TYPES OF DISJUNCTION: NEGATIVE SCOPE[*]

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1.   Introduction

The current chapter is designed to illustrate how experimental pragmatic studies contribute to discussions on the properties of disjunction in Japanese, clarifying the true nature of disjunction in natural language.

Research (e.g., Goro & Akiba, 2004; Goro, 2007) suggests that the Japanese language disjunctive connective *ka* 'or' exhibits a different pattern of scopal interaction with negation from its English counterpart *or*, as the contrast between (1a) and (1b) exemplifies:[1]

(1)   a. Taro-ga   ringo-ka   banana-o   tabenakatta.

         Taro-Nom   apple-or   banana-Acc   eat.Neg.Past

         'Taro did not eat apples or he did not eat bananas.'

                                                                                      (*Neg > *ka*; *ka* > Neg)

      b. Taro did not eat apples or bananas.

The sentence in (1a) can only mean 'Taro ate either apples or bananas.'   The sentence in (1b), in contrast, can also mean 'Taro ate neither apples nor bananas' (e.g., Szabolcsi & Haddican, 2004; Goro & Akiba, 2004; Goro, 2007).   The literature has seen such asymmetry between

[1] Abbreviations used in this chapter include: 3 'third person', Acc 'accusative', Art 'article', Det 'determiner', Fut 'future', Indf 'indifinit', Neg 'negation', Nom 'nominative', Sg 'singular', Pl 'plural', Prn 'pronoun', Prs 'present', and Q 'question particle/ marker.'

the languages covered extensively, yet consensus concerning how this was brought about remains elusive.

Goro (2007) claims that Japanese disjunction has characteristics of *positive polarity items* (PPIs henceforth). Similarly, others (e.g., Nicolae, 2017; Spector, 2014; Szabolcsi, 2004) argue that disjunction in languages such as Hungarian and French exhibits PPI behavior. (2) demonstrates this in French.

(2) Marie n'a   pas   invité Léa   ou   Jean à   dîner.

Marie Neg. have.pre.3Sg   Neg   invite Lea   or   Jean for   dinner

'Marie has not invited Lea or Jean for dinner.'

(*Neg > *ou*; *ou* > Neg)

(Nicolae, 2017, p. 3)

Significantly, however, Japanese does allow for a context in which Goro's and Nicolae's proposals make different predictions. The current chapter introduces Tamura, Miyamoto and Sauerland (2019; hereinafter TMS), and their work in testing the behavior of the Japanese disjunction *ka* in this Japanese context, illustrating how experimental pragmatic research contributes to this issue.

The chapter is organized as follows: Section 2 presents a basic overview of PPIs and establishes the bases for discussion in the following sections; Section 3 reviews previous analyses of Japanese connectives and clarifies the context to be tested in TMS's study; Section 4 describes the TMS study; and, finally, Section 5 concludes the chapter.

2.   Basic Overview

The properties of PPIs cannot be explained without referring to the notion of *downward entailing* (hereinafter DE) Ladusaw (1979) introduced.   This section, therefore, begins with a brief introduction of DE.

2.1 Downward Entailment

DE, first described by Ladusaw (1979), is defined as follows: For sets a and b, conceived of as the denotations of some expressions in a language, if a $\subset$ b, then $f(b) \subset f(a)$.   Consider (3a, b):

(3)   a. Every mother runs.

b. Every woman runs.

Since *woman* is a superordinate concept of *mother*, 〚mother〛 $\subset$ 〚woman〛 , even if (3a) is true, then (3b) may well be false since when every mother runs, women who are not mothers might not run.   However, if (3b) is true, then (3a) is necessarily true, illustrating that *every* creates a DE environment.

DE is sometimes classified into up to four subtypes: monotone decreasing, anti-additive, anti-multiplicative, and antimorphic (e.g., van der Wouden, 1997), the distributions of which are shown in (4a-d).   We use these terms as descriptive labels for convenience, while an explanation for the different environments may lie elsewhere (e.g., Gajewski, 2011; Chierchia, 2013).

(4)　a. A function f is monotone decreasing iff f (X ⊆ Y) → f (Y) ⊆ f (X).

b. A function f is anti-additive iff f (X ∪ Y) = f (X) ∩ f (Y).

c. A function f is antimultiplicative iff f (X ∩ Y) = f (X) ∪ f (Y).

d. A function f is antimorphic iff

(f (X ∩ Y) = f (X) ∪ f (Y)) & (f (X ∪ Y) = f (X) ∩ f (Y)).

(van der Wouden, 1997, p. 104)

For example, *no N* is an anti-additive operator (hereinafter AA-Op) in (5) because (6) holds in accordance with (4b).

(5)　No girl sings or dances.

(6)　No girl sings or dances ↔ No girl sings and no girl dances.

(van der Wouden, 1997, p. 99)

With this background on DE, Section 2.2 examines the properties of PPIs, as analyzed by Szabolcsi (2004).

2.2　Positive Polarity Items

The existential quantifier *some* in English cannot take scope below negation when the sentence is uttered with normal intonation.　For example, (7) can only mean that there is a person whom Taro does not call and cannot describe the situation in which Taro does not call anyone.

(7)　Taro does not call someone.

If *someone* took scope below negation, the latter reading should be permitted in (7). In other words, *someone* necessarily takes scope above negation, considered a typical characteristic of PPIs. Words like *anyone*, by contrast, which are comfortable being under the scope of negation, are called *negative polarity items* (NPIs).

Note that PPIs are sensitive not only to simple negation but also to DE operators, as discussed in Section 2.1. In (8a), *someone* necessarily takes scope above *no one*, which is an AA-Op. However, *someone* can take scope under *at most n*, which is classified as monotone decreasing, as shown in the contrast between (8a) and (8b).

(8) a. No one called someone.   (*no one > *some*)

　　 b. At most five boys called someone.   (at most five > *some*)

(Szabolcsi, 2004, p. 414)

PPIs have also been divided into three types based on the distribution of the DE types: *strong PPIs*, *weak PPIs*, and *PPIs of medium strength* (van der Wouden, 1997): strong PPIs necessarily take scope above all DE operators; weak PPIs can take scope under monotone decreasing and AA-Op's, while they cannot be scopally under antimorphic operators; and, *PPIs of medium strength* can occur in monotone decreasing context, but they cannot take scope under AA-Op's.

Similarly, NPIs are also categorized into three classes (van der Wouden, 1997). Szabolcsi (2002) suggests that the Hungarian disjunction *vagy* has a strong NPI feature because the disjunction is only licensed by antimorphic environments (see (4d)): In English, phrases like *in weeks* and *yet* exhibit the same behavior as Hungarian *vagy* regarding antimorphic environments.[2]

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[2] For more detail, see van der Wouden (1997) and Zwarts (1998).

One property of PPIs worth noting, and of some significance to the discussion below, is that they can take scope below negation when the negation is in an NPI-licensing context, as in (9a, b); this is called a *rescuing effect* (Baker, 1970; Szabolcsi, 2002).

(9)   a. I don't think that John didn't call someone.   (not > (not > *some*))

     b. Every boy who didn't call someone…   (every > (not > *some*))

(Szabolcsi, 2004, pp. 417-418)

Furthermore, PPIs can take scope below extra clause negation and NPI-licensors, as shown in (10a, b).

(10)   a. I don't think that John called someone.   (not > [CP/IP some])

     b. Every boy who called someone got help.   (every > [CP/IP some])

(Szabolcsi, 2004, p. 415)

The generalization on PPIs can be stated as in (11).

(11)   PPIs do not occur in the immediate scope of a clause-mate AA operator AA-Op,

     unless [AA-Op > PPI] itself is in an NPI-licensing context.

(Szabolcsi, 2004, p. 419)

2.3 PPI Disjunction

In line with Section 2.2, Spector (2014) and Nicolae (2017) observe that the French disjunction *ou* is a PPI, which cannot take scope under negation in simple negative sentences but can take scope under DE operators such as *peu* and *moins de n* 'few/less than *n*'.   The

disjunction in point can also take narrow scope in the antecedent of conditionals and the restrictor of a universal quantifier, such as *tout* 'every'.   This is illustrated in (12):[3]

(12) a. Peu de/ Moins   de dix étudiants   parlent   espagnol ou italien.

       few of/ less.than de ten   student.Pl speak.Prs.3Pl Spanish   or   Italian

       'Few/ Less than ten students speak Spanish or Italian.'

    b. Si Marie a   pris   un   cours   de   maths ou   de

       if Marie have.pre.3Sg take.Past.3Sg Indf.Sg   course   in   math   or   in

       Physique   ce   semestre, elle   réussira   l'examen.

       physics   this   semester, she   pass.Fut.3Sg   Det.exam

       'If Marie took a course in Math or Physics this semester, she'll pass the exam.'

    c. Tout   étudiant qui   a   pris   un   cours   de   maths

       every   student   who   have.pre.3Sg   take.Past   Indf.Sg   course   in   math

       ou   de Physique   réussira   l'examen.

       or   in   physics   pass.Fut Det.exam

       'Every student who took Math or Physics will pass the exam.'

(Nicolae, 2017, p. 15)

Here, strong NPIs such as *in weeks* in English can only appear in an antimorphic context (e.g., with *no* in (13a)).   The NPIs under consideration are not licensed in a monotone DE context, in the antecedent of conditionals, or in the restrictor of the universal quantifier *every*, demonstrated by the contrast between (13a) and (13b–d).

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[3] The glosses in (12) were added by the current authors.

(13) a.   No students have attended this course *in weeks*.

b. * Few/ less than ten students have attended this course *in weeks*.

c. * If Mary has attended this course *in weeks*, she should inform us.

d. * Every student who has attended this course *in weeks* will pass.

Moreover, Nicolae (2017) suggests that French *ou* exhibits rescuing effects, as illustrated in (14).

(14) Tout   étudiant   qui   n'a   pas   pris   de   cours
     every   student   who Neg.have.Pre.3Sg Neg   take.Past Indf.Sg   course

de   math   ou   de   physique   a   rate   l'examen.
in   math   or   in   physics   have.Pre.3Sg   fail.Past Det.exam

'Every student who didn't take Math or Physics failed the exam.'

Given these rescuing effects, Nicolae (2017) proposes that *ou* is the PPI counterpart of strong NPIs because a strong NPI, such as *in weeks*, appears to be acceptable in all and only the types of environments in which *ou* is unacceptable, as observed in the contrast between (12a–c) and (13a–d).

Considering the discussion to follow, specifics of Nicolae's (2017) proposal with the example in (15) are illustrative:

(15) Mary invited John or Bill

    a. *Alt* (Mary invited John or Bill) = {Mary invited John and Bill, Mary invited John,

      Mary invited Bill}

    b. *Exh* [Mary invited John or Bill] = Mary invited John or Bill & <u>Mary didn't invite</u>

    <u>John and Bill</u>

<div align="right">(Nicolae, 2017, p. 4)</div>

Following Sauerland (2004), Alonso-Ovalle (2006), Fox (2007), and others, Nicolae (2017) relates its proposition to the alternative set, given in (15a), which includes conjunctive alternatives and individual disjunctions, dubbed as domain alternatives. The exhaustivity operator *Exh* negates only innocently excludable (IE) alternatives; the alternatives given in (15a) can be negated without producing a meaning that entails another alternative. Thus, *Exh* produces the enriched meaning in (15b), formally represented as in (16):

(16) Exh (p) = p $\land$ $\forall q \in$ **IE** (p, Alt (p)): $\neg q$

    where: **IE** (p, Alt (p)) = {q $\in$ Alt (p) | $\neg \exists r \in Alt$ (p): (p $\land \neg q$) $\rightarrow$ r }

<div align="right">(after Nicolae, 2017, p. 4)</div>

However, this does not mean that the proposition always has enriched meaning given in (15b). The proposition in (15) can be interpreted 'Mary invited John or Bill, possibly both' in certain context. Making a similar observation in its French counterpart, Nicolae (2017) suggests that in principle, disjunction *ou* permits either of the two Logical Forms (LFs), given

in (17a, b), which, in turn, lead to the alternative sets in (18a) and (18b) respectively.[4,5]

(17) a. [p ∨ q]

   b. *Exh* [p ∨ q]

(18) a. Alts (p∨q) = {p, q, p∧q}

   b. Alt$_D$ (p∨q) = {p, q}

Further, Nicolae (2017) argues that Mayer's (2013) covert doxastic operator, assumed to be a necessity modal as defined in (19), is operative in (18a, b).[6]

(19) $[\![\Box_\chi P]\!]$ $= \lambda w. \forall w' \in \mathrm{Dox}(x)(w) \colon P(w')$

   $w' \in \mathrm{Dox}(x)(w)$ iff given the beliefs of x in w, w' could be the actual world.

<div align="right">(Nicolae, 2017, p. 11)</div>

According to the economy condition (see footnote 5), PPIs such as French disjunction *ou* trigger obligatory exhaustivity.   This enables Nicolae to accommodate the enriched meaning (*Exh$_D$* [□p∨□ q]).   Alternatively, with the LF shown in (17b), the 'in fact both' interpretation is realized as (*Exh$_D$* [□[*Exh$_D$* [p∨ q]]]).

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[4] French has another disjunction such as *soit ... soit*.   Nicolae (2017) suggests that disjunction *ou* can be associated with either of the alternative sets in (18a) or (18b), where 'S' in the former means scalar and 'D' in the latter means domain.   The disjunction *soit ... soit* can associate only with that in (18a).   Due to space limitations, we do not illustrate Spector's (2014) proposal on *soit ... soit*.   We refer the reader to Spector (2014).

[5] The difference between French *ou* and English *or* is that the French disjunction is a PPI, which triggers obligatory exhaustivity under the economy condition, stated in (i), proposed by Spector (2014).

(i)   An occurrence of *Exh* in sentence S is not licensed if eliminating this occurrence leads to a sentence S' which entails or is equivalent to S. An occurrence of Exh is licensed only if it leads to strengthening.

<div align="right">(Nicolae, 2017, p. 7)</div>

Since the English disjunction is a non-PPI; therefore, it does not trigger obligatory exhaustivity, it can take scope under all DE environments.   For more detail, see Nicolae (2017) and Spector (2014).

[6] See Nicolae (2017) for relevant discussion.

In DE context, in contrast, the exhaustification in (20b) does not yield exhaustivity—enriched meaning—because the alternatives in (20a) are not innocently excludable. In other words, the disjunction *ou* does not conform to the economy condition. Accordingly, *ou* cannot take scope under negation in DE environment, and therefore, (20) is unavailable.

(20) Exh$_D$ [□¬[p∨q]]

  a. Alt$_D$ (□¬[p∨q]) = {□¬p, □¬q}

  b. Exh$_D$ [□¬[p∨q]] = □¬(p∨q)

(Nicolae, 2017, p. 11)

By adopting the doxastic operator, however, what remains unresolved one final issue remains is the reasoning behind the disjunction *ou* being unacceptable under any DE environment. To respond, because disjunction *ou* can take narrow scope interpretation as shown in (12a–c), Nicolae (2017) proposes that disjunction *ou* realizes both truth-conditional and non-truth-conditional meanings of their licensor, as illustrated in (21).[7]

(21) Every student who took math or physics passed the exam.

  defined if: Some student(s) took Math or Physics.

(Nicolae, 2017, p. 15)

In this section, Nicolae's proposal has been shown to enable an account for the behavior of non-PPI disjunction such as *or*, and PPI disjunction such as French disjunction *ou* and *soit…soit* in a principled manner. Since, as mentioned from the outset, Japanese disjunction *ka* has a

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[7] The subject phrase of a universally quantified sentence is called Strawson-DE (von Fintel, 1999). The universal quantifier carries an existential presupposition.

similar scope behavior to its French disjunction, extending Nicolae's analysis of *ou* to Japanese disjunction *ka* remains desirable.   In the next section, we turn to the proposals, entertained in the literature, regarding Japanese disjunction *ka*.

3.   The Japanese Disjunction

Based on the previous discussion, we turn to the Japanese disjunction *ka* and clarify the issue to be examined to verify its true nature.   We introduce two representative proposals on the Japanese disjunction: Shibata (2015a, b) and Goro (2007).

Shibata (2015a, b) proposes a unified account for negation of Japanese and English; Negation is situated in the same position in Japanese and English.   Accordingly, the difference between Japanese and English is due to different positions that objects occupy in these two languages, and Shibata argues that the disjunctive phrase in the object position obligatorily moves above negation for Case-theoretic reasons.[8]   Importantly, he suggests that the silent exhaustive operator O_{ALT} (Chierchia, Fox, & Spector, 2012) is to be attached to the raised disjunctive phrase, as shown in (22).

$$O_{ALT}$$

(22) [$_{TP}$ Subj. [$_{XP}$ Obj. [$_{NegP}$ … *t* … Neg] T]]
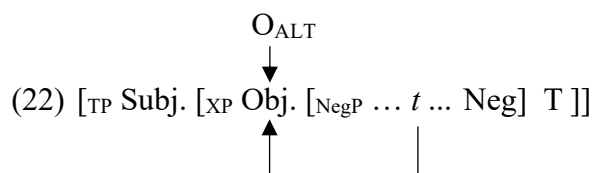
(Shibata, 2015a, p. 240 (O_{ALT} is added by the authors))

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[8] Shibata (2015b) argues that all the overt VP-internal phrases must be raised out of VP for morphological reason. He claims that overt phrases located in VP have potential to be an intervener for complex predicate formation, which he assumes is an instance of morphological merger.

Shibata (2015a, b) argues that this late adjunction of the O$_{ALT}$ to the raised disjunctive object prevents *ka* from taking scope below negation.[9]

Based on Szabolcsi's (2004) work on Hungarian, Goro (2007), on the other hand, proposes that the Japanese disjunction *ka* is a PPI; still, sharing the basic insight with Shibata (2015a, b), he also claims that PPI properties of the element in point are derived in syntax; the disjunctive phrase is raised above negation in covert syntax, as illustrated in (23):

(23) [$_{TP}$ Subj. [$_{f}$P Obj. [$_{NegP}$ ... *t* ... Neg] T]]
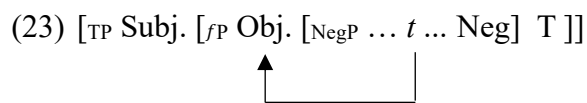
(Goro, 2007, p. 258)

Goro assumes that *ka* has a weak uninterpretable feature that needs to be checked in the SPEC of *f*P.   Given the assumption the *ka*, being a PPI, is interpreted at this very position, it necessarily takes scope over negation.

Notice that Shibata's (2015a, b) theory predicts that *ka* takes scope above negation embedded in a DE environment, since Japanese objects are obliged to move above their local negation, regardless of the environment.   Goro's (2007) theory also predicts that in principle, *ka* should not show rescuing effects because it obligatorily moves to the SPEC of *f*P, located above negation.   In this respect, Goro (2007) explicitly states that "to explain the scope behavior of items like *some* in the rescuing contexts, some mechanism should be added on top of covert movement" (p. 272).[10]

Interestingly, however, Goro (2007) observes that there are cases where negation takes scope over *ka*.   (24) is one such example:

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[9] Due to space limitation, we do not illustrate how the reconstruction in point is prohibited.   We refer the reader to Shibata (2015a, b) and Saito and Takita (2016).
[10] See (9a, b) in Section 2.2 for illustration.

(24) Mosi   John-ga   supeingo   ka   furansugo-o   hanasa-nai-to,

    if   John-Nom   Spanish   or   French-Acc   speak-Neg-Comp

kare-wa   komaru.

he-TOP   in.trouble

(Lit.) 'If John doesn't speak Spanish or French, he will be in trouble.'

<div align="right">(Goro, 2007, p. 260)</div>

Given that *ka* occupies the SPEC of *f*P, he attributes the fact that NEG can take scope over *ka* in this example to the syntactic NEG-raising to a position above TP, which Kato (1994) assumes is a TP-adjoined position, represented in (25):

(25)   [$_{CP}$ [$_{XP}$ [$_{TP}$ Subj. [$_{fP}$ Obj. [$_{NegP}$ … *t* … *t*] *f*] T] NEG] C]
                        [+affective]

<div align="right">(Goro, 2007, p. 262)</div>

Kato speculates that the availability of the NEG-raising in point is tied to the way the [+affective] feature on C is licensed; the NEG-raising can take place when the feature under consideration is licensed by either an inherent property of C, such as the interrogative *ka* or a higher inherently negative verb which selects this CP, which Goro dubs 'adversative' predicates.

    This proposal makes a clear prediction regarding relative clauses: no matter whether the relative head contains the universal quantifier, no apparent rescuing effect should be observed. Under the assumption that Japanese relative clauses are TP in category, as Murasugi (1991) claims, the condition for the NEG-raising cannot be met in this configuration, since there is

no C.   Goro (2007, p. 166) states that this prediction is borne out, claiming that *ka* cannot take scope below negation in (26):[11]

(26) Supeingo   ka   furansugo-o   hanasa-nai   dono   gakusei   mo …

   Spanish   or   French-Acc   speak-Neg   every   student   also

   (Lit.) 'Every student who does not speak Spanish or French …'

$$\text{(every} > * (\text{Neg} > ka); \text{every} > (ka > \text{Neg}))$$

(Goro, 2007, p. 166)

If, however, we adopt Nicolae's (2017) analysis for the Japanese disjunction *ka*, the example in (26) in which *every* creates DE environment, is predicted to show the rescuing effects (see Section 2) — countering assertions from Shibata (2015a, b) and Goro (2007) assertion.   Sentences of the type in (26) therefore provide us with a positive testing ground to identify the true nature of Japanese disjunction.

4.   Experiment by Tamura, Miyamoto, and Sauerland (2019)

As mentioned in Section 3, the Japanese disjunction *ka* has basic PPI characteristics: it strongly prefers the scope above negation in simple sentences.   However, this very fact has been accounted for in different manner, and we have not reached any consensus as to the nature of the Japanese disjunction.   We also saw that the presence or absence of rescuing effect may

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[11] We find (26) and (i) below, which includes a different predicate, ambiguous, and disagree to Goro's judgment on (26).

(i)   Supeingo ka furansugo-o risyuusitei-nai dono gakusei mo eigo-de   repooto-o   kakanakereba ikenai.
      Spanish   or French-Acc have not taken every student also English-in report-Acc write   must
      (Lit.) 'Every student who have not taken Spanish or French must write a report in English.'

In this sentence, not only those who are not taking one of the foreign languages, but also those who are taking none of them must submit a paper in English.   This fact indicates that the disjunctive object can take scope below negation.

shed light on PPI properties of the element under discussion.   In the current section, we introduce the experiment conducted by TMS (2019) and illustrate how experimental results contribute to a better understanding of Japanese disjunction *ka*.[12]

4.1 Method

4.1.1 Participants

The participants in TMS's (2019) study were 24 students (12 women) from a Japanese university who were first language (L1) Japanese speakers (*Mean* = 21.46, *SD* = 2.90).

4.1.2 Procedure

Three sub-experiments were performed following one method.   Sub-experiments 1 and 2 examined scope in the Japanese disjunction *ka* in DE environments other than sentential negation.   Sub-experiment 3 examined rescuing effects of *ka*.   All 24 participants completed all three sub-experiments concurrently.

The experiments by TMS (2019) comprised three phrases, listed in (27) and shown in Figure 1.   The participants conducted a truth-value judgment task using PsychoPy v.1.81.   The participants were then presented with pictorial contexts and 144 sentences, among which there were eight target sentences for each sub-experiment (four sentences for the control context, and four sentences for the important context).   The Japanese connectives *ya* 'or/and' were used as a filler.   Prior to the experiment, the participants received instructions and took part in 14 practice trials.   A break was given every 36 sentences.   The presentation order was manually counterbalanced, so no conjunction appeared consecutively.   The experiment took approximately 45 minutes for each participant.[13]

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[12] We do not report Japanese conjunction *...mo...mo* in this chapter.   The reader is referred to TMS (2019).

[13] One of the reviewers asked why TMS showed test sentences before pictures, which might be significant since in experiments with child subjects, it is usually the case that test sentences are presented after pictures. Although

(27) PHASE 1: Fixation

A gaze point was displayed on the computer screen for 2,000 ms to inform the

participants that a sentence would be shown.

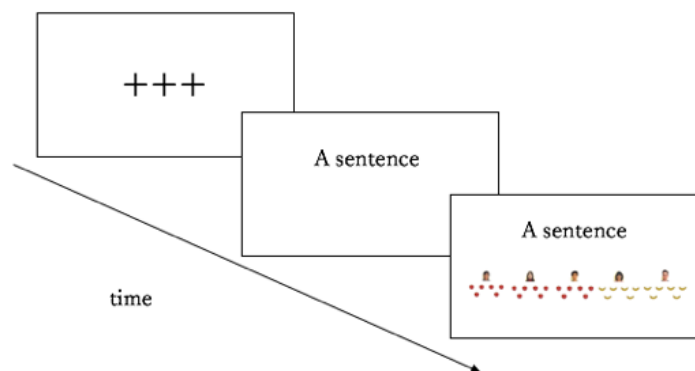PHASE 2: Sentence and Picture Presentation

First, a sentence was presented for 2,000 ms.   Then, its pictorial context was given

below the sentence.

PHASE 3: Forced Choice Decision

The participants pressed the 'yes' button if they decided the pictorial context expressed

the sentence.   If not, they pushed the 'no' button.

Figure 1

Procedure of TMS's (2019) experiment

4.2 Three Experiments

4.2.1 Sub-experiment 1

For the first sub-experiment, we tested sentences with *futari-ika* 'no more than two',
which create DE context.   A sample test sentence is shown in (28).[14]

(28)   Futari-ika-no   hito-ga   ringo   ka   banana-o   kaimashi-ta.

two-smaller.than-Gen   person-Nom   apples   or   bananas-Acc   buy-Past

(Lit.) 'No more than two people bought apples or bananas.'

An important pictorial for sentence (28) is shown in Figure 2.[15]   This context featured one
of the four sets of situations (as in Sub-experiments 2 and 3, for example, Set 1 had apples,
bananas, and mangoes, and Set 2 had strawberries, kiwis, and grapes).

Figure 2

Sample picture from Sub-experiment 1
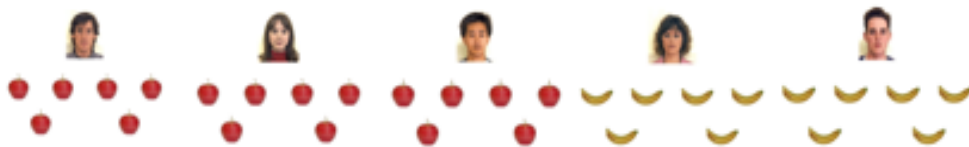
Shibata (2015a, b), Goro (2007), and Nicolae (2017) make the same prediction for this setup.
The syntactic theory assumes that the disjunctive object obligatorily moves only to a position

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[14] The Japanese expression *futari-ika* is like English 'less than two' in its DE properties, but it is closer to 'two or
fewer' or 'no more than two' when read literally.   We use 'no more than two' as the English gloss because it
makes the range of permissible interpretations closer to the original sentences.
[15] The pictorial contexts are indicated as follows: A = apples, B = bananas, M = mangoes, AB = apples and
bananas, 0 = no fruit.

within the scope of the DE subject.   Thus, disjunction is required to be within the scope *futari-ika*, which means that no more than two people bought apples or bananas.   The prediction noted indicates that the target sentences should be judged false in the context of Figure 2 because five people bought apples or bananas.   However, when the disjunction takes scope above the DE subject, the target sentence should be equivalent to the following paraphrase: 'Fewer than three people bought apples or fewer than three people bought bananas.'   Since only two people bought bananas, the second disjunct of the target sentence is true.   We, therefore, predict that the target sentence is judged to be true in the context of Figure 2.

    The results are shown in Table 1.   The pictorial context [A, B, 0, M, M] was the control. We predicted the control context to be judged as true.

Table 1

Participants' Responses for Japanese Disjunction 'ka' in the Sentence 'no more than n'

Context	Positive response	Negative response
Critical [A, A, A, B, B]	4.17% (1/24)	95.83% (23/24)
Control [A, B, 0, M, M]	97.92% (22/24)	2.08 (0/24)

Table 1 shows the participants' responses and the number of participants who consistently answered 'yes' and 'no' for the four target sentences: for example, 23 participants always pressed the no button when given sentences with important contexts.[16]   The results are consistent with Shibata (2015a, b), Goro (2007), and Nicolae (2017).[17]

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[16] Throughout, the tables show the positive and negative responses, the number of those who consistently answered, and our predictions.

[17] One of the reviewers questioned how the subjects would respond to the type of sentences given in (28) with the disjunctive object being scrambled over the subject Quantifier Phrase (QP).   We also ran a pilot experiment to this effect and observed that the subject interpreted the test sentences as if no scrambling had taken place, which seems consistent with Nicolae (2017) because the relevant scope is calculated in semantics.   However, the result

Before proceeding, we provide some commentary on participant responses to the control pictorial context. Typically, we use a sentence with a disjunction when both disjunctions are not known to be true. For example, 'Mary bought sushi or pizza' is presented when the speaker knows Mary bought sushi or Mary bought pizza, but he does not know that she did both. For the control pictorial context under consideration: [A, B, 0, M, M], the target sentence is pragmatically inappropriate because it makes clear that both disjuncts—no more than two people bought apples and no more than two people bought bananas—are true, which could be why some participants responded 'no' for this control pictorial context.

4.2.2 Sub-experiment 2

For the second experiment, we tested the case where the disjunction *ka* is in the restrictor phrase of the universal quantifier *every*, example of which is given in (29):

(29) Ringo ka banana-o   katt-ta   dono hito-mo   mango-o   kaimashi-ta.

apples or bananas-Acc buy-Past every person-also mangoes-Acc buy-Past

(Lit.) 'Everyone who bought apples or bananas bought mangoes.'

Both the important [0, A, BM, ABM, ABM] and control [0, AM, BM, ABM, ABM] contexts were tested with this example.

Shibata's (2015a, b) theory predicts that Japanese objects with disjunction *ka* must move to a position within the scope of the DE; therefore, no difference is expected between the current experiment and the previous one, which relates to test sentences of the type which involves *furati-ika* 'No more than two.' The target sentence in (29) is 'Everyone who bought apples or

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might challenge Shibata (2015) and Goro (2007), because we know independently that when the object QP is scrambled over the subject QP, scope ambiguity is expected to result in principle. We intend to investigate this issue.

bananas bought mangoes.'   In the important pictorial context, a person who bought apples did not buy mangoes.   Shibata's theory therefore predicts that the target sentence is to be judged false in the important pictorial context.   Goro (2007) does not discuss the scope behavior of *ka* in extra clause NPI-licenser, but his theory predicts that *ka* can take scope below an extra NPI-licenser, as mentioned in Section 2.2.   Nicolae (2017) also makes the same prediction, as noted in Section 2.3.

If disjunctive objects took scope above the DE subject, the sentence (29) should mean 'Everyone who bought apples bought mangoes or everyone who bought bananas bought mangoes.'   In the important pictorial context, those who bought apples did not buy mangoes, but those who bought bananas bought mangoes.   Thus, under the context depicted in (29), the test sentence should be judged true if the disjunction takes scope over *every*; otherwise, it should be judged false.   In addition, the control context, predicted to be judged true, is created.

Table 2

Participants' Responses for Japanese Disjunction 'ka' in Universal Quantifier 'every'

Context	Positive response	Negative response
Critical [0, A, BM, ABM, ABM]	4.17% (0/24)	95.83% (20/24)
Control [0, AM, BM, ABM, ABM]	93.75% (21/24)	6.25% (1/24)

In short, the participants' responses for *ka* are consistent with the predictions from Shibata (2015a, b), Goro (2007) and Nicolae (2017).

4.2.3 Sub-experiment 3

Sentences with the universal quantifier *every*, such as in (30), were used to investigate whether *ka* showed rescuing effects.   Figure 3 shows the crucial context for (30).

(30) Ringo   ka   banana-o   kawa-nakat-ta   dono   hito-mo   mango-o

apples   or   bananas-Acc   buy-Neg-Past   every   person-also   mangoes-Acc

kaimashi-ta.

buy-Past

(Lit.) 'Everyone who did not buy apples or bananas bought mangoes.'

Figure 3

Critical picture

Since both Shibata (2015a, b) and Goro (2007) predict that *ka* should not show rescuing effects, the participants would be expected to judge the target sentence as false for the critical context [M, A, B, AB, M] because the person who bought apples did not buy mangoes or the person who bought bananas did not buy mangoes.   Conversely, Nicolae's (2017) analysis predicts the intended rescuing effect, and the participants are expected to judge the critical context to be true.   The results are shown in Table 3.

Table 3

Participants' Responses for Japanese Disjunction 'ka': Rescuing Effects

Context	Positive response	Negative response
Critical [M, A, B, AB, M]	77.08% (15/24)	22.92% (2/24)
Control [M, AM, BM, AB, M]	87.50% (17/24)	12.50% (1/24)

Primarily, those who answered negatively must have interpreted the test sentences such as (30), in the way that the disjunctive phrase takes scope over negation, which indicates that the wide scope reading of the disjunctive phrase over negation must be option available to native speakers of Japanese.   However, under the critical context designed to prefer the reading where the disjunctive phrase takes scope lower than negation, most participants judged the critical test sentence to be true.   Also, participants tended to provide a positive answer to ambiguous sentences in case where the most accessible reading is true (Meyer & Sauerland, 2009), which therefore shows that the Japanese disjunction *ka* indeed shows rescuing effects, as predicted by Nicolae (2017).[18]

4.3 Discussion

Research on NPIs (Zwarts, 1998; Gajewski, 2011) and PPIs (van der Wouden, 1997; Nicolae, 2017) shows that polarity items exhibit differential sensitivity to DE environments. In the Sub-experiments 1 and 2, we show the Japanese disjunction takes scope under *less than n* and *every*, assumed to create DE environment.   Importantly, in the Sub-experiment 3, we

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[18] To be precise, Meyer & Sauerland (2009) proposed Truth Dominance.   The definition is shown below. See Meyer & Sauerland (2009) for more detail.

(i)   Truth Dominance: Whenever an ambiguous sentence S is true in a situation its most accessible reading, we must judge sentence S to be true in that situation.

(Meyer & Sauerland, 2009, p. 140)

observe rescuing effects with disjunction *ka*, a key property of PPIs, which supports Nicolae's (2017) view that *ka* is a PPI counterpart of strong NPIs.

Nicolae (2017) proposes that PPIs like *ou* respond to both the truth-conditional and non-truth-conditional meanings of their licensor. According to Nicolae (2017), the presuppositions can enter calculation of exhaustification. Gajewski (2011) proposes that one important distinction appears between environments that are logically DE and Strawson DE: Strawson DE is weaker in notion than logical DE.[19] Standard presupposition tests also argue that both *futari-ika-no obake-ga* ('no more than two ghosts') and *dono obake-mo* ('every ghost') are presuppositional in Japanese. If we consider the occurrence of a presupposition trigger in a question: both (31a) and (31b) have the inference that the speaker believes that ghosts exist. In other words, *every* and *no more than two* in Japanese are Strawson-DE in their restrictors because they yield the implicature that *someone* is present, regardless of whether the ghosts indeed exist.

(31) a. Futari-ika-no   obake-ga   aisukuriimu-o kaimashita-ka.

two-smaller.than-Gen ghost-Nom ice cream-Acc buy.Past-Q

(Lit.) 'Did no more than two ghosts buy ice cream?'

b. Dono obake-mo aisukuriimu-o kaimashita-ka.

which ghost-also ice cream-Acc buy.Past-Q.

(Lit.) 'Did every ghost buy ice cream?'

We, therefore, conclude that Japanese disjunction *ka* can occur in the scope of Strawson DE operators. Namely, the absence of anti-licensing is correctly predicted by the current proposal that *ka* is a strong PPI in Japanese, like *ou* in French, per Nicolae (2017).

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[19] See fn.7 for Strawson DE.

The results from sub-experiment 3 also support the proposal, as we tested whether disjunction *ka*, being anti-licensed by negation, could be rescued in the subject phrase containing a universal quantifier. If the subject phrase with a universal quantifier is only Strawson-DE, it is predicted not to anti-license PPIs, although it can rescue PPIs that are anti-licensed by negation. The test sentences we tested in Sub-experiment 3 are therefore correctly predicted to be ambiguous in two interpretations: one where negation takes scope above the disjunction *ka* and one where negation takes scope below the disjunction *ka*.

5. Conclusion

TMS (2019) show empirical support for Nicolae's (2017) proposal in that Japanese disjunction *ka* is a PPI counterpart of strong NPIs. This represents a first and important step towards understanding features of Japanese disjunction through empirical investigation. The experimental approach provides a more stringent test of the hypothesis regarding not only disjunctives but also the broader topic of connectives cross-linguistically. Such research may yet further expand our understanding of how connectives work in natural language, which in turn deepens our understanding of the properties of our mind.

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