A Compositional Account of Japanese *ka* in Inquisitive Semantics

Summary The multifunctional Japanese particle *ka* occurs in questions, indefinites, and disjunctions. This calls for a compositional treatment in inquisitive semantics, where these three items form a natural class (Ciardelli, Groenendijk & Roelofsen 2018). Our central insight is that *ka* in all its guises can be understood in terms of inquisitive union plus conditional inquisitive closure.

Facts Questions can be formed directly from a declarative sentence by adding a sentence-final *ka* (see (1)). Any *wh*-phrases remain in-situ; typical *wh*-phrases are indeterminates such as *dare* "who" and *nani* "what" (see (2)). Another use of *ka* is to turn an indeterminate into an indefinite (see (3)). Finally, *ka* is also used to mark the disjuncts of a disjunction (see (4)).

Previous work The only inquisitive semantic treatment so far, Szabolcsi (2015), is ambitious in its scope but does not include a compositional account. The most comprehensive compositional account so far, Uegaki (2018), uses alternative rather than inquisitive semantics. Alternative semantics has been claimed to interact poorly with binding (Shan 2004, though see Charlow 2019). Inquisitive semantics sidesteps this problem, and is built on a well-understood logic of questions (Ciardelli, Roelofsen & Theiler 2017). Also, all previous accounts are based on the premise that question-marking *ka* must occur in a local or at least island-bound relationship with any indeterminates it binds. Early work assumed that this relationship cannot cross the edge of an intervening embedded question (i.e. another *ka*); e.g. Shimoyama (2001) takes it to be limited by embedded questions (though not by other islands). But Hirotani (2003) experimentally shows that this relationship is not in fact limited in this way (see (5)). In response, Kratzer (2005) patches Shimoyama's account by allowing the indeterminate in (5) to undergo covert (island-bound) movement past the closest *ka* and thereby enter a relationship with the *ka* in the main clause.

Novel data Using sentences in which the relevant movement would have to be island-escaping, we show that Kratzer's patch is not sufficient. In sentence (6), the indeterminate is in a complex DP island. In (7), it is in an adjunct island. Japanese consultants judged both readings available in each case. This is problematic for Hamblin (1973)-style theories (Shimoyama 2001, 2006, Kratzer 2005). While Reading 2 in (5)-(7) tends to be more marked, this is highly sensitive to prosodic and pragmatic factors (Hirotani 2003, Kitagawa 2005). A hard syntactic constraint is unlikely to leave room for this kind of pattern. This motivates a system based not on movement but on binding of the indeterminate by *ka*, and which allows in principle for long-distance binding configurations.

Our analysis is in the spirit of Baker (1970) and Karttunen (1977). Question particles may bind any number of indeterminates locally or at a distance via predicate abstraction, similarly to unselective quantifiers (Lewis 1975). We assume that an interrogative presupposes that one of the possible answers it denotes is true (otherwise, *wh*-questions would be informative). Indeterminates denote variables that can be nonlocally bound by question-forming *ka*. Nonlocal binding is necessary even for indefinite-forming *ka*: (8) is grammatical for some speakers (Yatsushiro 2009). We model indefinite-forming *ka* as taking scope at the edge of the DP and binding the indeterminate in its scope. For disjunction, we propose that Japanese employs a list construction, inspired by the inquisitive semantic treatment of disjunctions of polar questions by which "Did John run? Or did Mary run?" is predicted to be an alternative question (Ciardelli, Groenendijk & Roelofsen 2018: §6.1). A silent operator *op* whose presence is reflected by uninterpreted morphemes on each list item (e.g. A-ka B-ka when *op* is *ka*) is interpreted at the edge of the construction. An abstract coordinator (which can also be overt, Uegaki 2018) combines list items via union or intersection.

We implement an inquisitive semantics within Ty2 (Gallin 1975). We use $s, s' \ldots$ to range over states (type $\langle s,t \rangle$), and $p, p' \ldots$ to range over propositions in the inquisitive sense (ie. type

$\langle st,t\rangle$, or T for short). For s_0 of type $\langle s,t\rangle$, we write $\widehat{s_0}$ for the proposition $\wp(s_0)$ of type T. More generally, if s_n is a relation between n entities and a world, we write $\widehat{s_n}$ for $\lambda\vec{x}\lambda s.\ s\subseteq s_n(\vec{x})$. Consider a relation talks of type $\langle e,st\rangle$ between an entity x and a world w. We let *talks* denote $\lambda x\lambda s.s\subseteq\{w|\mathsf{talks}(x)(w)\}$, or $\lambda x.\widehat{\mathsf{talks}}(x)$ of type $\langle e,T\rangle$ for short. Proper names denote constants of type e, so we have, by function application: $[\![\text{John talks}]\!]=\widehat{\mathsf{talks}}(j)=\{s\mid\forall w\in s.\ \mathsf{talks}(j)(w)\}$ of type T. Analogously, transitive verbs are of type $\langle e,eT\rangle$, etc. We write $\mathbb{V}$ for $\lambda p\lambda q\lambda s.p(s)\vee q(s)$ or equivalently $\lambda p\lambda q.p\cup q$, the union operation on propositions. We write $\exists\!\!\!\exists$ for $\lambda P.\bigcup_{\vec{x}}P(\vec{x})$ where $\vec{x}$ is a sequence of variables. One can define $\mathbb{A}$ and $\forall\!\!\!\forall$ in analogous ways to $\mathbb{V}$ and $\exists\!\!\!\exists$.

As is common in inquisitive semantics, we assume that sentences contain a silent "flattening operator" $!\overset{\text{def}}{=}\lambda p_T.\wp(\bigcup p)$ of type $\langle T,T\rangle$, which returns the noninquisitive closure (the powerset of the union) of its complement. Similarly to Dotlačil & Roelofsen (2020), we assume that this operator is contributed by a node somewhere in the lower right periphery of every clause, even in interrogative clauses, since DP-level disjunctions and indefinites lose their inquisitive potential under question-marking *ka* (see (9) and (10)). Uegaki (2018) observes that TP-level disjunctions are declaratives but CP-level disjunctions are alternative questions, and relies on framework-specific type mismatches to determine if a disjunction has declarative or interrogative force. Our independently motivated peripheral ! derives this with no further stipulations. For TP- and DP- level disjunctions, this ! flattens alternatives. For CP-level disjunctions, the coordinator takes in two CPs; there is no higher ! node to flatten the disjuncts, accounting for the alternative question reading.

Questions CPs and TPs are of type T prior to predicate abstraction. We represent CP- and TP-level *ka* as $\lambda P_{\langle e^nT\rangle}\langle ?\rangle\exists\!\!\!\exists\vec{x}.P(\vec{x})$. Here, $\langle e^nT\rangle$ stands for any type T, eT, $\langle e,eT\rangle$, etc. and $\langle ?\rangle$ is the conditional inquisitive closure operator of type $\langle T,T\rangle$ which leaves inquisitive propositions alone and expands noninquisitive propositions to fill the logical space: $\langle ?\rangle\overset{\text{def}}{=}\lambda p\lambda s.s\in p\vee[s\cap\bigcup p=\emptyset\wedge\neg\mathsf{inq}(p)]$ where $\mathsf{inq}(p)$ is true iff p contains at least two maximal states, called alternatives. The $\exists\!\!\!\exists$ introduces a different alternative for each possible value of the indeterminate(s) in the prejacent. If there are no indeterminates, *ka* is equivalent to just ?, which turns the clause into a yes-no question; e.g. $[\![(1)]\!]=?!\widehat{go}(j)$. If there are n pronouns, *ka* triggers predicate abstraction on up to n of them before it applies, and is equivalent to $\lambda P_{\langle e^nT\rangle}\exists\!\!\!\exists\vec{x}.P(\vec{x})$. E.g. $[\![(2)]\!]=\exists\!\!\!\exists x.!\widehat{eat}(j,x)$.

Indefinites DPs in general are of type $\langle eT,T\rangle$ pre-abstraction. Thus, for DP-level *ka*, we type-lift CP/TP-level *ka*, yielding $\lambda R_{\langle e^n,\langle eT,T\rangle\rangle}\lambda P_{\langle e,T\rangle}.(\langle ?\rangle\exists\!\!\!\exists\vec{x}.R(\vec{x}))(P)$, which is suitable even for complex examples like (8). At the DP-level, *ka* binds indeterminates to form indefinites. For simple examples like *dare-ka*, we Montague-lift *dare* before we abstract over its variable, allowing us to reuse this same entry for *ka*. E.g. $[\![[\lambda_1\ [\ \text{Lift}(dare_1)]]]\!]=\lambda x\lambda P_{\langle e,T\rangle}.P(x)$ and $[\![(3)]\!]=!\exists\!\!\!\exists x.\widehat{go}(x)$.

Disjunctions We treat coordinations as list constructions. Like Szabolcsi (2015), we assume that list items are combined by a silent coordinator. This can in principle be either $\mathbb{A}$ or $\mathbb{V}$. The combined list serves as input to an operator, in our case $\langle ?\rangle$. *ka* contributes a single $\langle ?\rangle$ even though it is realized on each list item, similarly to agreement and concord. (For lists of clauses, the entry is as for questions with $n=0$, yielding $\lambda p_T.\langle ?\rangle P$, which is equivalent to just $\langle ?\rangle$. For lists of DPs, the entry is as for indefinites but with $n=0$, yielding $\lambda Q_{\langle eT,T\rangle}\lambda P_{\langle e,T\rangle}.\langle ?\rangle Q(P)$.) Due to the $\langle ?\rangle$, the silent coordinator cannot be $\mathbb{A}$, otherwise $\langle ?\rangle$ would expand the proposition to cover the entire space of possible worlds, which would result in a tautology when the clause-peripheral ! applies to the resulting proposition. *ka* thus forces the silent coordinator to be $\mathbb{V}$, in which case the resulting proposition is inquisitive and $\langle ?\rangle$ is vacuous. E.g., $[\![(4)]\!]=!\langle ?\rangle(\widehat{s}(j)\ \mathbb{V}\ \widehat{s}(m))=!(\widehat{s}(j)\ \mathbb{V}\ \widehat{s}(m))$.

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

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

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

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

(5) John-wa [Mary-ga **nani**-o katta **ka**] shirimasu **ka**?
John-TOP Mary-NOM what-ACC bought Q know Q
Reading 1: 'Does John know what Mary bought?' (embedded *ka* binds *nani*)
Reading 2: 'What x is s.t. J knows whether M bought x?' (main-clause *ka* binds *nani*)

(6) John-wa [[**nani**-o osieru sensei]-ga kitano **ka**] kikimashita **ka**?
John-TOP what-ACC teach teacher-NOM came Q asked Q
Reading 1: 'Did John ask what the teacher who came teaches?'
Reading 2: 'What x is s.t. John asked whether a teacher who teaches x came?'

(7) John-wa [Mary-ga [**nani**-o shita ato ni] hirune-o shitano **ka**] kikimashita **ka**?
John-TOP Mary-NOM what-ACC did after LOC nap-ACC did Q asked Q
Reading 1: 'Did John ask what x is such that Mary napped after she did x?'
Reading 2: 'What x is s.t. John asked whether Mary napped after she did x?'

(8) [**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.' (Yatsushiro 2009)

(9) John-**ka** Mary-**ka**-ga kita **ka** oshiete.
John-DISJ Mary-DISJ-NOM came Q tell
'Say whether either J or M came.' (YNQ) / *'Say which is true: J or M came.' (AltQ)

(10) **Nani-ka**-o katta **ka** oshiete.
what-INDEF-ACC bought Q tell
'Say whether you bought something.' (YNQ) / *'Say what you bought.' (ConstQ)

Language studied in the paper: Japanese

REFS: **Ciardelli et al 18**. *Inquisitive semantics*. Oxford UP. **Ciardelli et al 17**. Composing alternatives. *L&P* 40(1). **Dotlačil & Roelofsen 20**. A dynamic semantics of single-wh and multiple-wh questions. *SALT 30*. **Hirotani 03**. Prosodic effects on the interpretation of Japanese wh-questions. *UMass Occ.P.* 27. **Kratzer 05**. Indefinites and the operators they depend on. *Reference and quantification*. **Shan 04**. Binding alongside Hamblin alternatives calls for variable-free semantics. *SALT 14*. **Shimoyama 06**. Indeterminate phrase quantification in Japanese. *NLS* 14(2). **Szabolcsi 15**. What do quantifier particles do? *L&P* 38(2). **Uegaki 18**. A unified semantics for the Japanese Q-particle *ka* in indefinites, questions and disjunctions. *Glossa* 3(1).