Numerals and Negative Polarity Items in Japanese

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1. Introduction

Adverbs such as *even* and *only* evoke different implications depending on the placement of focus (Rooth 1985, among others). For instance, (1a) implies that Bill is an unlikely person for Al to introduce to Colin ([ ]$_F$ marks the element with intonational focus that *even* associates with). In contrast, (1b) implies that Colin is an unlikely person for Al to introduce Bill to.

(1)　a．Al even introduced [Bill]$_F$ to Colin.

　　　b．Al even introduced Bill to [Colin]$_F$.

The Japanese particle *-mo* also exhibits the association with focus. As in (2a), *-mo* yields the additive reading that Al saw someone besides Bill. When *-mo* associates with a focused element, as in (2b), an additional implication arises, namely, Bill is an unlikely person for Al to see. This implication is analogous to the one evoked by English *even* in (1). In this way, *-mo* is ambiguous between English *also* and *even*, and the two can be teased apart by focus: the *also* interpretation obtains with neutral intonation, while the *even* interpretation shows up when *-mo* associates with focus.

(2)　a．Al-wa　Bill-mo　mi-ta.　　　b．Al-wa　[Bill]$_F$-mo mi-ta.

　　　　Al-TOP　Bill-MO　see-PAST　　　Al-TOP　Bill-MO　see-PAST

　　　　'Al saw Bill, too.'　　　　　　　'Al even saw Bill.'

Another property to remark regarding *-mo* is its presence in so-called negative polarity items (NPIs). NPIs are words or expressions that appear only in semantically restricted contexts, which are generally characterized as downward-entailing (DE) contexts (Ladusaw 1980, among others). DE contexts come with an operator that reverses an entailment: an operator f is downward entailing if and only if, for any $\alpha \subset \beta$, f(α)$\supset$f(β), in other words, a DE operator reverses an entailment. For instance, *Al saw a dog* entails *Al saw an animal* (but not vice versa), while *Al didn't see an animal* entails *Al didn't see a dog* (but not vice versa), indicating that *not* is a DE operator. English NPI *any* appears in a negative sentence (*Al didn't see any dog*), but not in a positive sentence (**Al saw any dog*).

In Japanese, when *-mo* attaches to an expression of a minimal amount, the resulting complex expression behaves as an NPI. For instance, in (3), *one*-CL(ASSIFIER) + *-mo* is grammatical only in the negative sentence.

(3) Al-wa   inu-o   ip-piki-mo   {*mi-ta / mi-na-katta}.

   Al-TOP   dog-ACC   one-CL-MO   {see-PAST / see-NEG-PAST}

   'Al {saw/didn't see} any dog(s).'

Independently, it is well known that numerals in Japanese can appear in various locations, as in (4). The three sentences in (4) are truth-conditionally equivalent in that all of them are true if and only if Al saw one dog.

(4) Type I   Al-wa ip-piki-no   inu-o   mi-ta.

             Al-TOP one-CL-GEN   dog-ACC   see-PAST

             'Al saw one dog.'

   Type II   Al-wa inu   ip-piki-o   mi-ta.

             Al-TOP dog   one-CL-ACC   see-PAST

   Type III   Al-wa inu-o   ip-piki   mi-ta.

             Al-TOP dog-ACC   one-CL   see-PAST

Recall now that the NPI in (3) includes the numeral *one*. This NPI is schematically the same as Type III numeral in (4), the only difference being the presence of *-mo* instead of the case marker. We obtain the other two types of NPIs by replacing the case marker with *–mo*, as shown in (5).[1] The schema of the three types of NPIs is given in (6). However, there is an idiosyncrasy with Type II in that the presence of *-mo* leads to ungrammaticality. Regardless of this fact, I argue in section 4 that Type II comes with the covert *-mo*. In the following, the three types of NPIs consisting of *one*-CL and (the overt or the covert) *-mo* are called *one* NPIs.

(5) Type I   Al-wa   ip-piki-no inu-mo   {*mi-ta / mi-na-katta}.

             Al-TOP   one-CL-GEN dog-MO   {see-PAST / see-NEG-PAST}

   Type II   Al-wa   inu   ip-piki(*-mo)   {*mi-ta / mi-na-katta}.

             Al-TOP   dog   one-CL(-MO)   {see-PAST / see-NEG-PAST}

(6) Type I   one-CL-GEN NP-MO

   Type II   NP one-CL(*-MO)

   Type III   NP-CASE one-CL-MO

The central goal here is to examine semantic differences among the three types of *one* NPIs. In section 2, I present novel empirical data indicating that Type III is semantically different from Type I and II. Section 3 provides tools needed to explain this difference, namely, the semantics of *even* and Lahiri's (1998) analysis of Hindi NPIs. In section 4, by extending Lahiri's analysis, I account for the differences of Japanese *one* NPIs. Section 5 is the conclusion.

2. Semantic Differences among *One* NPIs

Consider first the following scenario: Al saw no dogs, although he saw other animals. In this context, Type III *one* NPI in (3) is felicitous, but not Type I and II *one* NPIs in (5). In contrast, under the scenario where Al saw no dogs as well as no other animals/people, Type I and Type II, but not Type III, are felicitous. In the second scenario, it is crucial to assume that, if you

were to encounter anything/anyone, that would be a dog. The examples in (7) illustrate the same point. There is a general understanding that bread is a typical food that we would often eat, whereas steaks are not. Given this, Type I and II are fine with bread, but not with steaks. Moreover, Type I and II with bread in (7) mean something stronger than that Al ate no bread. In particular, they mean that Al ate nothing, not just any bread. Type III, in contrast, is compatible both with bread and with steak, yielding the interpretation that Al didn't eat any bread/steak, although he might have eaten something else.

(7) I   Al-wa   iti-mai-no   {pan/??suteeki}-mo   tab-ena-katta.
        Al-TOP one-CL-GEN {bread/steak}-MO   eat-NEG-PAST
        '(lit.) Al didn't eat one {bread/steak}.'

    II Al-wa   {pan/??suteeki}   iti-mai(*-mo)   tab-ena-katta.
        Al-TOP {bread/steak}   one-CL(-MO)   eat-NEG-PAST

    III Al-wa   {pan/suteeki}-o   iti-mai-mo   tab-ena-katta.
        Al-TOP {bread/steak}-ACC one-CL-MO   eat-NEG-PAST

In sum, with Type I and II, we obtain the 'not … anything' reading, given that the NP represents the most plausible or typical element which the description of the sentence applies to (e.g. dogs as the most plausible animal to be seen, bread as the most typical food to be eaten, etc.). With Type III, regardless of the semantic content of the NP, we always obtain the 'not … any NP(s)' reading, just like with English NPI *any* NP(s). In order to account for the difference here, I introduce some semantic tools in the next section.

3. *Even* and Negative Polarity Items

In section 3.1, I first briefly sketch the semantics of the focus particle *even*, and then in section 3.2, I introduce Lahiri's (1998) analysis of Hindi NPIs.

3.1. The Semantics of *Even*

As mentioned in section 1, *even* is sensitive to the placement of focus, which suggests that focus needs to play a role at the LF. Assuming that *even* is a sentential operator, the LF of (8a) is given in (8b): *even* combines with C (a silent restrictor variable) and the proposition p 'Al saw Bill'. In Rooth's (1985, 1992) alternative semantics, focus evokes a set of alternatives. In (8a), we obtain alternatives by replacing Bill with alternatives of the same type. C denotes a subset of such a set that only includes the propositions relevant to the context. In (8a), in the context where only Andy, Bill, and Conan are relevant individuals, C denotes the set of propositions exemplified in (9).

(8) a．Al even saw [Bill]$_F$.
     b．LF: even C [Al saw [Bill]$_F$]

(9) $\llbracket even \rrbracket^w$ (C)(p), where p = λw. see(a,b,w)
     C $\subseteq$ {q: $\exists$x[q = λw. see(a,x,w)]}
     (E.g. C = {Al saw Andy, Al saw Bill, Al saw Conan})

Karttunen and Peters (1979) claim that *even* does not contribute to the truth-conditions of a sentence, but it introduces a scalar presupposition (ScalarP): the proposition that *even* combines with is the least likely among the relevant alternatives.[2] For instance, (8a) asserts that 'Al saw Bill' and presupposes that 'Al saw Bill' is the least likely proposition in C.

When *even* appears in negative contexts, we obtain a different ScalarP. For instance, (10a) presupposes that Bill is the most likely person for Al to see. Karttunen and Peters (1979) argue that this is because *even* takes scope over negation, yielding the LF in (10b) (see also Wilkinson 1996).[3] At this LF, the proposition that *even* combines with includes negation, which yields the ScalarP in (12) that 'Al didn't see Bill' is the least likely proposition among the alternatives in C, that is, 'Al saw Bill' is the most likely proposition in C. In this way, when *even* takes scope over negation, ScalarP gets reversed by negation. Note that the same logic should go through with other DE operators, assuming that all DE operators reverse the likelihood scale just like negation does. Then, we should be able to obtain the most-likely presupposition whenever *even* takes scope over a DE-operator. This point serves as the essence of Lahiri's (1998) analysis summarized below.

(10)　a．Al didn't even see [Bill]$_F$.

　　　b．LF: even C [not [Al saw [Bill]$_F$]]

(11)　$[\![even]\!]^w$ (C)(p), where p = λw. $\neg$see(a,b,w)

　　　C $\subseteq$ {q: $\exists$x[q = λw. $\neg$see(a,x,w)]}

　　　(E.g. C = {Al didn't see Andy, Al didn't see Bill, Al didn't see Conan})

3.2. Lahiri's (1998) Analysis on NPIs in Hindi

Lahiri (1998) shows that the semantics of *even* discussed above plays a crucial role to account for the distribution of NPIs in Hindi. Just like Japanese, Hindi has an NPI that is composed of *one* and *even*, as in (12).

(12)　maiN-ne　ek　　bhii　aadmii-ko　*(nahiiN)　dekhaa

　　　I-ERG　　　one　even　man　　　(not)　　　saw

　　　'I {saw/didn't see} any man/men.'　　　　　　　　　　　　　　　(Lahiri 1998: 61)

Assuming that *bhii* 'even' associates with focus, just like *even*, Lahiri argues that *bhii* in NPIs associates with the cardinality predicate *ek* 'one'. Then, in (12), the relevant alternatives would be the propositions that we obtain by replacing *ek* 'one' with other cardinality predicates, as in (13).

(13)　$[\![bhii]\!]^w$ (C)(p), where p = λw. $\exists$x[|x|=1 $\wedge$ see(I,x,w)]

　　　C $\subseteq$ {q: $\exists$n[q = λw. $\exists$x[|x|=n $\wedge$ see(I,x,w)]]}

　　　(E.g. C = {I saw one man, I saw two men, I saw three men, ···})

ScalarP says that 'I saw one man' is the least likely proposition in C. However, this is inconsistent with the meaning of *one*. For example, if 'I saw five men' is true, then 'I saw one man' must be true, and if I saw three men, I must have seen one man. In this way, as in (14), 'I saw one man' is always entailed by the proposition with other cardinal predicates, i.e., the proposition with *one* is the weakest or the most likely (cf. Chierchia 2004: 77, "··· being stronger entails being less likely", see also Chierchia 2013).

(14) $\exists x[\ |x|=n \wedge see(I,x,w)\ ] \rightarrow \exists x[\ |x|=1 \wedge see(I,x,w)\ ]$

This analysis naturally accounts for why *ek bhii* is licensed in negative contexts. Adopting Karttunen and Peters's scope theory of *even*, *bhii* combines with the proposition 'I didn't see one man', as in (15).

(15) $[\![bhii]\!]^w$ (C)(p), where p = λ w. $\exists x[\ |x|=1 \wedge \neg see(I,x,w)\ ]$

C $\subseteq$ {q: $\exists n[\ q = \lambda$ w. $\exists x[\ |x|=n \wedge \neg see(I,x,w)\ ]\ ]$}

(C = {I didn't see 1 man, I didn't see 2 men, I didn't see 3 men, ⋯})

Then ScalarP would be that this proposition is the least likely proposition among the alternatives in C, that is, 'I saw one man' is the most likely proposition, which is consistent with the meaning of *one* in (14). More generally, Lahiri's analysis predicts that *ek bhii* is licensed whenever *bhii* takes scope over an operator that reverses the likelihood scale. It follows that *ek bhii* is licensed only if a DE operator is present, giving a natural explanation for Ladusaw's (1980) generalization that NPIs are licensed only in DE contexts. In other words, under Lahiri's analysis, the correlation between NPIs and DE contexts are not arbitrary. The restricted distribution of NPIs is derived from independent properties of *bhii* 'even'.

4. The Semantics of Japanese *One* NPIs

I now turn to the Japanese data and apply Lahiri's analysis with some elaboration. I make the following two claims: *-mo* in *one* NPIs can be analyzed as *even*, and all types of *one* NPIs come with the *even*-component. Then I argue that *even* in Type I and II NPIs associates with a different focus site from a site that *even* in Type III NPI associates with, and that this difference accounts for the difference in interpretation discussed in section 2.

4.1. *-Mo* in *One* NPIs as *Even*

We have seen in section 1 that *-mo* with an NP can be interpreted as *even* when the NP is focused (see (2b)). We have also seen that *-mo* can follow *one*-CL in negative sentences and yields an NPI interpretation. Knowing that a Hindi NPI can be decomposed to *one* and *even*, it is reasonable to assume that *-mo* in Japanese *one* NPIs corresponds to *even*. However, it would be convincing if we could provide an independent piece of evidence.

Let us reevaluate the examples in (3) and (5), which are repeated below:

(16) I Al-wa   ip-piki-no   inu-mo   {*mi-ta / mi-na-katta}.

Al-TOP   one-CL-GEN dog-MO   {see-PAST / see-NEG-PAST}

II Al-wa   inu   ip-piki(*-mo)   {*mi-ta / mi-na-katta}.

Al-TOP   dog   one-CL(-MO)   {see-PAST / see-NEG-PAST}

III Al-wa   inu-o   ip-piki-mo   {*mi-ta / mi-na-katta}.

Al-TOP   dog-ACC   one-CL-MO   {see-PAST / see-NEG-PAST}

Interestingly, the examples in (16) in the positive sentence are acceptable when *-mo* is interpreted as the additive particle *also*. For example, suppose that the speaker is listing animals that Al saw.

Then we can naturally obtain from (16) the interpretation that Al also saw one dog.[4] However, crucially, the prosodic pattern of *ip-piki* 'one-CL' in (16I) under the NPI reading and of (16I) under the additive reading are substantially different. Japanese is a pitch-accent language that has high and low tones, and accents are observed as a falling tone (i.e., a high-low sequence). While *ki* is accented in (16I) under the additive reading, *ki* is unaccented in (16I) under the NPI reading. The unacceptability of (16I) should be taken as a judgment given for the same unaccented prosodic pattern as (16I) under the NPI reading. The same argument holds for Type III items.[5] Based on these observations, I argue that *-mo* in *one* NPIs do not correspond to *also*.

Note now that the prosodic pattern of *ip-piki* 'one-CL' in (4) where *-mo* is absent is the same as that of *ip-piki* in (16) under the additive interpretation. In other words, the prosodic pattern of *ip-piki* 'one-CL' is different only when *ip-piki* is followed by *-mo*. Although this fact itself does not necessarily show that *-mo* is a focus particle, it at least suggests that *-mo* affects a prosodic pattern of the preceding expression of minimal amount. Assuming that focus is often expressed by prosodic prominence, it is not implausible to assume that *-mo* in *one* NPIs is a focus particle corresponding to English *even*.

A similar discussion extends to an indeterminate pronoun. Indeterminate pronouns are identical to *wh*-items, but they do not have interrogative interpretations inherently. Rather, they must associate with an operator, and yield various interpretations depending on which operator is used (Kuroda 1965). The combination of the indeterminate *dare* 'who' and *-mo* is acceptable in a negative sentence, but not in a positive sentence, as in (17).

(17) Al-wa dare-mo {mi-na-katta/*mi-ta}.

Al-TOP who-MO {see-NEG-PAST/see-PAST}

'Al {didn't see/saw} anyone.'

Note that *dare-mo* may yield a universal interpretation when it is followed by a case marker, as in (18).

(18) Dare-mo-ga ki-ta.

who-MO-NOM come-PAST

'Everyone came.'

The NPI *dare-mo* in (17) is prosodically different from the universal *dare-mo* in (18): while *dare-mo* in (17) is unaccented, *dare-mo* in (18) is accented (a falling tone at *da*). This is the same contrast as the one found between the NPI *one* + *-mo* and the additive *one* + *-mo* in (16), that is, the same unaccented pattern is found for both the NPI *dare-mo* and the NPI *one* + *-mo*.

Going back to (18), *-mo* in this example has been considered to be a universal quantifier that combines with an NP and then with the rest of the sentence (Nishigauchi 1990, von Stechow 1996, Shimoyama 2001, 2006). I assume that *-mo* in NPIs is different in nature from the universal quantifier *-mo*. There are at least three differences between the two. First, as shown above, *-mo* in NPIs triggers a different prosodic pattern from the universal *-mo*. Second, the universal *-mo* must be followed by a case marker, while *-mo* in NPIs must not. Third, while the universal *-mo* can be apart from an indeterminate, *-mo* in NPIs must be adjacent to an indeterminate (see Nishigauchi (1990) and Shimoyama (2001, 2006) for actual examples).

In sum, the examples in this section show that *–mo* in (16) that evokes an NPI reading cannot be treated as *also* or as the universal quantifier. This opens up a possibility of treating *–mo* in (16) as *even*. This view receives supports from a cross-linguistic perspective: it is not uncommon to find languages that use *even* for NPIs, as we have seen in Hindi (see section 5 for further discussion). Some researchers argue that the semantics of *even* helps to understand the distribution of NPIs (Heim 1984, Lee and Horn 1994, Lahiri 1998, Guerzoni 2003, see also Chierchia 2006, 2013).

4.2. Silent *Even* in Type II *One* NPI

Before presenting the compositional analysis of *one* NPIs, a discussion on Type II *one* NPI is in order. Unlike Type I and Type III *one* NPIs, Type II *one* NPI does not co-occur with the overt *-mo*, as in (16II). Regardless of this apparent difference, we have seen above that Type I and II NPIs are semantically equivalent[6]. Then we would hope that the same analysis that applies to Type I should apply to Type II. For this argument to go through, we need to show that Type II NPI comes with a silent *even*. Positing a silent *even* is not inconceivable; it has been independently proposed that some NPIs in English, such as the ones in (19), come with a silent *even* (which may be optionally expressed overtly) (Heim 1984).

(19)   a．Al didn't (even) lift a finger to help Bill.

       b．Colin didn't (even) have a single bite.

I provide two further pieces of evidence to support the assumption that Type II *one* NPI comes with a silent *even*. First, although Type II *one* NPI cannot be followed by *-mo*, it can appear with *-sae*, another focus particle that corresponds to *even*. (20) shows that *-sae* is compatible with Type II NPI, contra (7II) with *-mo*. Regardless of this difference, (20) and (7II) have the same interpretation, that is, Al didn't eat anything.

(20) II Al-wa   pan   iti-mai-sae   tab-ena-katta.

         Al-TOP bread   one-CL-even   eat-NEG-PAST

         '(lit.) Al didn't even eat one slice of bread.'

Second, in some limited context, Type II *one* NPI can occur with yet another focus particle *-demo*, which is a variant of *-mo*. When Type I and Type III *one* NPIs are licensed in negative contexts, the NPIs are formed with *-mo*. However, in other NPI-licensing contexts (e.g., the antecedent of conditionals, the restrictor of universal quantifiers, etc.), *-demo* appears with these NPIs, as in (21) (Nakanishi 2006). (22) shows that Type II NPI can also co-occur with *-demo* in the antecedent of conditionals.

(21) I   Iti-mai-no   pan-demo   tabe-ta-ra   okoru-yo.

          one-CL-GEN   bread-MO   eat-PAST-if   get angry-EMP

          '(lit.) If you even eat one slice of bread, I'll get mad at you.'

     III Pan-o   iti-mai-demo   tabe-ta-ra   okoru-yo.

          bread-ACC   one-CL-DEMO eat-PAST-if   get angry-EMP

          '(lit.) If you even eat one slice of bread, I'll get mad at you.'

(22) II Pan   iti-mai(-demo) tabe-ta-ra   okoru-yo.
          bread   one-CL(-DEMO)   eat-PAST-if   get angry-EMP

'(lit.) If you even eat one slice of bread, I'll get mad at you.'

Based on the two empirical observations presented above, I assume that Type II *one* NPI comes with a silent *even*. The fact that *-mo* cannot overtly appear in Type II NPI may be considered as a morphological discrepancy in Japanese. Indeed, in Korean, the language that has the same three types of *one* NPIs, the overt *even* item is able to appear in Type II *one* NPI.

4.3. Analysis

Having established the assumption that all three types of *one* NPIs include either the overt or the covert *even*, the next step is to examine the source of the semantic difference between Type I / II and Type III. We have seen in section 2 that, while Type I / II NPIs yield 'nothing, nobody' interpretations when the relevant NP is the most common instance (e.g., dogs at a dog-populated park), Type III NPI means 'no NP'. I argue that this semantic difference is due to the difference in the location of focus, which is tied to the structural difference between the two. In particular, I show that, with Type I / II, the entire NP consisting of *one* and the modified NP serves as a focus that associates with *even*, whereas, with Type III, only the cardinality predicate *one* followed by a classifier associates with *even*. This difference is schematized in (23), where a covert *even* is expressed as EVEN. In (24), I provide the three types of numerals (see (4) for actual examples).

(23) I   [one-CL-GEN NP]$_F$-MO   (24) I   one-CL-GEN NP-CASE
      II   [NP one-CL]$_F$-EVEN   II   NP one-CL-CASE
      III NP-CASE [one-CL]$_F$-MO   III NP-CASE one-CL

Regarding (24), it has been assumed that the numeral and the associated NP in Type I and II form a nominal constituent, while the relation between the numeral and the NP is much more controversial in Type III (Watanabe 2006, among others). Traditionally, the numeral in (24III) is called a floating quantifier (FQ) in that it can appear away from the associated NP. While some element such as adverbs and PPs can intervene between the NP and the FQ, such a configuration leads to ungrammaticality in (24I) and (24II). Moreover, the FQ in (24III) may scramble to any location of the sentence, whereas such a scrambling is impossible in Type I and II. The same distinction extends to *one* NPIs. For instance, while Type III numeral *one*-CL and the associated NP can have an intervening element, as in (25III), such a configuration is impossible with Type I and II, as in (25I) and (25II).

(25) I   *Al-wa   iti-mai-no   sokode   pan-mo   tab-ena-katta.
           Al-TOP   one-CL-GEN   there   bread-MO   eat-NEG-PAST

           'Al didn't eat anything there.'

      II   *Al-wa   pan   sokode   iti-mai   tab-ena-katta.
           Al-TOP   bread   there   one-CL   eat-NEG-PAST

           'Al didn't eat anything there.'

      III Al-wa   pan-o   sokode   iti-mai-mo   tab-ena-katta.
           Al-TOP   bread-ACC   there   one-CL-MO   eat-NEG-PAST

'Al didn't eat any bread there.'

Thus, it makes sense to assume that, in Type I and II, -*mo* associates with the entire NP (i.e., *one*-CL + host NP), while -*mo* associates only with *one*-CL in Type III, as schematized in (23).

The focus association of Type III *one* NPI is just like that of Hindi NPIs, that is, the focus particle *even* (*bhii* in Hindi and -*mo* in Japanese) associates with the cardinality predicate *one*. Thus, Lahiri's (1998) analysis of Hindi NPIs should directly extend to Type III *one* NPI, repeated in (26) (with the addition of [ ]$_F$). Alternatives are created by replacing *one* with other cardinality predicates. In the case of positive contexts, *even* introduces ScalarP that 'Al ate one slice of bread / one steak' is the least likely proposition, and this presupposition conflicts with the semantics of *one* that the proposition with *one* is the most likely one (see (14)). This conflict is resolved in negative contexts. The relevant LF and the alternatives are given in (27) and (28), respectively. ScalarP in this case would be that 'Al didn't eat one slice of bread / one steak' is the least likely proposition, i.e., 'Al ate one slice of bread / one steak' is the most likely proposition due to the scale-reversal property of the negation. This presupposition is in harmony with what *one* means.

(26)   Al-wa   {pan / suteeki}-o   [iti-mai]$_F$-mo   {*tabe-ta / tab-ena-katta}.

      Al-TOP   {bread / steak}-ACC one-CL-MO   {eat-PAST/eat-NEG-PAST}

      'Al {ate / didn't eat} any {bread / steak}.'

(27)   LF : even C [not [Al ate [one]$_F$ bread/steak]]

(28) $⟦even⟧^w$ (C)(p), where p= λw. $\neg\exists$x[|x|=1$\wedge$bread/steak(x)$\wedge$eat(a,x,w)]

      C $\subseteq$ {q: $\exists$n[q = λw. $\neg\exists$x[|x|=n$\wedge$bread/steak(x)$\wedge$eat(a,x,w)]}

      (E.g. C = {Al didn't eat one slice of bread / one steak, Al didn't eat two slices of bread / two steaks, ⋯ , Al didn't eat n slices of bread / n steaks})

Turning now to Type I and II NPIs, *even* associates with the entire NP, rather than just with the cardinality predicate, as indicated by [ ]$_F$ in (29). The LF structure of these sentences is given in (30). Then, the alternatives obtain by replacing 'one slice of bread' or 'one steak' with elements of the same type. Assuming that these are generalized quantifiers of type <<e,t>, t> and that any NPs can be type-shifted to <<e,t>, t> (Partee 1987), the alternatives would include propositions where 'one slice of bread' or 'one steak' is replaced by any NPs, as in (31).

(29)   I   Al-wa   [iti-mai-no   {pan / ??suteeki}]$_F$-mo   tab-ena-katta.

         Al-TOP   one-CL-GEN   {bread / steak}-MO   eat-NEG-PAST

       II   Al-wa   [{pan / ??suteeki}   iti-mai]$_F$ tab-ena-katta.

         Al-TOP   {bread / steak}   one-CL   eat-NEG-PAST

         'Al didn't eat anything.'

(30)   LF: even C [not [Al ate [one bread/steak]$_F$]]

(31) $⟦even⟧^w$ (C)(p), where p= λw.$\neg\exists$x[|x|=1$\wedge$bread/steak(x)$\wedge$eat(a,x,w)]

      C $\subseteq$ {q: $\exists$Q$_{<<e,st>,st>}$[q = λw. $\neg$Q(λx.λw'. eat(a,x,w'))(w)=1]}

      (E.g. C = {Al didn't eat 1 slice of bread, Al didn't eat 2 slices of bread, Al didn't eat 3 slices of bread, ⋯ , Al didn't eat most slices of bread, Al didn't eat all slices of bread, ⋯ , Al didn't eat 1 steak, that Al didn't eat 2 steaks, ⋯ , Al didn't eat 1 banana, Al didn'

t eat 2 bananas, ⋯ , Al didn't eat those eggs, ⋯ , Al didn't eat the cake, ⋯ })

In (29) with one slice of bread, ScalarP is the following: 'Al didn't eat one slice of bread' is the least likely proposition among the alternatives, i.e., 'Al ate one slice of bread' is the most likely proposition. This is consistent with the meaning of *one* in (14) that the proposition with *one* is the most likely, and also with the intended contexts where bread is a typical food for Al to eat. Moreover, the fact that the most likely proposition 'Al ate one slice of bread' is false suggests that all other propositions must be false, that is, Al didn't eat anything. In contrast, in (29) with one steak, we obtain ScalarP that 'Al ate one steak' is the most likely proposition, and of course this is inconsistent with a general assumption that steak is not a food that we often eat. Thus, in (29), *bread*, but not *steak*, can be used in Type I / II *one* NPIs.

Let us now examine Type I / II *one* NPIs in positive contexts, repeated in (32) (with the addition of [ ]$_F$). In the case with *bread*, ScalarP is that 'Al ate one slice of bread' is the least likely proposition among the alternatives in (33). This is inconsistent with the meaning of *one* and also with bread being a typical food to be eaten. Similarly, with *steak*, ScalarP is that 'Al ate one steak' is the least likely proposition among the alternatives in (33). This may be consistent with the contexts where steaks are considered to be the least likely food to be consumed. However, this ScalarP always conflicts with the assumption that *one* is the weakest cardinality, as stated in (14). As long as the alternatives include propositions with numerals ('Al ate two steaks', 'Al ate ten steaks', etc.), 'Al ate one steak' cannot be the least likely proposition.

(32) I * Al-wa   [iti-mai-no   {pan / suteeki}]$_F$-mo   tabe-ta.
      Al-TOP   one-CL-GEN   {bread / steak}-MO   eat-PAST

    II *Al-wa   [{pan / suteeki}   iti-mai]$_F$ tabe-ta.
      Al-TOP   {bread / steak}   one-CL   eat-PAST

(33) $[\![even]\!]^w$ (C)(p), where p = λw.$\exists$x[|x|=1∧bread/steak(x)∧eat(a,x,w)]

    C $\subseteq$ {q: $\exists$Q$_{<<e,st>,st>}$[q = λw. Q(λx.λw'. eat(a,x,w'))(w)=1]}

    (E.g. C = {Al didn't eat 1 slice of bread, Al didn't eat 2 slices of bread, Al didn't eat 3 slices of bread, ⋯ , Al didn't eat most slices of bread, Al didn't eat all slices of bread, ⋯ , Al ate 1 steak, Al ate 2 steaks, ⋯ , Al ate 1 banana, Al ate 2 bananas, ⋯ , Al ate those eggs, ⋯ , Al ate the cake, ⋯ })

5. Discussions

In this paper, I presented a semantic analysis of Japanese *one* NPIs that accounts for why the three types of *one* NPIs are unacceptable in positive contexts and also for why Type I / II and Type III differ in meaning. The unacceptability in positive contexts is explained as a 'presupposition clash': ScalarP introduced by *even* contradicts with the meaning of *one*. The semantic difference between Type I / II and Type III is explained by their difference in focus sites: while *even* in Type I / II is associated with the entire NP (including *one* and the host NP), *even* in Type III is associated only with the cardinal predicate *one*. It follows that different alternatives are introduced

in computing ScalarP of *even*, which in turn yields different interpretations, that is, Type I / II 'not ··· anything' and Type III 'not ··· any NP'. In this way, like Lahiri (1998), the distributions and interpretations of *one* NPIs are derived from independent properties of *-mo* 'even'.

Another implication that arises from this paper is that Japanese *one* NPIs should behave as 'strong' NPIs. It has been independently argued that there are two types of NPIs in English, namely, strong and weak NPIs, where the strong ones can occur with *even* and the weak ones cannot, as in (34) and (35). The proposed analysis assumes that all types of Japanese *one* NPIs come with *even*, suggesting that the *one* NPIs are strong NPIs.

(34)　a．Al didn't (even) lift a finger to help Bill.

　　　b．Colin didn't (even) have a single bite.　　　　　　　　　　(=(19))

(35)　a．Al didn't (*even) do anything to help Bill.

　　　b．Colin didn't (*even) have any bite.

It has been claimed that strong and weak NPIs are different at least in two respects. First, strong NPIs, but not weak NPIs, are negatively biased in questions (Ladusaw 1980, Heim 1984, Wilkinson 1996, Guerzoni 2003). For instance, the strong NPI in (36a) is biased toward negative in that it cannot be followed by an affirmative answer, while the weak NPI in (36b) is neutral in this respect.

(36)　a．Did Al lift a finger to help Bill?　　　??Yes. / No.

　　　b．Did Al do anything to help Bill?　　　Yes. / No.

Second, strong NPIs, but not weak NPIs, require non-accidental generalizations (Linebarger 1980, Heim 1984, Guerzoni 2003). The examples in (37) show that the strong NPI is unacceptable when there is no natural relation between the relative clause and the main clause, while (38) show that the weak NPI is immune to such a restriction.

(37)　a．Every boy who had a single bite of the salad got sick.

　　　b.??Every boy who had a single bite of the salad is taller than me.

(38)　a．Every boy who had any of the salad got sick.

　　　b．Every boy who had any of the salad is taller than me.

Now the question is whether Japanese *one* NPIs have the two properties of strong NPIs. As briefly mentioned above, *one* NPIs other than in negative contexts involve *-demo* instead of *-mo*, although both items correspond to English *even* (see section 4.2). Thus, in questions and in the restrictor of universal quantifiers, *-demo* appears instead of *-mo*. With this caveat, let us examine the question in (39). This seems to be negatively biased in that the speaker is expecting to hear a negative answer; the speaker seems to believe that Al didn't read any book. Second, the examples in (40) show that the *one* NPI is unacceptable when the relation between the relative clause and the main clause is merely accidental. In sum, (39) and (40) show that Japanese *one* NPIs have the two characteristic properties of strong NPIs.

(39)　Al-wa　　　hon-o　　　　is-satu-demo　　　yon-da-no?

　　　Al-TOP　　book-ACC　　one-CL-DEMO　　　read-PAST-Q

　　　'Did Al read even a single book?'

(40)　a．Sarada-o　hito-kuti-demo　tabe-ta　　subete-no　syoonen-wa

salad-ACC   one-CL-DEMO   eat-PAST   all-GEN   boy-TOP

byooki-ni   nat-ta.

sick-DAT   become-PAST

'Every boy who had a single bite of the salad got sick.'

b.??Sarada-o hito-kuti-demo   tabe-ta   subete-no   syoonen-wa

salad-ACC   one-CL-DEMO   eat-PAST   all-GEN   boy-TOP

watasi-yori   se-ga   takai.

I-than   hight-NOM   high

'Every boy who had a single bite of the salad is taller than me.'

As a last remark, I would like to discuss some difference between Type I and Type II NPIs. In the proposed analysis, these NPIs come with *even* that takes [*one* + NP] as a focus, predicting that they are semantically equivalent. Indeed, as far as the data presented above are concerned, this prediction seems to be borne out. However, the two types may differ in that idiomatic expressions can be formed with Type II *one* NPI, but not with Type I *one* NPIs. For example, take the expression *hitokko* 'human child'. This expression cannot be used in ordinary sentences, regardless of whether it is positive or negative, as in (41). However, Type II NPI *hotokko hito-ri* in (42II) is widely used. Note that it cannot be used in Type I NPI, as in (42I).

(41)   *Al-wa   hitokko-o   {mi-ta / mi-na-katta}.

Al-TOP   human child-ACC   {see-PAST / see-NEG-PAST}

'(lit.) Al {saw / didn't see} a human child.'

(42) II Al-wa   hitokko   hito-ri   mi-na-katta.

Al-TOP   human child   one-CL   see-NEG-PAST

'(lit.) Al didn't see one human child.' = Al didn't see anyone.

I *Al-wa   hito-ri-no   hitokko-mo   mi-na-katta.

Al-TOP   one-CL-GEN   human child-MO   see-NEG-PAST

Another example is given in (43II), where *namida hito-tu* 'tear one-CL' in negative contexts yields the interpretation 'didn't cry at all'. What is remarkable here is that *namida* 'tear' generally occurs with the classifier *-teki* that is used to count drops of liquid, and not with *-tu*, as in (44). Indeed, Type I NPI in (43I) is unacceptable.

(43) II Al-wa   namida   hito-tu   mis-ena-katta.

Al-TOP   tear   one-CL   show-NEG-PAST

'(lit.) Al didn't show one tear.' = Al didn't cry at all.

I *Al-wa   hito-tu-no   namida-mo   mis-ena-katta.

Al-TOP   one-CL-GEN   tear-MO   show-NEG-PAST

(44) a．yon-teki-no   namida   b．*yot-tu-no   namida

four-CL-GEN   tear   four-CL-GEN   tear

'four drops of tear'

I do not have any account for the idiomatic nature of Type II NPI, but I would like to point out that English NPIs with a silent *even* also brings in an idiomatic flavor. For instance, you can say

that 'John didn't lift a finger to help Bill', meaning 'John didn't help Bill at all', but you cannot get this idiomatic interpretation by saying that 'John didn't lift a toe to help Bill'. Given that Type II NPI in Japanese also comes with the silent *even*, we may be able to say that the silent *even* may be a culprit here.

References

Aoyagi, H. 1994. On association with focus and scope of focus particles in Japanese. *MIT Working Papers in Linguistics* 24, 23-44.

Chierchia, G. 2004. Scalar implicatures, polarity phenomena, and the syntax/pragmatics interface. In A. Belletti ed., *Structures and Beyond*, 39-65. Oxford: Oxford University Press.

Chierchia, G. 2006. Broaden your views: Implicatures of domain widening and the "logicality" of language. *Linguistic Inquiry* 37:4, 535-590.

Chierchia, G. 2013. *Logic in Grammar: Polarity, Free Choice, and Intervention*. Oxford: Oxford University Press.

Downing, P. 1996. *Numeral Classifier Systems: The Case of Japanese*. Amsterdam: John Benjamins.

Giannakidou, A. 2007. The landscape of EVEN items. *Natural Language and Linguistic Theory* 25, 39-81.

Greenberg, Y. 2016. A novel problem for the likelihood-based semantics of even. *Semantics and Pragmatics* 9, 1-28.

Greenberg, Y. 2018. A revised, gradability-based semantics for *even*. Natural Language Semantics 26, 51-83.

Guerzoni, E. 2003. *Why Even Ask? On the Pragmatics of Questions and the Semantics of Answers*. Ph.D. dissertation, MIT.

Heim, I. 1984. A note on negative polarity and downward entailingness. In *The Proceedings of the 14th Conference of the North East Linguistic Society (NELS 14)*, 98-107.

Herburger, E. 2003. A note on Spanish *ni siquiera, even*, and the analysis of NPIs. *Probus* 15, 237-256.

Karttunen, L., and Stanley P. 1979. Conventional implicature. In *Syntax and Semantics 11: Presuppositions*, 1-55. New York: Academic Press.

Kay, P. 1990. Even. *Linguistics and Philosophy* 13, 59-111.

Kuroda, S.-Y. 1965. *Generative Grammatical Studies in the Japanese Language*. Ph.D. dissertation, MIT.

Ladusaw, W. 1980. *Polarity sensitivity as Inherent Scope Relations*. New York: Garland.

Lahiri, U. 1998. Focus and negative polarity in Hindi. *Natural Language Semantics* 6, 57-123.

Lee, Y., and L. Horn. 1994. *Any* as Indefinite plus *Even*. Manuscript. Yale University.

Linebarger, M. 1980. *The Grammar of Negative Polarity*. Ph.D. dissertation, Massachusetts Institute of Technology.

Nakanishi, K. 2006. *Even, only,* and negative polarity in Japanese. *The Proceedings of the 16th Semantics and Linguistics Theory (SALT 16)*.

Nishigauchi, Taisuke. 1990. *Quantification in the Theory of Grammar*. Dordrecht: Kluwer.

Partee, B. 1987. Noun phrase interpretation and type-shifting principles. In *Studies in Discourse Representation Theory and the Theory of Generalized Quantifiers*, 115-143. Dordrecht: Foris.

Rooth, M. 1985. *Association with Focus*. Ph.D. dissertation, University of Massachusetts, Amherst.

Rooth, M. 1992. A theory of focus interpretation. *Natural Language Semantics* 1, 75-116.

Rullmann, H. 1997. *Even*, polarity, and scope. M. Gibson, et al. eds., *Papers in Experimental and Theoretical Linguistics* 4, 40-64.

Shimoyama, J. 2001. *Wh–Constructions in Japanese*. Ph.D. dissertation, University of Massachusetts at Amherst.

Shimoyama, J. 2006. Indeterminate phrase quantification in Japanese. *Natural Language Semantics* 14, 139-173.

von Stechow, A. 1991. Current issues in the theory of focus. In *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung*, 804-825. Berlin: Walter de Gruyter.

von Stechow, A. 1996. Against LF pied-piping. *Natural Language Semantics* 4, 57-110.

Takami, K. 2001. *Nitieigo–no Kinooteki Koobun Bunseki [A Functional Analysis of English and Japanese Constructions]*. Tokyo: Hoo Syoboo.

Watanabe, A. 2006. Functional projections of nominals in Japanese: Syntax of classifiers. *Natural Language and Linguistics Theory* 24, 241-306.

Wilkinson, K. 1996. The scope of even. *Natural Language Semantics* 4, 193-215.

1   With some contextual help, (5) in positive contexts may become acceptable. Moreover, there are some complications regarding prosodic patterns of NPIs. See section 4.1 below for details.

2   It is controversial whether the relevant proposition is 'less' likely or the 'least' likely (Kay 1990, Rullmann 1997, Guerzoni 2003, and more recently, Greenberg 2016, 2018). I simply assume here that the proposition is the least likely one.

3   Alternatively, we may posit another lexical entry for *even* with the 'most-likely' ScalarP (Rooth 1985, von Stechow 1991, Rullmann 1997, Herburger 2003, Giannakidou 2007).

4   (16III) in the positive sentence sounds a little awkward under the additive interpretation. In general, in Type III (i.e., NP-CASE one-CL), the NP that the numeral is associated with is interpreted as a topic of the sentence (Takami 2001: see also section 4.3 below). Thus, (16III) roughly corresponds to the English sentence 'as for dogs, Al also saw one', which is most natural in the context where there is other animals than dogs that Al saw one. The acceptability of (16III) improves under this context.

5   Unlike Type I and Type III, Type II has the same prosodic pattern. I suspect that this has something to do with the fact that Type II does not allow the overt presence of *-mo*.

6   However, Type I and II NPIs differ at least in one respect: Type II, but not Type I, can have an idiomatic interpretation. See section 5 below for some examples.