2006) system. In this section, I illustrate in what respect the current analysis has advantages over a simple extension of Shimoyama's (2006) analysis to disjunctions. In Shimoyama (2006), *wh*-words introduce Hamblin alternatives which pass up the structure via PWFA. The sentence-final question particle *ka* in a *wh*-question simply returns the set of alternatives at the sentence level. On the other hand, when there is an existential particle *ka* (which Shimoyama 2006 distinguishes from the question particle *ka*) or a universal particle *mo* in a syntactic position that is more local to the *wh*-word, the alternatives denoted by the sister constituent of these particles serve as the restrictor of the quantifiers the particles denote.

Shimoyama (2006) does not discuss *ka*-disjunctions explicitly, but a natural way to extend her analysis to them would be to employ the alternative-semantic analysis of disjunctions (Kratzer & Shimoyama 2002; Alonso-Ovalle 2006; Beck & Kim 2006). The basic

idea of such an analysis would be to treat α-ka β-ka as introducing alternatives, as in the following schema:

(92) $[\![\alpha\text{-ka } \beta\text{-ka}]\!] = \{[\![\alpha]\!],[\![\beta]\!]\}$

This analysis certainly captures the AltQ interpretation of CP-sized *ka*-disjunctions, as in the following examples:

(13)   a.   [$_{CP}$ [Hanako-ga   hashitta-mitai-na-no-**ka**] [Jiro-ga
                  Hanako-NOM ran-seem-COP-GEN-KA   Jiro-NOM
            hashitta-mitai-na-no-**ka**]].
            ran-seem-COP-GEN-KA
            'Which is true: It seems that Hanako ran or it seems that Jiro ran?'

        b.   [$_{CP}$ [Hanako-ga   hashitta-daroo-**ka**] [Jiro-ga   hashitta-daroo-**ka**]].
                  Hanako-NOM ran-may.well.be-KA   Jiro-NOM ran-may.well.be-KA
            'Which is true: Hanako might well have come or Jiro might well have come?'

However, this analysis would incorrectly predict an AltQ interpretation for the following examples involving *ka*-disjunctions smaller than CPs:

(15)   [[$_{DP}$ Hanako-**ka** Jiro-**ka**]-ga   hashitta-**ka**] (oshiete).
            Hanako-KA Jiro-KA-NOM ran-KA   tell
        'Tell me whether or not Hanako ran or Jiro ran.'   (✓YNQ)
       *'Tell me which is true: Hanako ran or Jiro ran.'   (*AltQ)

(16)   [[$_{TP}$ [Hanako-ga   hashitta-**ka**] [Jiro-ga   hashitta-**ka**]] mitai-**ka**] (oshiete).
            Hanako-NOM ran-KA   Jiro-NOM ran-KA   seem-KA   tell
        'Tell me whether or not it seems to be that Hanako or Jiro ran.'   (✓YNQ)
       *'Tell me which is true: Taro saw Hanako or he saw Jiro.'   (*AltQ)

Of course, one could syntactically distinguish the *ka* in CP-sized disjunctions and in sub-CP-sized disjunctions. In fact, Shimoyama (2006) does distinguish the question particle *ka* in the complementizer position and the existential particle *ka* in syntactically more local positions. Distinguishing two kinds of *ka*-disjunctions in a similar fashion, we would have the following distinct interpretations for CP-sized *ka*-disjunctions and DP/TP-sized *ka*-disjunctions:

(93)   a. $[\![[\alpha\text{-ka}]_{CP} [\beta\text{-ka}]_{CP}]\!] = \{[\![\alpha]\!],[\![\beta]\!]\}$
        b. $[\![[\alpha\text{-ka}]_{DP/TP} [\beta\text{-ka}]_{DP/TP}]\!] = [\![\alpha]\!] \sqcup [\![\beta]\!]$

CP-sized disjunctions introduces alternatives, but DP/TP-sized disjunctions are interpreted as generalized disjunction, which does not introduce alternatives. As a result the former is interpreted as an AltQ while an interrogative embedding the latter is interpreted as an YNQ.

   This analysis would be descriptively adequate. However, the analysis would not offer principled answers to the following two questions: (i) why the syntactic size of the disjunction affects interpretations of disjunctions in the way sketched in (93); and (ii) why there is a parallel between *wh*-indeterminates and disjunctions. That is, why the way in which the syntactic size of *ka*-phrases affects interpretations is the same in *wh*-indeterminates and disjunctions. Syntactically distinguishing the two kinds of *ka*-disjunctions as in (93) does not offer an answer to the first question. Also, it is not straightforward how the

distinction in (93) follows from the distinction between the question particle *ka* and the existential particle *ka*, at least without adopting the JP-based analysis described in 3.2.

In the current analysis, these two questions are answered in principled ways. The particle *ka* has a unified analysis, encompassing both the "question particle" use and the "existential particle" use in both *wh*-indeterminates and disjunctions. The effect of the syntactic size of *ka*-phrases on interpretations is a consequence of the fact that *ka*-phrases denote sets (in their o-value) and that they have to be flattened in order to enter the semantic composition in the sub-CP level. Also, the effect is parallel between *wh*-indeterminates and disjunctions because both *wh* + *ka* and *ka*-disjunctions introduce alternatives which by themselves are interpreted as questions in the CP-level but are flattened into existential meaning in the sub-CP-level.

6.3 ka as a free variable over choice-functions (Yatsushiro 2009)

In this section, I review Yatsushiro's (2009) analysis of *wh* + *ka*. I will first discuss Yatsushiro's (2009) empirical claim that *ka* does not take scope at the surface position, and then move on to how the analysis can be extended to *ka*-disjunctions.

Yatsushiro (2009) proposes that *ka* in *wh*-indefinites is a free variable over choice-functions, which is bound by an existential closure inserted at vP, TP or CP. The primary evidence for this claim comes from the following contrast:

(94)　a.　[Dare-**ka**-no　　dono-kaban] -**mo** tsukue-no ue-ni　　aru.
　　　　　　who-KA-GEN which-bag　-MO　desk-GEN　top-LOC　be
　　　　　'Someone's every bag is on the desk.'　　　　　　　(✓∃ > ∀, *∀ > ∃)

　　　b.　[[Dare-**ka**-o　　hihanshita hito　　] -no dono-kaban] -**mo** tsukue-no
　　　　　　who-KA-ACC criticized　person -GEN　which-bag　-MO　desk-GEN
　　　　　ue-ni　　aru.
　　　　　top-LOC　be
　　　　　'Every bag of a person who criticized someone is on
　　　　　the desk.'　　　　　　　　　　　　　　　　　　(✓∃ > ∀, ✓∀ > ∃)

Yatsushiro (2009) observes that (94a) lacks an interpretation in which the universal quantifier *dono-kaban-mo* 'every bag' takes scope over the indefinite *dare-ka*, and that it only receives an interpretation in which the indefinite takes the higher scope. On the other hand, (94b) can receive an interpretation in which the universal takes the higher scope.

This is surprising, under the view that *ka* takes scope at the surface position, assuming the following structure for (94a):

(95)
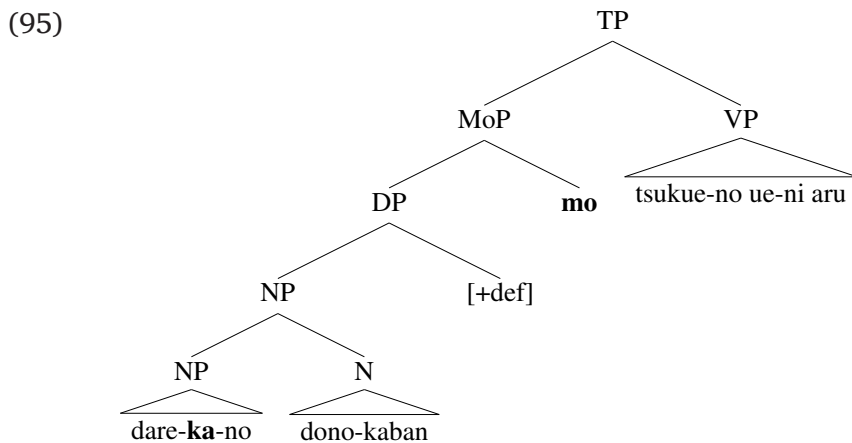
Yatsushiro (2009) argues that this puzzle can be resolved if we view *ka* as a free variable over choice functions that is bound by an existential closure at a clausal projection. In (95), the existential closure will be applied to the TP, and thus the existential quantification has to take scope over the universal quantification by *mo*. On the other hand, since (94b) involves a TP node within the subject, the existential closure can be applied there scoping below the universal quantification by *mo*.

Although the analysis proposed in the current paper also employs existential closure, it would predict that the indefinite *can* take scope below the universal in a structure like (95) since the existential closure ∃ in the current system can be applied at sub-clausal positions. Thus, if the pattern reported by Yatsushiro (2009) is systematic, it would be problematic for the current analysis. However, I claim that the contrast in (94) stems from pragmatic rather than from syntactic differences. In the following, I will explain the reasoning behind this claim.

The universal over existential interpretation of (94a) would be represented as follows:

(96) $\forall x[\mathbf{bag}(x) \wedge \exists y[\mathbf{human}(y) \wedge \mathbf{own}(y,x)] \rightarrow \mathbf{on\text{-}desk}(x)]$

This is contextually equivalent to the interpretation of the following sentence, under the normal context in which every bag is owned by someone.

(97)   Dono-kaban-**mo** tsukue-no ue-ni   aru.
        which-bag-MO   desk-GEN top-at be
        'Every bag is on the desk.'

Thus, under this normal context, a speaker who would like to convey (96) would use (97) instead of (94a), according to the Gricean principle of brevity (Grice 1975). Accordingly, a cooperative interlocutor who hears (94a) would infer that the speaker does not intend the meaning in (96), but rather the other meaning with the wide-scope indefinite.

Turning now to (94b), we see that its interpretation with the universal-over-existential scope configuration, (98), is *not* contextually equivalent to (97) under the normal context.

(98) $\forall x[\mathbf{bag}(x) \wedge \exists y \exists z[\mathbf{human}(y) \wedge \mathbf{human}(z) \wedge \mathbf{criticize}(y,z) \wedge \mathbf{own}(y,x)]$
        $\rightarrow \mathbf{on\text{-}desk}(x)]$

Under the normal context, not all bags are owned by someone who criticized some other person. Thus, there is no reason for the interlocutor to infer that the speaker of (94b) is intending another construal.

If the contrast in (94) is pragmatic in nature, as I suggest above, we should be able to construct an example that allows a narrow-scope indefinite interpretation, without recourse to a clausal structure within the subject. This is indeed the case. In the following example, the indefinite can take either wide or narrow scope with respect to the universal quantifier *mo*.

(99)   [Gakubusei dare-**ka**-no   dono-sensei   ]-**mo** kaetta.
          undergrads who-KA-GEN which-teacher -MO   went.home
          'Some undergrad's every teacher went home.'

To see that (99) has a narrow-scope indefinite interpretation consider the following context:

(100) **Context**: There is a university in Tokyo with a linguistics program, with 20 professors and 30 graduate students. There are also only three undergraduates in the program. Their names are Hanako, Ken and Takashi. Each undergraduate is taking classes from the following professors:

- Hanako: Professor Suzuki, Professor Takada
- Ken: Professor Wilson, Professor Terasawa
- Takashi: Professor Suzuki, Professor Sato

Keiko, one of the graduate students, will be TAing for a class open to undergraduates next semester, and she needs some general advices on undergraduate teaching. So, she wants to talk to some professor or other who currently has an undergraduate in their class. Keiko asks Taro if any of the professors who teaches some undergraduate is still around the department. Taro answers by (99).

Under this context, (99) can convey that *all* of the five professors who has any undergraduate in their class, i.e., Professors Suzuki, Takada, Wilson, Terasawa and Sato, have already left the department. This indicates that the sentence has an interpretation in which the indefinite takes a narrow scope with respect to the universal quantifier. If only the wide-scope indefinite interpretation is possible, the sentence would only mean the following:

(101)   Both Professors Suzuki and Takada left, or both Professors Wilson and Terasawa left, or Both professors Suzuki and Sato left.

This is certainly a possible construal of (99), but, crucially, the stronger interpretation mentioned above is also possible.

   The possibility of the narrow-scope indefinite in (99) makes sense under the pragmatic account sketched above. Since not all professors teach undergraduates, the narrow-scope indefinite interpretation of (99) does not end up contextually equivalent to 'Every professor left'. Hence, the interpretation does not get excluded on pragmatic grounds. On the other hand, the syntactic account in Yatsushiro (2009) has difficulty explaining the availability of the narrow-scope indefinite in (99) since there is no clausal projection below *mo* in (99) such that the existential closure can be applied to it.

   The fact that wide-scope indefinite is *possible* in (94, 99) might seem puzzling for the current account since the current basic setup would predict the indefinite to take scope below *mo*. However, Schwarzchild (2002) has shown that an interpretation predicted by a wide-scope indefinite can be achieved by a narrow scope *singleton indefinite*. That is, for example, if the domain of undergraduates in (99) is contextually restricted to be the singleton set of a certain student, the reading predicted by a wide-scope indefinite and the reading predicted by a narrow-scope indefinite would be truth conditionally indistinguishable. This gives rise to the appearance that the indefinite has a wide scope even with respect to the universal quantifier even if it is structurally below the universal quantifier at LF.[30]

   Next, let us move on to how Yatsushiro's (2009) analysis can be extended to *ka*-disjunctions. If *ka* in *ka*-disjunctions is also analyzed as a free variable over choice functions that is bound by an existential closure at some clausal projection, a disjunctive statement such as (102) would receive an interpretation along the lines of (103) below.

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[30] The implicit singleton domain of the indefinite can be *private* (Schwarzchild 2002: 307) to the speaker. Thus, the hearer's interpretation of (99) with the singleton indefinite can still be indeterminate with respect to the identity of the undergraduate who serves as the witness of the existential quantification.

(102) Hanako-ka ∅ Jiro-ka-ga   hashitta.
       Hanako-KA or Jiro-KA-NOM ran
       'Hanako or Jiro ran.'

(103) ∃*f*[**ran**(*f* (⟦Hanako⟧)) ∨ **ran** (*f* (⟦Jiro⟧))]

Assuming that names can denote singleton sets, and that a choice function applied to a singleton set always returns its unique member, (103) does capture the interpretation of (102). However, what is problematic is that a parallel analysis can be made for CP-sized *ka*-disjunctions, which empirically expresses an AltQ, such as the following.

(104) [Hanako-ga   hashitta-ka ∅ Jiro-ga   hashitta-ka] (oshiete).
         Hanako-NOM ran-KA   or Jiro-NOM ran-KA   tell
         'Tell me which is true: Hanako ran or Jiro ran.'

Again, assuming that the sister of *ka* is analyzed as denoting a singleton set, we would derive the following reading for (104), if we maintain the same semantics for *ka* in (104):

(105) ∃*f*[*f* ({**ran(h)**}) ∨ *f* ({**ran(j)**})]

This interpretation would be equivalent to (103), i.e., that Hanako ran or Jiro ran. This is empirically incorrect: (104) only receives an AltQ interpretation unless it is embedded under proposition-embedding operator. Hence, the precise interpretation of *ka*-disjunctions cannot be captured by the extension of Yatsushiro (2009).

7 Conclusions and cross-linguistic prospects

This paper started out with mentioning the following three research questions currently discussed in the semantics of Q-particles.

- What is shared by the semantic representations of indefinites, questions and disjunctions?
- What is the semantic contribution of the Q-particle in indefinites, questions and disjunctions?
- How are the different syntactic environments in which the Q-particle occurs mapped to the interpretations of indefinites, questions and disjunctions?

The proposed unified analysis of the Japanese Q-particle *ka* in questions, indefinites and disjunctions offers clear answers to these questions, from a language-specific point-of-view.

- Indefinites, question and disjunctions all involve **a set of alternatives** at some point in the compositional semantic derivation. These alternatives are introduced (in the alt-dimension) by a *wh*-item in questions and indefinites while they are introduced in the JP structure in disjunctions.
- The semantic contribution of the Q-particle is **to bring the set of alternatives in the alt-dimension to the o-dimension**.
- The phrase denoting the set of alternatives in the o-dimension is interpreted differently depending on whether its syntactic environment is **set-compatible or not**. If it is, then the phrase is interpreted as a question (i.e., *wh*-question or AltQ). Otherwise, it is interpreted existentially (i.e., as an indefinite or as a declarative disjunction) through the mechanism of existential closure.

As mentioned in the introduction, note that this proposal is a conservative extension of existing proposals, which have been argued for from independent grounds. The unified analysis of indefinites and questions in terms of alternatives has been extensively defended at least since Kratzer & Shimoyama (2002), and the extension of this program to the JP structure is undertaken by Mitrovič & Sauerland (2014) and Szabolcsi (2015b). The role of Q-particle as an operator that brings the alt-value of the prejacent to the o-value is proposed by Beck (2006) and Kotek (2014), and is shown to have further positive consequences for independent empirical problems such as the interpretation of multiple *wh*-questions. There are two features of the current proposal that set it apart from previous proposals: (i) the adoption of the above semantics for the Q-particle for its *clause-internal* use, not only for its *clause-final* use; and (ii) the employment of type-compatibility and existential closure in the account of the interpretations of *ka*-ending phrases. Throughout the body of the paper, I have argued that addition of these two claims have far-reaching consequences, including a unified analysis of indefinites and *wh*-questions and an account of the parallelism between *wh* + *ka* and *ka*-disjunctions.

Finally, I will conclude by speculating on the cross-linguistic implications of the analysis. Although the primary aim of the current paper has been a language-specific one, the analysis can be potentially extended to the distribution of the Q-particle common in languages such as Sinhala and Shuri Okinawan. In these languages, the Q-particle itself is located in the vicinity[31] of the *wh*-item both in indefinites and *wh*-questions while the *wh*-question comes with a specific morphology in the clause-final verb: the *E*-suffix in Sinhala and the *ra*-suffix in Shuri Okinawan. The following Sinhala pair from Hagstrom (1998: 23) exemplifies this:

(106)   a.   mokak də wætuna.
             what   Q   fell
             'Something fell.'

        b.   mokak də wætun**e**?
             what   Q   fell-**E**
             'What fell?'

Under the current analysis, the existential interpretation of (106a) follows from the basic setup, without assuming a movement of the Q-particle *də* (contra Hagstrom 1998). On the other hand, the analysis cannot be directly extended to the question in (106b). Under the current analysis, the sub-CP position of *də* in (106b) would entail an existential closure, contrary to fact. One way to extend the analysis to this case is to posit a covert movement of the Q-particle to the clause-edge position marked by the *E*-suffix. The structure after such a covert movement would look exactly like that of modern Japanese, and the current analysis for *wh*-questions can be directly applied to it.

In fact, a covert movement of *də* to the clause-edge position in Sinhala is something that is extensively argued for based on island data (Kishimoto 1992; Hagstrom 1998). However, the analysis sketched above calls for a different semantic implementation of the movement from the one proposed in the existing literature. That is, the covert movement of *də* has to be *semantically vacuous* under the current analysis, rather than being interpreted as creating a variable-binding configuration as in Hagstrom (1998). The cross-linguistic difference between Japanese on the one hand and Sinhala and Shuri Okinawan on the other (with respect to the grammar of Q-particles) would then boil down to the

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[31] The Q-particle is not always adjacent to the *wh*-item. For example, it appears just outside of an island which contains a *wh*-item it associates with (Kishimoto 1992).

absence/presence of this semantically-vacuous covert movement of the Q-particle to the clause-edge position. Given that Premodern Japanese exhibits similar association between the *wh*-item and a verb-suffix morphology (the so-called "kakari-musubi"), the diachronic variation in the Japanese Q system might also consist in the presence and absence of this semantically-vacuous covert movement. Evaluating the full cross-linguistic and diachronic prospects of the current analysis requires further data collection and research.

Abbreviations

ACC = accusative, C_{decl} = declarative complementizer, C_{int} = interrogative complementizer, COND = conditional marker, COP = copula, DAT = dative, GEN = genitive, GOAL = goal marker, NEG = negation, NMNL = nominalizer, NOM = nominative, POL = politeness, TOP = topic marker

Acknowledgements

Competing Interests

The author has no competing interests to declare.

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