A compositional account of Japanese *ka* in Inquisitive Semantics

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1 Japanese *ka*

- The multifunctional particle *ka* occurs in questions, indefinites, and disjunctions. This calls for a compositional treatment in inquisitive semantics (Szabolcsi 2015, Ciardelli, Groenendijk & Roelofsen 2018).

1.1 Questions

- Both yes/no and constituent questions in Japanese often contain the question particle *ka* (e.g. Kratzer & Shimoyama 2002, Szabolcsi 2015, Uegaki 2018).
- Yes/no questions can be formed directly from a declarative sentence by adding a sentence-final *ka*:

(1) John-wa ikimashita **ka**?
John-TOP went Q
'Did John go?'

- *Wh*-phrases in constituent questions remain in-situ. *Wh*-words such as *dare* and *nani* are commonly referred to as indeterminate pronouns (Shimoyama 2001).

(2) **Dare**-ga ikimashita **ka**?
Who-NOM went Q
'Who went?'

(3) John-wa **nani**-o tabemashita **ka**?
John-TOP what-ACC ate Q
'What did John eat?'

- Another use of *ka* is to turn an indeterminate pronoun (e.g. *dare*) into an indefinite:

1.2 Indefinites

(4) **Dare**-**ka**-ga ikimashita.
who-INDEF-NOM went
'Someone went.'

- *ka* is also used to mark the disjuncts of a disjunction:

1.3 Disjunctions

(5) John-**ka** Mary-**ka**-ga ikimashita.
John-DISJ Mary-DISJ-NOM went
'John or Mary went.'

- The only inquisitive semantic treatment so far is Szabolcsi (2015), which is ambitious in its scope but does not provide a compositional account.
- Uegaki (2018) is a unified compositional account but uses alternative rather than inquisitive semantics.
- Alternative semantics is well known to interact poorly with binding (Shan 2004), while inquisitive semantics presents no such problems (Ciardelli, Roelofsen & Theiler 2017).
- Here we provide novel evidence that *ka* is able to long-distance bind indeterminates, and present a compositional account.
- For illustration, we first couch our account in classical predicate logic, and switch to inquisitive semantics in the second part.

2 Long-distance binding of indeterminates by *ka*

- We start by focusing on the nature of the relationship between question-forming *ka* and indeterminates.

2.1 *Wh*-Locality Effects

- *Wh*-phrases in Japanese have been said to scope outside of islands, e.g. complex noun phrase island in (6a), adjunct island in (6b).

(6) a. Taro-wa [**dare**-ga katta mochi]-o tabemashita **ka**?
Taro-TOP who-NOM bought rice.cake-ACC ate Q
'Who is the x such that Taro ate rice cakes that x bought?'

b. Taro-wa [**dare**-ga kita-kara] kaerimashita **ka**?
Taro-TOP who-NOM came-because left Q
'Who is the x such that Taro left because x came?'

(Adapted from Shimoyama (2001))

- This poses problems for theories that assume in-situ *wh*-phrases covertly move to Spec, CP (e.g. Lasnik & Saito 1990, Hoji 1985; see also May 1985).
- But it has been claimed that *wh*-phrases resist scoping out of *wh*-islands (Nishigauchi 1986, Shimoyama 2001, 2006, Watanabe 1992).
- The following judgment is from Shimoyama (2006):

(7) Taro-wa [Yamada-ga **dare**-ni **nani**-o okutta **ka**] tazunemasita **ka**?
Taro-TOP Yamada-NOM who-DAT what-ACC sent Q asked Q

a. 'Did Taro ask what Yamada sent to whom?'
b. ?*'Who$_x$ did Taro ask what Yamada sent to x?'
c. *'What$_x$ did Taro ask to whom Yamada sent x?'
d. ?*'Who$_x$ did Taro ask whether Yamada sent what to x?'

- Shimoyama (2006) takes the scope of Japanese *wh*-phrases to be limited by *wh*-islands but by no other islands.
- This motivates her to adopt an alternative semantics analysis (Hamblin 1973, Rooth 1985), which interprets *wh*-phrases in-situ.
- The alternatives introduced by a *wh*-phrase are propagated up until C. After C, the alternatives cannot be accessed by a higher clause.

2.2 *Wh*-Locality is Not a Hard Constraint

- Shimoyama's theory is designed to rule out a matrix scope interpretation of a *wh*-phrase in an embedded question.
- But the matrix scope reading is attested, in contradiction to the generalization above: (e.g. Richards 1997, Hirotani 2003, Kitagawa 2005).

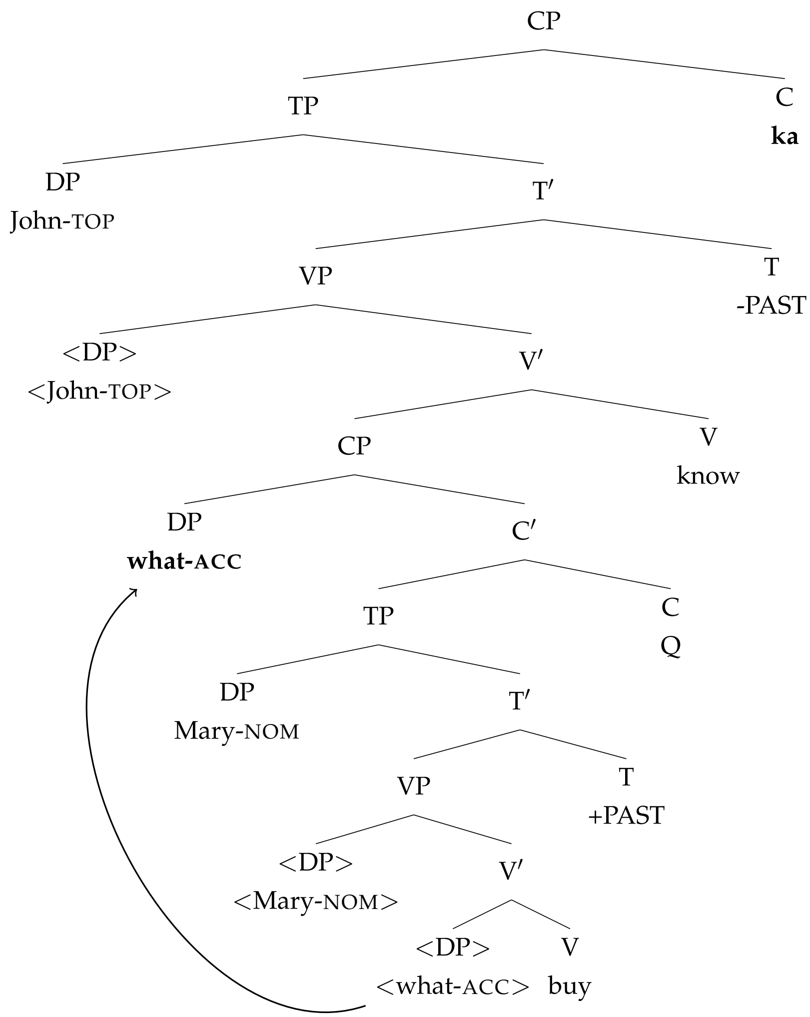
(8) John-wa [Mary-ga **nani**-o katta **ka**] shirimasu **ka**?
John-TOP Mary-NOM what-ACC bought Q know Q
'Does John know what Mary bought?' (embedded scope)
'What x does John know whether Mary bought x?' (matrix scope)

   – Notably, Hirotani (2003) presents experimental evidence that speakers of Tokyo Japanese find this reading more readily available when presented with a certain prosody.

- Shimoyama's account undergenerates the full range of possible question meanings in Japanese.

2.3 Kratzer's (2005) Local Movement

- In response to Hirotani, Kratzer (2005) implements a minor change to Shimoyama's account. Here we show that this is not sufficient.
- Kratzer suggests that the *wh*-phrase in (8) may undergo covert movement to Spec, CP.
- This gives the *wh*-phrase an escape hatch—no longer c-commanded by the embedded *ka*, its alternatives are accessible to the matrix clause.
- See below for Kratzer's (2005) covert local movement.



(9)

- This analysis does not violate the *wh*-island constraint.
- That constraint *should* be violated if we embed the *wh*-phrase under yet another island.
- In sentence (10a), the *wh*-phrase is in a complex noun phrase island. In (10b), it is in an adjunct island. Japanese consultants judged both readings to be available in each case.

(10) a. John-wa [[**nani**-o osieru sensei]-ga kitano **ka**] kikimashita **ka**?
John-TOP what-ACC teach teacher-NOM came Q asked Q
'Did John ask what the teacher who came teaches?'
'What x did John ask whether a teacher who teaches x came?'

b. John-wa [Mary-ga [**nani**-o shita ato ni] hirune shitano **ka**]
John-TOP Mary-NOM what-ACC did after LOC nap-NOM did Q
kikimashita **ka**?
asked Q

'Did John ask what x is such that Mary napped after she did x?'

'What x did John ask whether Mary napped after she did x?'

- Kratzer presents the covert local movement as subject to island constraints, so this will not account for the matrix scope readings in (10).
- This motivates a system that builds in more flexible scope-taking of *wh*-phrases.

3 A Semantics for *Wh*-phrase Binding

- In this section we develop an analysis in the spirit of Baker (1970) and Karttunen (1977), in which Q morphemes may bind any number of *wh*-phrases, similarly to unselective quantifiers (Lewis 1975).
- Shimoyama (2001) considers essentially this analysis before discarding it in favor of alternative semantics.
  - *ka* takes in a TP with 0 or more variables. After lambda abstraction, *ka* combines with the TP, resulting in a set of propositions.
  - This set contains propositions in which any variables have been substituted with actual entities in the domain.
- Individual entries for different instances of *ka*, modeled after the Q morpheme in Karttunen (1977) ...

(11) a. $[\![ka^0]\!] = \lambda A_{\langle st\rangle}\lambda p_{\langle s,t\rangle}.p = A(x) \vee (p = \lambda w_s.\neg A(w))$

b. $[\![ka^1]\!] = \lambda A_{\langle e,st\rangle}\lambda p_{\langle s,t\rangle}.(\exists x.p = A(x)) \vee (p = \lambda w_s.\neg\exists x.A(x)(w))$

c. $[\![ka^2]\!] = \lambda A_{\langle e,\langle e,st\rangle\rangle}\lambda p_{\langle s,t\rangle}.(\exists x\exists y.p = A(x)(y)) \vee (p = \lambda w_s\neg\exists x\exists y.A(x)(y)(w))$

... and so on.

- ... can be captured in this single generalized entry ($\vec{x}$ represents a series of zero or more variables).

(12) $[\![ka]\!] = \lambda A_{\langle e^n,\langle s,t\rangle\rangle}\lambda p_{\langle s,t\rangle}.(\exists\vec{x}.(p = A(\vec{x})) \vee (p = \lambda w_s.\neg\exists\vec{x}A(\vec{x})(w))$

- In this system, an indeterminate pronoun denotes a variable.
  e.g. $[\![\mathsf{dare}_1]\!] = v_1$

- In order to avoid interpreting indeterminates as ordinary pronouns, we also propose a condition on *wh*-binding:

(13) *Wh*-Binding Condition
All *wh*-phrases must be bound.

- A sample derivation with these assumptions:

(14) a. Mary-wa dare-o mimashita ka?
Mary-TOP who-ACC saw Q
'Who did Mary see?'

b. $[\![\text{Mary-wa dare}_1\text{-o mimashita}]\!]^{w,g} = \lambda w.saw_w(Mary, v_1)$

c. $[\![\text{Mary-wa dare}_1\text{-o mimashita ka}_1]\!]^{w,g} =$
$\lambda p_{\langle s,t\rangle}.(\exists x.p = \lambda w.saw_w(Mary, x)) \vee (p = \lambda w_s.\neg\exists x.\lambda w.saw_w(Mary, x)(w))$
$=$ {Mary saw Bill, Mary saw Julie...}

3.1 Derivation of Both Readings

- Using the semantics outlined above, we can now straightforwardly derive the two possible readings of question (15):

(15) John-wa [Mary-ga **nani**-o katta **ka**] shirimasu **ka**?
John-TOP Mary-NOM what-ACC bought Q know Q
'Does John know what Mary bought?' (embedded scope)
'What x does John know whether Mary bought x?' (matrix scope)

- In the embedded scope reading, the embedded *ka* binds the *wh*-phrase, and the matrix *ka* does not bind anything:
  [[...**wh**$_1$...**ka**$_1$] ka]

- In the matrix scope reading, the embedded *ka* does not bind the *wh*-phrase. It is instead bound by the matrix *ka*, which gives the phrase matrix scope:
  [[...**wh**$_1$...ka] **ka**$_1$]

- See Fig. 1 and 2 in the Appendix for full derivations.

4 Interim conclusion

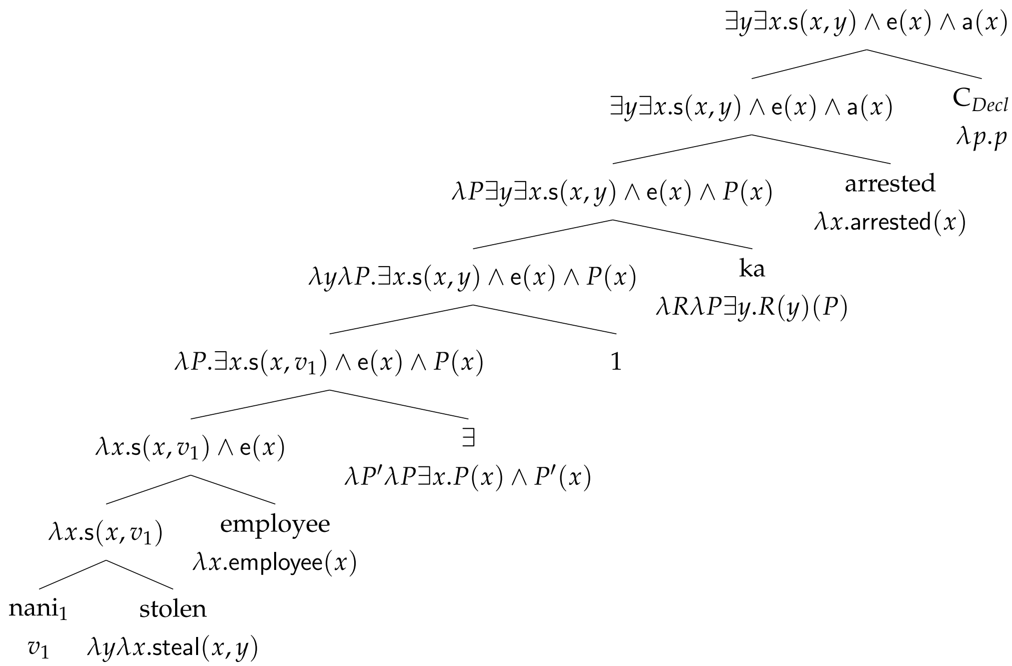
- Japanese questions have in large part motivated the use of Hamblin-Rooth style theories of questions (Shimoyama 2006, Kratzer 2005).
- Our new Japanese data is problematic for these analyses.
- In the system so far:
  1. *wh*-phrases denote variables bound by question morpheme *ka*.
  2. This question morpheme binds any number of *wh*-phrases.
- The account straightforwardly models ambiguities in Japanese questions.
- This account on its own does not explain why the matrix-scope reading of embedded *wh*-phrases is more marked.
  - But, interpretation is highly sensitive to prosodic and pragmatic factors (Hirotani 2003, Kitagawa 2005). A hard syntactic constraint is therefore not likely to provide an explanation for this.

5 Indefinites

- We have assumed that indeterminate pronouns denote variables, so that they can be nonlocally bound by Q-forming *ka*.
- This turns out to be necessary even for indefinites: the following is grammatical for some speakers (Yatsushiro 2009, Uegaki 2018):

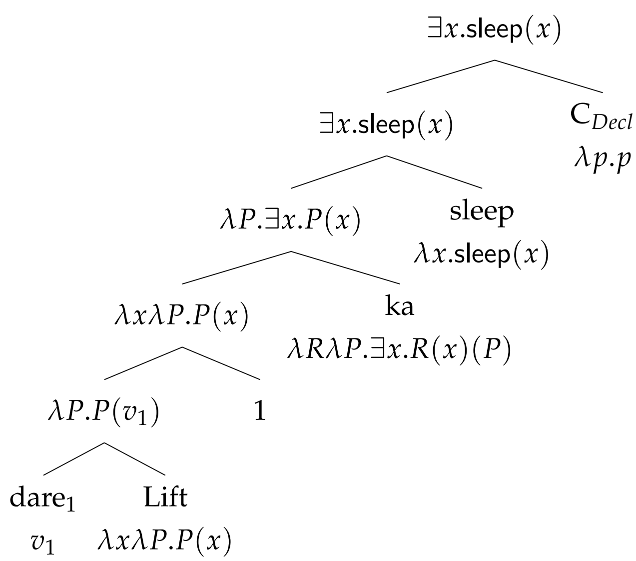
(16) [Nani-o nusunda juugyouin]-ka-ga taihosareta.
what-ACC stole employee-INDEF-NOM be.arrested
'An employee or other who had stolen something was arrested.'

- According to Uegaki (2018), whether an indeterminate is interpreted as a question word or as an indefinite depends on whether *ka* binds it from a CP or sub-CP position.
- Japanese lacks determiners, so we assume that the existential force of the (complex) subject is contributed by a silent operator ∃.
- We assume that *ka* takes scope at the edge of the noun phrase, above this operator:



- In simpler examples, we Montague-lift *dare* before we abstract over its variable. This allows us to reuse our entry for *ka*:

(17) Dare-ka-ga nemutta.
who-INDEF-NOM slept
'Someone slept.'

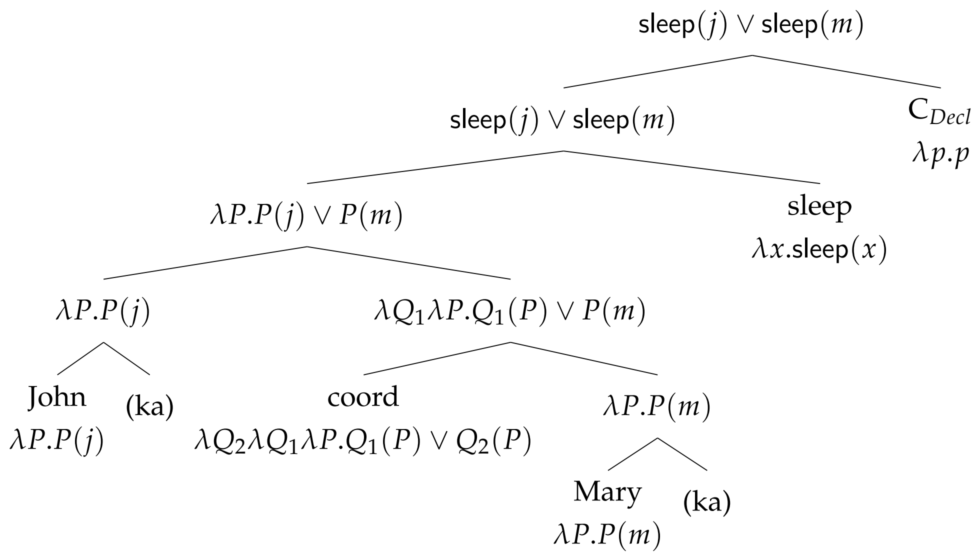


- One problem with this is that this *ka* has nothing in common with the question-forming *ka* earlier. We will get back to this point.

6 Disjunction

- Szabolcsi (2015) argues that in disjunction uses, each *ka* marks a disjunct and is itself meaningless.
- An abstract coordinator, which is licensed by the presence of *ka*, contributes semantic disjunction.
- This makes sense given that the coordinator can also be overt (Uegaki 2018).
- This can be straightforwardly implemented in the style of Partee & Rooth (1983):

(18) John-ka Mary-ka-ga nemutta.
John-*ka* Mary-*ka*-NOM slept
'John or Mary slept.'



- Again, one problem with this is that there is nothing in common between the disjunction use and the other uses of *ka*.
- Also, Uegaki (2018) observes that when two *ka*-marked CPs (as opposed to smaller constituents such as TPs or DPs) are coordinated, the result is a question. Crucially, this is the case even when these CPs are themselves declarative (19). But coordinating two of our declarative CPs would result in a disjunction, not a question.

(19) Hanako-ga hashitta-mitai-ka Jiro-ga hashitta-mitai-ka (oshiete).
Hanako-NOM ran-seem-DISJ Jiro-NOM ran-seem-DISJ tell
'(Tell me) which is true: It seems that Hanako ran or it seems that Jiro ran.'
*'(Tell me) it seems that Hanako ran or it seems that Jiro ran.'

7 Moving towards a Unified Analysis of *ka*

- Uegaki (2018) uses a Beck (2006) and Kotek (2014) style two-dimensional semantics to analyze the semantic contribution of *ka* in indefinites, disjunctions and questions.
- One issue with this: in his semantics, *ka* does not get "bound", it just introduces alternatives (as in Kratzer & Shimoyama 2002). Thus there is no handle on long-distance binding of indeterminates.
- Introducing binding into alternative semantics runs into technical issues (Shan 2004).
- Inquisitive Semantics sidesteps this issue (Ciardelli, Roelofsen & Theiler 2017).
- We start by introducing the basics of Inquisitive Montague Grammar (developed in unpublished notes since 2015 by Ivano Ciardelli, Lucas Champollion and Floris Roelofsen; similar to Ciardelli, Roelofsen & Theiler 2017).

8 Inquisitive Montague Grammar

- Inquisitive Montague Grammar (InqMG) reconstructs inquisitive semantics within the resources of Ty2 (Gallin 1975).
- We use s for the type of possible worlds, and $w, w', \ldots$ for variables over possible worlds. We model states as sets of possible worlds (type $\langle s, t\rangle$). We use $s, s' \ldots$ for variables over states. We write $p, p' \ldots$ for variables over inquisitive propositions (ie. sets of states).
- For s_0 a state (type $\langle s, t\rangle$), we write $\widehat{s_0}$ for the powerset of s_0, that is, the set of all states that entail s_0, written out as $\lambda s.s \subseteq s_0$. This predicate is of type $\langle st, t\rangle$. More generally, for any nonnegative integer n, if s_n is an $n+1$-place relation between n entities and a world, we write $\widehat{s_n}$ for the relevant relation $\lambda \vec{x} \lambda s.\ s \subseteq s_n(\vec{x})$.
- Assume that the object language contains a constant talks of type $\langle e, st\rangle$ that represents the relation that holds between an entity x and a world w iff x talks at w. We then let *talks* denote the relation that holds between an entity x and a state s iff s entails that x talks:

(20) $[\![\text{talks}]\!] = \lambda x \lambda s.s \subseteq \lambda w.\mathsf{talks}(x)(w)$ type $\langle e, \langle st, t\rangle\rangle$

- We will abbreviate the type $\langle st, t\rangle$ as T.

- Using the notation just introduced, we can write this more simply as follows:

(21) $[\![\text{talks}]\!] = \lambda x.\widehat{\mathsf{talks}}(x)$ type $\langle e, T\rangle$

- We represent proper names as constants:

(22) a. $[\![\text{John}]\!] = j$ type e
b. $[\![\text{Mary}]\!] = m$ type e

- So we have, by function application:

(23) $[\![\text{John talks}]\!] = \widehat{\mathsf{talks}}(j) = \{s \mid \forall w \in s.\ \mathsf{talks}(j)(w)\}$ type T

- We treat transitive verbs analogously: Assume a constant loves of type $\langle e, \langle e, st\rangle\rangle$ that maps any x and y to the state that x loves y. Then we represent the denotation of *loves* as follows:

(24) $[\![\text{loves}]\!] = \lambda y \lambda x \lambda s.s \subseteq \lambda w.\mathsf{loves}(x)(w)$ type $\langle e, eT\rangle$

- This can be equivalently written as:

(25) $[\![\text{loves}]\!] = \lambda y \lambda x.\widehat{\mathsf{loves}}(x)(y)$ type $\langle e, eT\rangle$

9 Connectives and quantifiers

- We assume the intersective, type-polymorphic theory of *and* (e.g. Partee & Rooth 1983). Simplifying slightly, define an inquisitive-conjoinable type as either the type T or a type $\langle \alpha, \beta\rangle$ where α is any type and β is an inquisitive-conjoinable type. Then for any inquisitive-conjoinable type τ we define:

(26) a. $[\![\text{and}]\!] = \lambda P_\tau \lambda Q_\tau.P \cap Q$ type $\langle \tau, \tau\tau\rangle$
b. $[\![\text{or}]\!] = \lambda P_\tau \lambda Q_\tau.P \cup Q$ type $\langle \tau, \tau\tau\rangle$

- As a special case, we will write $\mathbin{\rotatebox[origin=c]{180}{$\mathbb{A}$}}$ (pronounced *inquisitive or* or *i-or*) for the case where we disjoin two inquisitive propositions p and q of type T. That is, $\lambda p \lambda q \lambda s.p(s) \vee q(s)$. Similarly for $\mathbb{A}$.

- Inquisitive conjunction and disjunction share various desirable properties with ordinary conjunction and disjunction, such as idempotence and associativity.

- We assume that proper names can be lifted to generalized quantifiers (note the type):

(27) a. $[\![\text{Lift(John)}]\!] = \lambda P_{\langle e,T\rangle}.P(j)$ type $\langle eT, T\rangle$

- We assume that declarative sentences contain a silent complementizer C_{decl} that flattens meanings. This denotes the noninquisitive closure of its complement:

(28) $! \overset{\text{def}}{=} \lambda p_T.\wp(\bigcup(p)) \overset{\text{def}}{=} \lambda p_T.\lambda s_{st}.\forall w.s(w) \to \exists s'.p(s') \wedge s'(w)$ type $\langle T, T\rangle$

(29) $[\![\text{C}_{decl}]\!] = !$

- This has the following effect, familiar from the inquisitive semantic literature: Where $A \mathbin{\vee\!\!\!\vee} B$ denotes the set of all states that entail A or entail B, $!(A \mathbin{\vee\!\!\!\vee} B)$ denotes the set of all states that entail $A \vee B$, including those that do not entail one of the disjuncts.

(30) $[\![\text{C}_{decl}$ [John or Mary walk]$]\!]$
$= !(\widehat{W}(j) \mathbin{\vee\!\!\!\vee} \widehat{W}(m))$ type T
$= \lambda s_{st}.s \subseteq [\lambda w.\mathsf{W}(j)(w) \vee \mathsf{W}(m)(w)]$

- By comparison, here is what we would get if we did not apply !:

(31) $[\![$John or Mary walk$]\!]$
$= \widehat{W}(j) \mathbin{\vee\!\!\!\vee} \widehat{W}(m)$ type T
$= \lambda s_{st}.[s \subseteq \lambda w.\mathsf{W}(j)(w)] \vee [s \subseteq \lambda w.\mathsf{W}(m)(w)]$

- We define inquisitive negation, $\neg\!\!\neg$, as in basic inquisitive semantics:

(32) $\neg\!\!\neg_{\langle T,T\rangle} = \lambda p_T \lambda s.\forall s'.p(s') \to s \cap s' = \emptyset$ type $\langle T, T\rangle$

- We represent the meaning of truth-functional linguistic negation via inquisitive negation.

(33) $[\![\text{not}]\!] = \lambda p_T.\neg\!\!\neg p$ type $\langle \alpha, T\rangle$

- We write $\exists\!\!\exists x\varphi$, where φ is of type T, for $\lambda s_{\langle s,t\rangle}\exists x.\varphi(s)$.

- We write $\forall\!\!\forall x\varphi$, where φ is of type T, for $\lambda s_{\langle s,t\rangle}\forall x\varphi(s)$.

- One could also define $\exists$ and $\forall$ categorematically as $\lambda P. \bigcup_x P(x)$ and $\lambda P. \bigcap_x P(x)$.
- One can define $\vee$ as $\lambda p \lambda q. p \cup q$. This brings out the similarity with $\exists$. Similarly for $\wedge$ and $\forall$.

10 Questions

- We can formalize question-marking *ka* in InqMG, following the predicate logic entry in the first part:

(34) $[\![ka]\!] = \lambda P^n ?\exists \vec{x}.!P(\vec{x})$

- The $\exists$ introduces a different alternative for each possible value of the indeterminate pronoun(s).
- If there are no indeterminate pronouns, ? turns this into a YNQ. If there are, ? introduces an alternative for "none of the above".
- The ! in *ka* flattens alternatives before outputting an inquisitive proposition. This is necessary because disjunctions and indefinites lose their inquisitive potential under question-marking *ka*:

(35) John-ka Mary-ka-ga kita ka oshiete.
John-DISJ Mary-DISJ-NOM came Q tell
'Tell me whether either John or Mary came.' (YNQ)
*'Tell me which is true: John came or Mary came.' (AltQ)

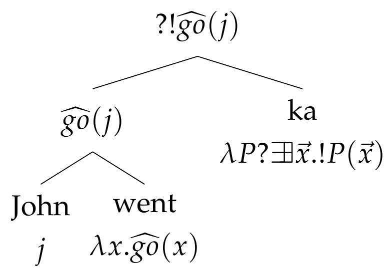
(36) Nani-ka-o katta ka oshiete.
what-INDEF-ACC bought Q tell
'Tell me whether you bought something.' (YNQ)
*'Tell me what you bought.' (ConstQ)

- That the alternatives are live before the complementizer kicks in is suggested by counterfactual antecedents, which validate SDA (Ciardelli 2016, Ciardelli, Zhang & Champollion 2018). Here the complementizer is the conditional marker.

(37) #John-ka Gojira-ka-ga kita-ra Mary-wa yorukobu-daroo.
John-DISJ Godzilla-DISJ-NOM came-if Mary-TOP be.happy-would
'If John or Godzilla came then Mary would be happy.'

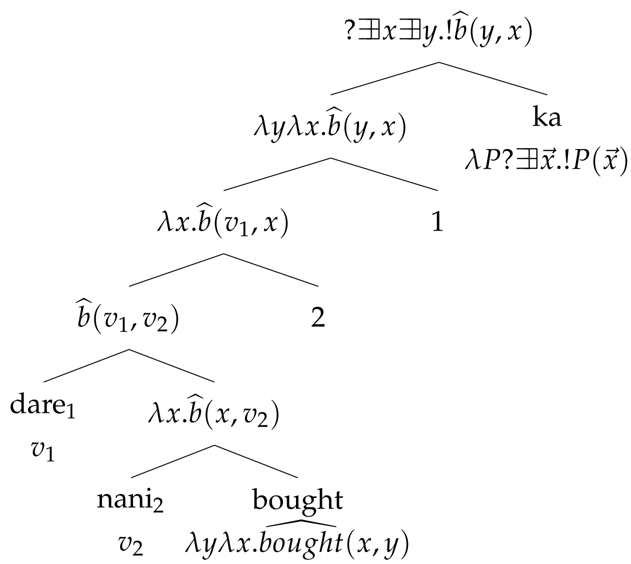
- Application to a simple yes/no question:

(38) John-wa ikimashita **ka**?
John-TOP went Q
'Did John go?'



- Application to a *wh*-question:

(39) Dare-ga nani-o kaimashita ka?
who-NOM what-ACC bought Q
'Who bought what?'



11 Embedding

- Let Dox_x^w denote the information state of x in w (the set of all worlds compatible with x's beliefs).

- Simplifying a bit, we can then give an entry for *know* (Ciardelli, Roelofsen & Theiler 2017):

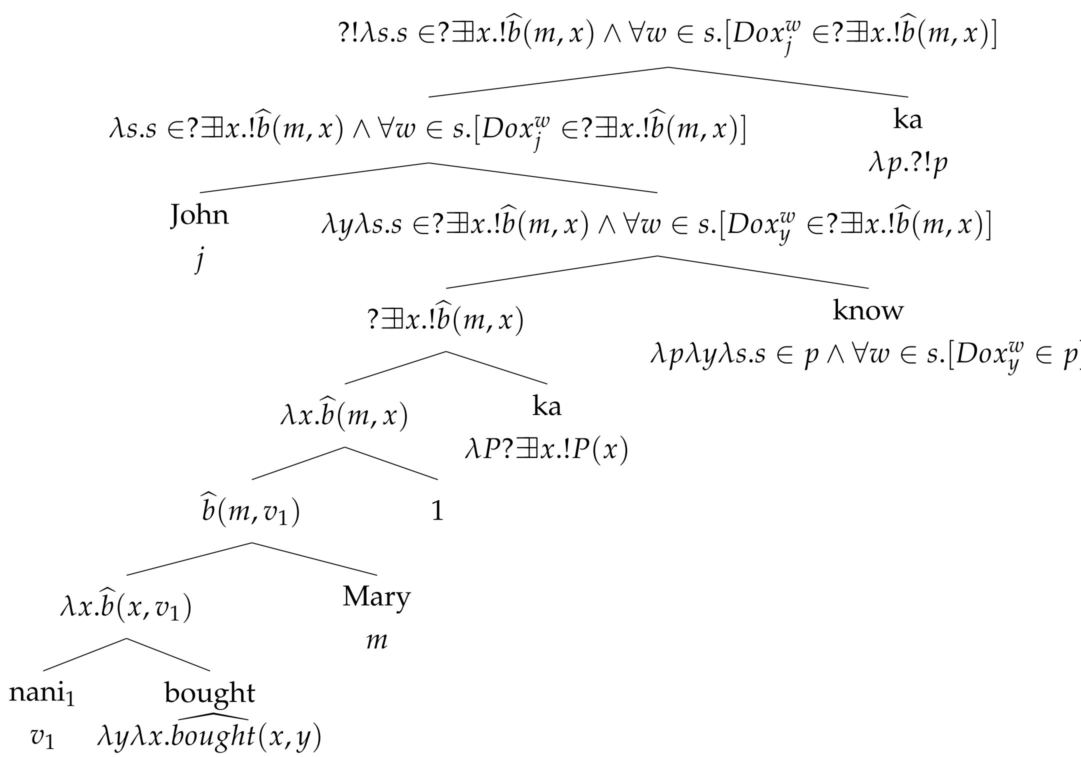
(40) $[\![\text{know}]\!] = \lambda p \lambda y \lambda s.\ s \in p \wedge \forall w \in s.[Dox_y^w \in p]$

(41)

John-wa	Mary-ga	nani$_1$-o	katta	ka$_1$	shirimasu	ka?
John-TOP	Mary-NOM	what-ACC	bought	Q	know	Q

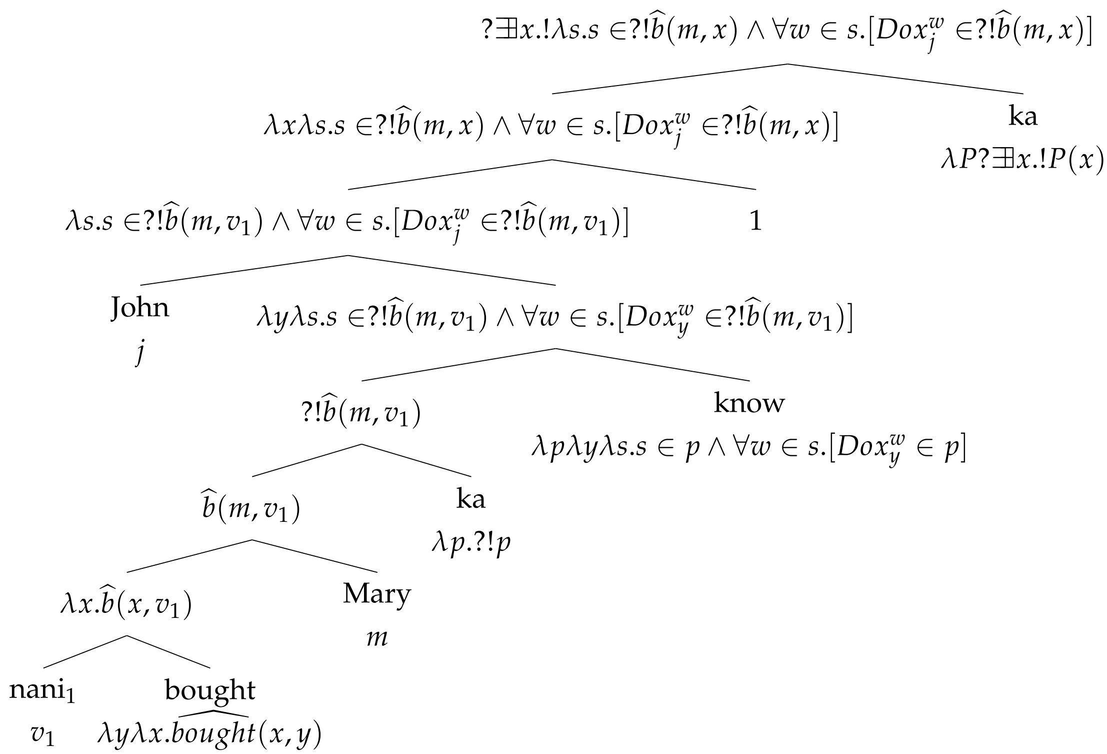
'Does John know what Mary bought?'

- Recall that our entry for question-embedding *ka* is $\lambda P ?\exists \vec{x}.!P(\vec{x})$.
- When the indeterminate is bound by the lower *ka*, that *ka* is in effect interpreted as $\lambda P ?\exists y.!P(y)$. The higher *ka* binds no variable and is in effect interpreted as $\lambda p ?!p$.



(42) John-wa Mary-ga nani$_1$-o katta ka shirimasu ka$_1$?
John-TOP Mary-NOM what-ACC bought Q know Q
'What is the x such that John knows that Mary bought x?'

- When the indeterminate is bound by the higher *ka*, it is the other way around: that *ka* is in effect interpreted as $\lambda P?\exists y.!P(y)$, and the lower *ka* as $\lambda p?!p$.



12 Indefinites

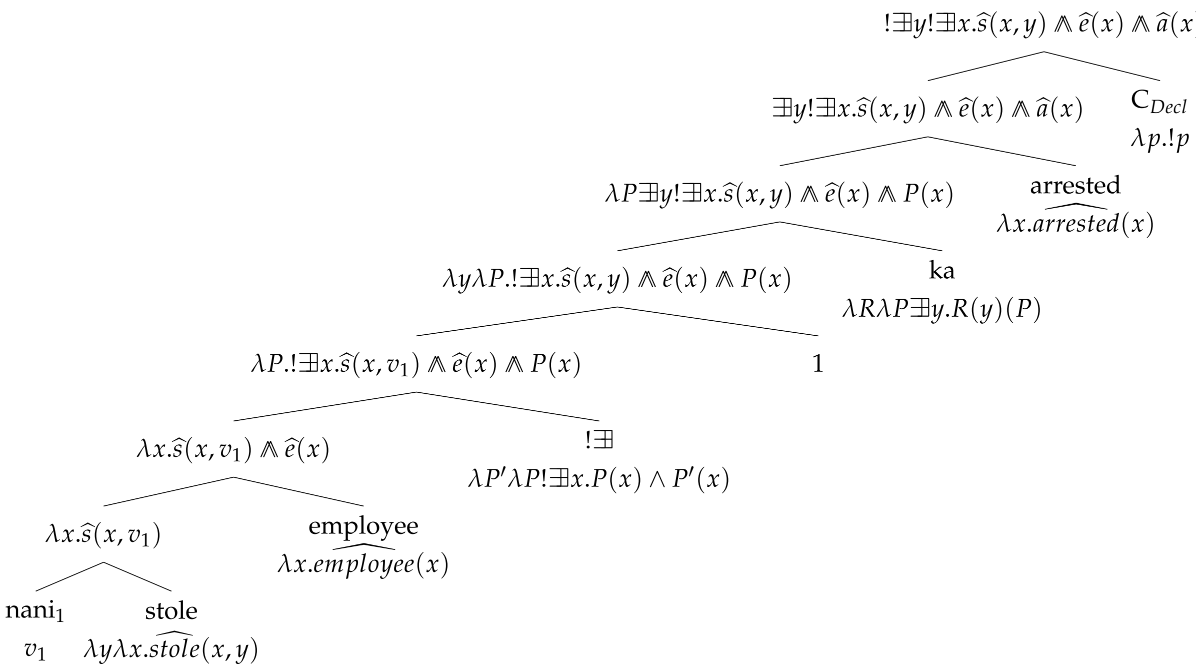
- For indefinite-forming *ka* in InqMG, we propose an entry that looks very similar to our predicate logic formalization:

(43) $[\![ka]\!] = \lambda R \lambda P \exists x.R(x)(P)$

- Derivation for non-local sub-CP *ka*-binding:

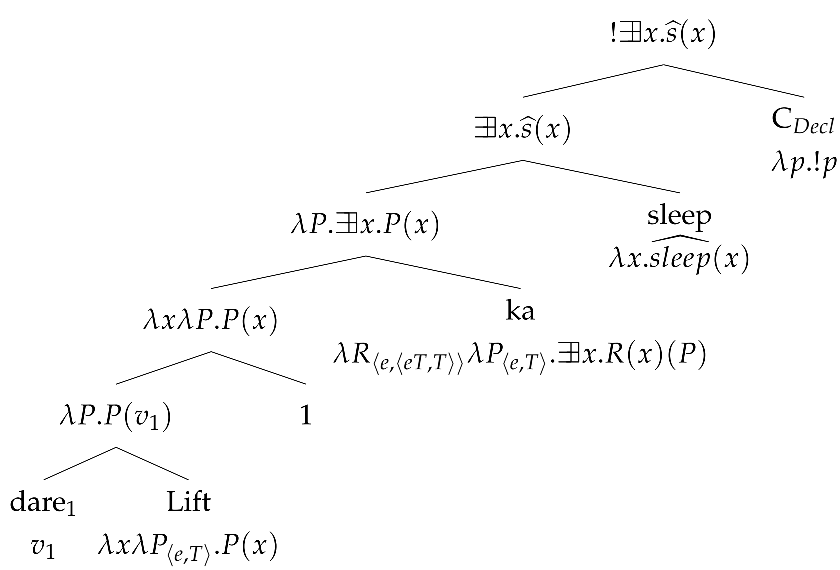
(44) [Nani-o nusunda juugyouin]-ka-ga taihosareta.
what-ACC stole employee-INDEF-NOM be.arrested
'An employee or other who had stolen something was arrested.'

- We represent the meaning of the silent indefinite that applies to the complex noun phrase as $!\exists$ and assume that it denotes $\lambda P' \lambda P ! \exists x.P(x) \Cap P'(x)$.



- As before, in a simpler indefinite, the indeterminate is lifted before *ka* applies, but this time to form an inquisitive proposition (of type T):

(45) Dare-ka-ga nemutta.
who-INDEF-NOM slept
'Someone slept.'



13 Disjunctions

- As in our predicate logic formalization, *ka* is a semantically vacuous marker of disjunction.
- We propose that the silent coordinator has the same denotation we defined for English *or*:

(46) $[\![\text{coord}]\!] = \lambda P_\tau \lambda Q_\tau . P \cup Q$

- As a special case, when it coordinates two DPs of type $\langle eT, T \rangle$, this amounts to the following:

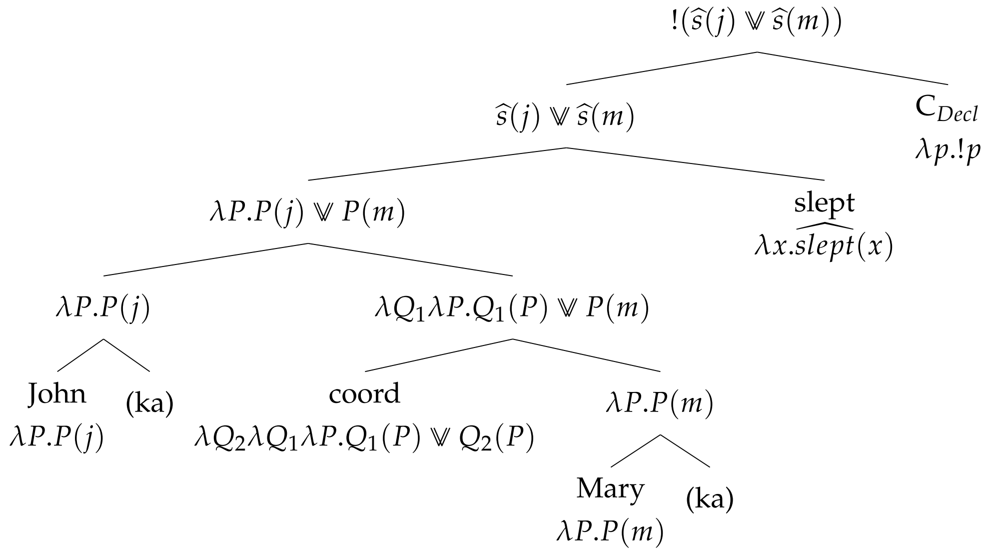
(47) $[\![\text{coord}_{DP}]\!] = \lambda Q_2 \lambda Q_1 \lambda P . Q_1(P) \Cup Q_2(P)$

- And when it coordinates two TPs or CPs of type T, we have this:

(48) $[\![\text{coord}_{CP}]\!] = \lambda q \lambda p . p \Cup q$

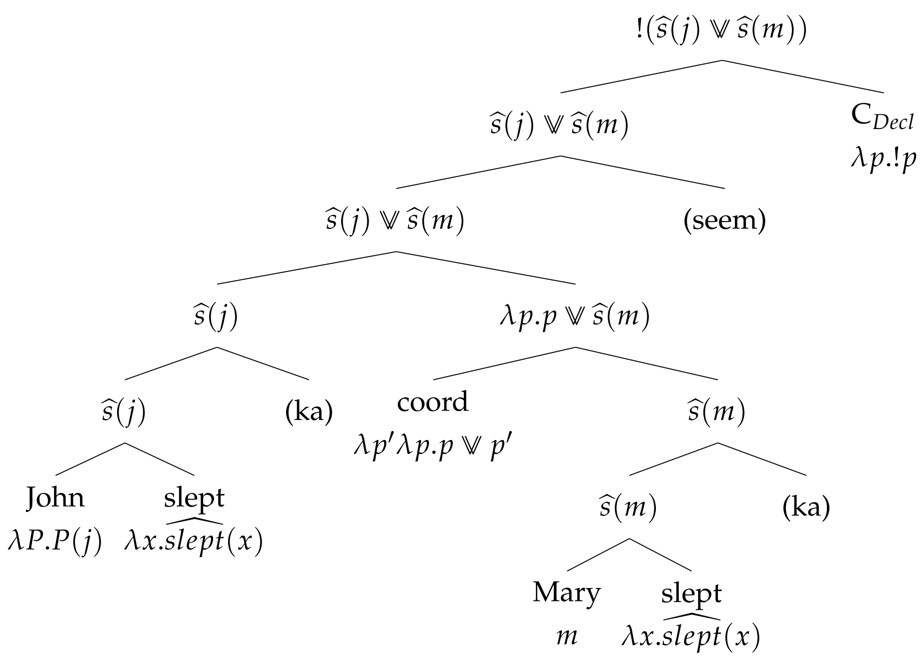
- Recall that Uegaki (2018) observes that sub-CP level disjunctions (e.g. DP, TP) are interpreted as declaratives while CP-level disjunctions are interpreted as alternative questions.
- For sub-CP level disjunction, a silent C_{decl} flattens alternatives. We illustrate this first with DP-level disjunction:

(49) [$_{DP}$[John-ka] [Mary-ka]]-ga nemutta.
John-DISJ Mary-DISJ-NOM slept
'John or Mary slept.'



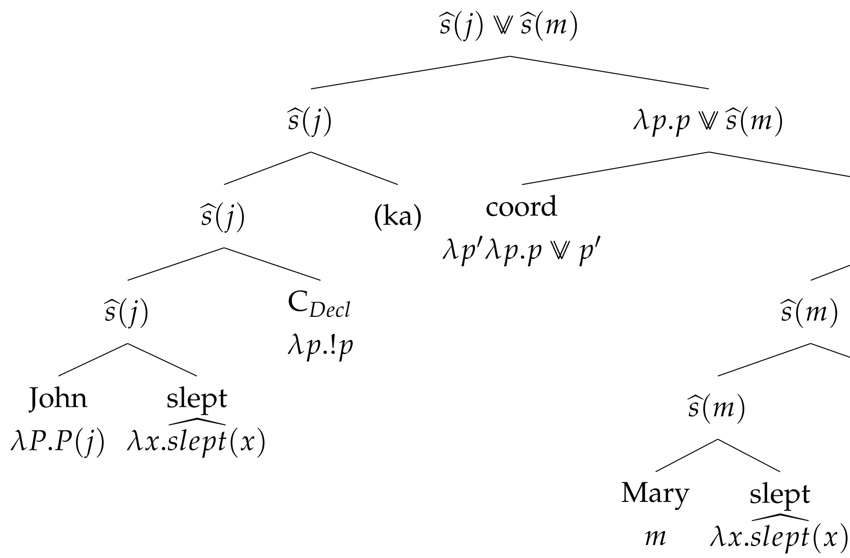
- With Uegaki (2018) and references therein, we assume that *mitai* "seems" selects for TP complements while *oshiete* "tell" selects for CP complements.
- For TP-level disjunction, a silent C_{decl} flattens the alternatives as in the DP case. We omit the contribution of *seems* here:

(50) [$_{TP}$[John-ga nemutta-ka] [Mary-ga nemutta-ka]] mitai-da.
John-NOM slept-DISJ Mary-NOM slept-DISJ seem-COP
'It seems that John slept or Mary slept.'



- In the case of CP-level disjunction, the coordinator takes in two CPs; there is no higher C_{decl} that would flatten the alternatives of the disjunction. This explains the AltQ reading:

(51) $[_{CP}$[John-ga nemutta-ka] [Mary-ga nemutta-ka]] (oshiete).
John-NOM slept-DISJ Mary-NOM slept-DISJ tell
'(Tell me) which is true: did John sleep or did Mary sleep?'



- Uegaki (2018) uses type mismatches to determine whether a disjunction has declarative or question-denoting force. Sub-CP disjunctions trigger a type shifter that collapses the two alternatives into one.

- It is not clear to us how this distinguishes TP- from CP-level disjunction since the two have the same type.

14 Conclusion

- Our predicate logic denotations for *ka* did not appear to have much in common:

(52) Question-marking: $[\![ka]\!] =$
$\lambda A_{\langle e^n, \langle s,t \rangle \rangle} \lambda p_{\langle s,t \rangle}.(\exists \vec{x}.(p = A(\vec{x})) \vee (p = \lambda w_s.\neg \exists \vec{x} A(\vec{x})(w))$

(53) Indefinite-marking: $[\![ka]\!] = \lambda R \lambda P \exists y.R(y)(P)$

(54) Disjunction: $\lambda Q_2 \lambda Q_1 \lambda P.Q_1(P) \vee Q_2(P)$

- It is not obvious what the first has in common with the second and third.
- Our InqMG denotations for *ka* all contribute inquisitive meaning:

(55) Question-marking: $[\![ka]\!] = \lambda P^n ?\exists\vec{x}.!P(\vec{x})$

(56) Indefinite-marking: $[\![ka]\!] = \lambda R \lambda P \exists x.R(x)(P)$

(57) Disjunction: $[\![\text{coord}]\!] = \lambda P_\tau \lambda Q_\tau . P \cup Q$ (presence indicated by *ka* on the disjuncts)

- Recall that one can define $\mathbb{V}$ as $\lambda p \lambda q.p \cup q$ and $\exists$ as $\lambda P. \bigcup_x P(x)$.
- So have we achieved a unified treatment?
- We have improved on the first part by making question-forming *ka* similar to the others in that they are now all defined in terms of union. This is in the spirit of InqSem.
- The remaining differences are due to two factors:
  - In the case of disjunction, we may have two *ka* rather than one as one might expect from English. We have followed Szabolcsi (2015) and assumed that there is underlyingly just one coordinator.
  - For indefinites, we have generalized from the worst case: the nonlocal indefinite formation. But aside from this, even for simple cases, it does not seem easy to reuse the question-marking or disjunction entry without changes.
- Ordinary predicate logic does not allow us to even come up with a unified kernel for this multifunctional particle. Inquisitive semantics holds out the promise that this might be possible, and inquisitive Montague Grammar provides the resources for modeling nonlocal binding cases.
- The question whether a fully unified and compositionally explicit account in inquisitive semantics is possible remains open.

15 Appendix

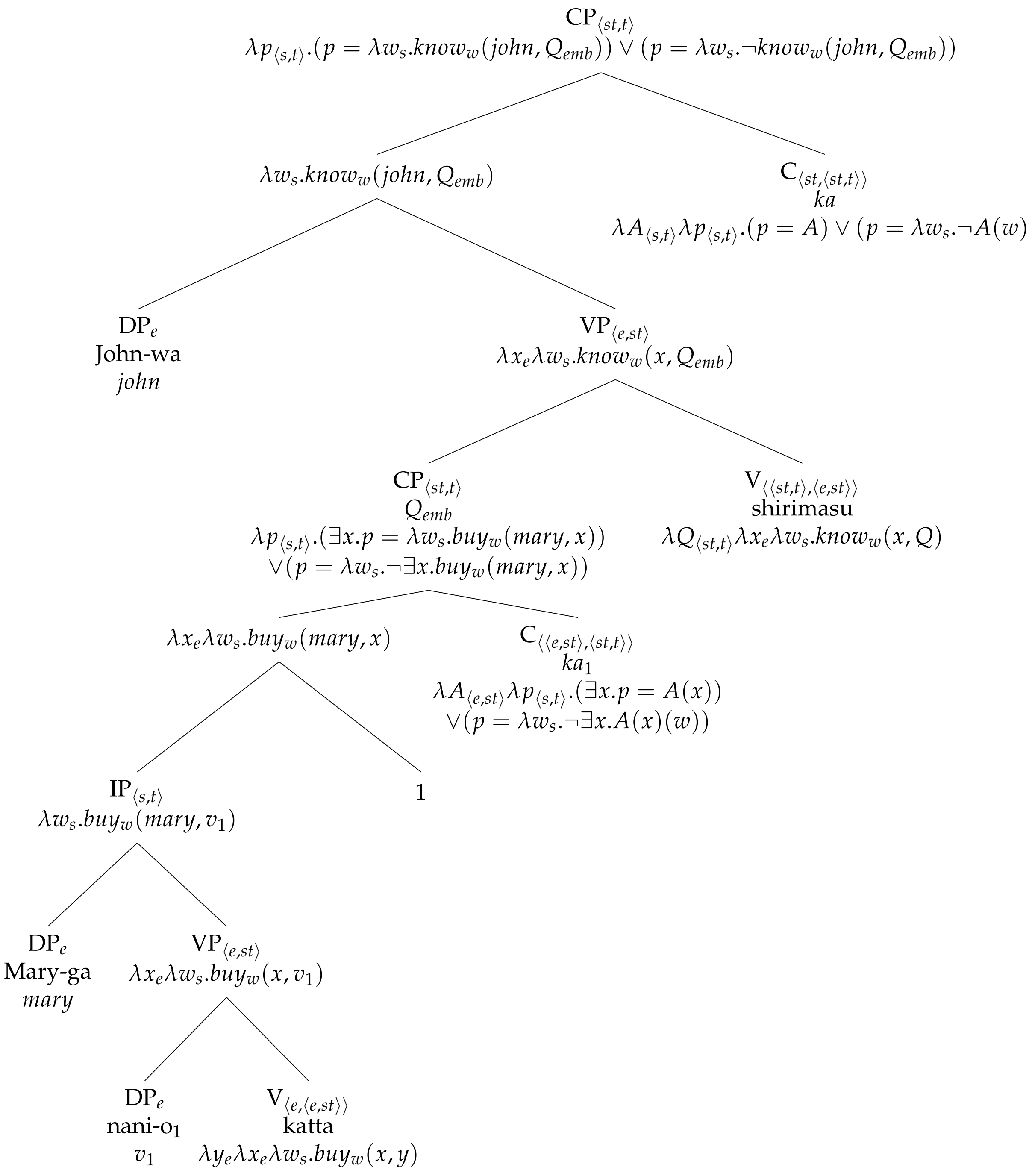


Figure 1: Predicate logic derivation of embedded scope reading for (15)

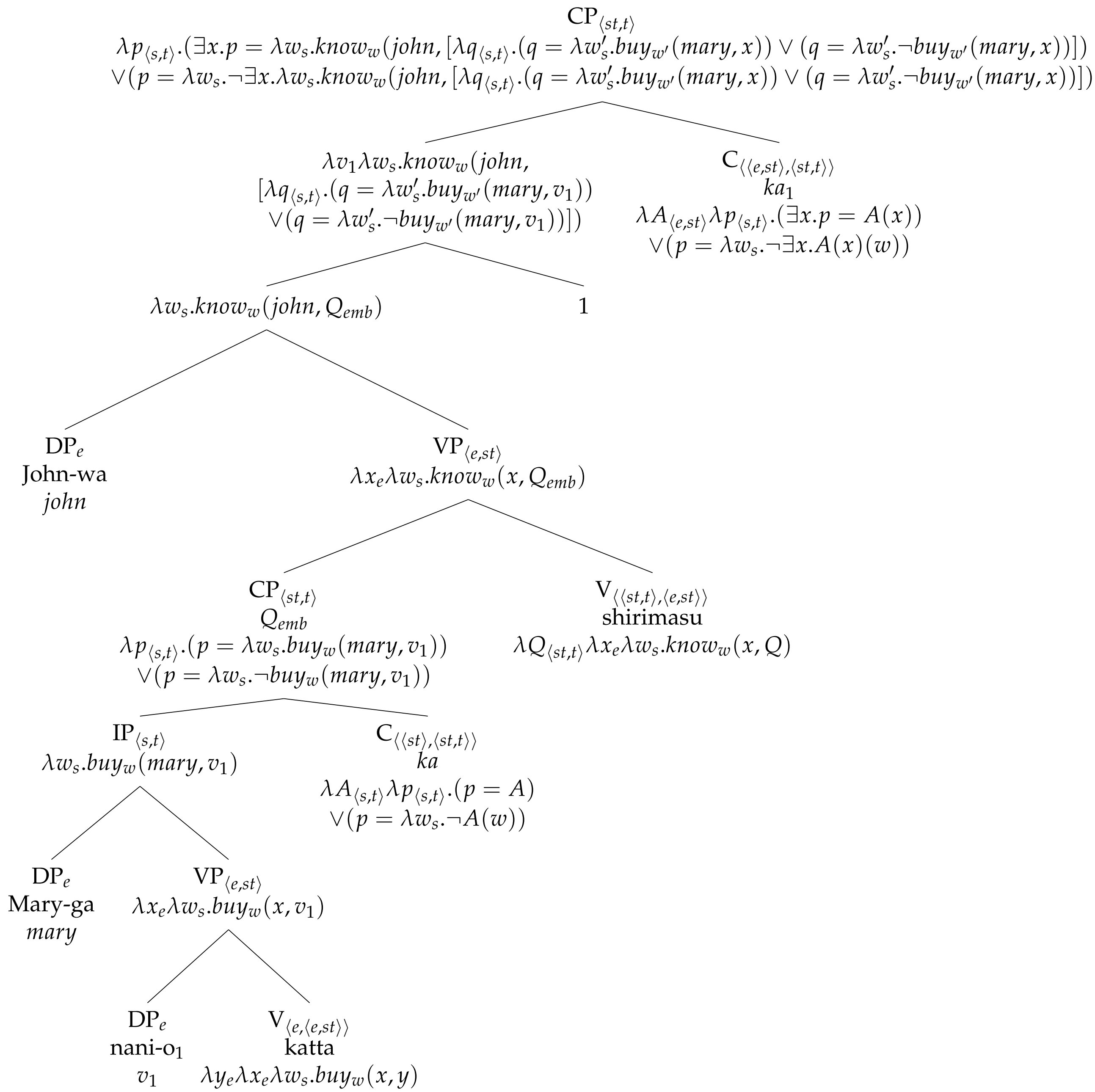


Figure 2: Predicate logic derivation of matrix scope reading for (15)

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