Processing Negative Polarity Items in Korean: Implications from an ERP Study

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ABSTRACT

The present study used event-related potentials (ERPs) to examine the neural correlates supporting the processing of two negative polarity items (NPI) (nominal *amwu+N+to* "any+N+even" and adverbial *te isang* "any more/longer") in Korean. Participants read sentences phrase by phrase while their brain activities during the processing of the NPIs and their licensors were being recorded. The results revealed that the NPI licensors in such contexts as positive or interrogative clauses not containing a proper licensor elicited a larger N400 component, possibly reflecting the cost of semantic or pragmatic integration. By contrast, sentences with the adverbial NPI *te isang* in the negative implicature-inducing "before" clause are not significantly different in ERP responses from those in the negative clause, thus evoking no ERP component. The present findings not only demonstrate semantic and pragmatic effects in neural signatures evoked by varied NPI-licensor relations, but also point to the multi-dimensionality of NPI processing/licensing recruiting semantic/pragmatic integration as well as syntactic dependency formation.

Keywords: NPI, *amwu+N+to*, *te isang*, licensor-licensee relation, ERP, N400, semantic integration

1. Introduction

Negative Polarity Items (NPIs) are an assortment of lexical items that need to associate with and be licensed by an NPI licensor, such as negation. For instance, the English NPI *any* + NP generally occurs in the syntactic (i.e. the c-command domain) and semantic scope and of its licensor (Klima, 1964; Ladusaw, 1979, 1980). As in (1), *any* is grammatically licensed when it occurs within the scope of negation (1a), but it is ungrammatical when there is no negation present (1b), or when a

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negation is present, but doesn't c-command the NPI (1c).

(1) a. John didn't talk to anybody.
b. *John has talked to anybody.
c. *Anybody didn't talk to John

Although negation is a cross-linguistically typical licensor for NPIs, it is to be noted that their distribution (within a single language or cross-linguistically) is quite broad and they associate with a vast range of negative and non-negative licensors, including negative quantifiers, conditionals, modal verbs, generic sentences, imperatives, questions, the scope of certain universal quantifiers and disjunctions (see Giannakidou and Yoon, 2016, for a review).

Granted the complexity of licensing NPIs, an immediate question arises: how quickly language users can deploy the relevant licensing conditions to integrate an NPI word into a larger sentence context. To address this issue, a commonly adapted experimental technique is to compare the processing profiles of licensed and unlicensed NPIs, and ascertain how quickly language can recognize the linguistic anomaly from the unlicensed NPI.

In the present study we employ the event-related potential (ERP) paradigm to compare neural responses to the two Korean NPIs: nominal *amwu+N+to* 'any+N+even' and adverbial NPI *te isang* 'any more/longer' in four constructions/conditions with analogous syntactic structure. We chose these two NPIs in Korean because they differ in terms of the contexts where they are licensed: *amwu+N+to* is known to be more restricted than its English counterpart *any NP*, whereas *te isang* is more permissible than *amwu+N+to*, thus being analogous in behavior to its English counterpart *any more/longer*. Specifically, the four constructions making up the experimental materials in EXP(eriment) 1 and EXP 2 are (i) negative clause, (ii) positive clause, (iii) question clause, and (iv) *-ki cen-ey* 'before' clause, which are known to differ in terms of the way of licensing an NPI in Korean. Although we start with the linguistic analyses and behavioral acceptability rating of these constructions containing one of the two NPIs, this study intends to connect theoretical analyses of NPIs with behavioral and neuro-linguistic aspects of such linguistic knowledge.

2. Previous studies

2.1. Negative Polarity Items and Syntactic/Semantic Licensor

Various views on NPI licensing have been put forth in the literature (Baker, 1970; Fauconnier, 1975; Ladusaw, 1979, 1980; Linebarger, 1980, 1987; Kadmon & Landman, 1993; Hoeksema, 1994; Krifka, 1995; Zwarts, 1995, 1996; Giannakidou, 1998, 2006; Lahiri, 1998; Von Fintel, 1999; Chierchia, 2006). The main concern of this paper is to report the experimental study regarding the comprehension of Korean NPIs. But before we do that, we will first offer a brief overview of the major syntactic or semantic notions that have been argued to be instrumental in NPI licensing.

As a first hypothesis, the syntactic licensing of NPIs can be identified with the c-commanding of them by their licensors. We thus submit that the licensing domain for the items is the c-command domain of their licensor at SS or LF. The arguments for the need to appeal to LF will be provided by cases where (a) NPIs are ungrammatical though that they are c-commanded by negation at s-structure, and (b) affective items are grammatical but not c-commanded by negation at s-structure.

We now turn to three lines of semantic approach that have been vital to our understanding of NPI licensing. According to the influential Downward Entailing (DE) hypothesis (Fauconnier, 1974; Ladusaw, 1979, 1980; see also Hoeksema, 1994; Von Fintel, 1999; among others), NPIs are licensed in the scope of the DE operators: A function f is DE iff for every arbitrary element X and Y, it holds that $X \subseteq Y \rightarrow f(Y) \subseteq f(X)$. The DE hypothesis for NPI licensing has been a dominant paradigm as it gives a unified semantic characterization of the issue at hand. It effectively accounts for the fact that a battery of seemingly unrelated elements can license NPIs because of their logical properties.

Noting that DE operators constitute a subset but not all of the NPI licensors, Giannakidou (1998, 1999) alternatively proposed that (non-)veridicality sensitivity is a key ingredient for licensing of NPIs (see also Zwarts, 1995). Non-veridical contexts do not entail or presuppose the truth of a proposition p. Sentential negation, being the cross-linguistically attested NPI licensor, is anti-veridical as well as being non-veridical, as the proposition under negation turns out to be necessarily false. The non-veridicality condition on NPI licensing ensure broad empirical coverage. Giannakidou (1998, 1999) argued that such licensing environments as questions, conditionals, modal contexts, future tense, and imperatives are not DE, but they

are non-veridical.

Kadmon & Landman (1993) still took a different tack, arguing that *any* NP makes a semantico-pragmatically stronger statement than a regular indefinite DP. Kadmon & Landman proposed that the semantics of *any* NP is composed of both that of an indefinite DP and an additional *domain widening* function. *Domain widening* arises when the interpretation of the regular NP widens along a certain contextual dimension. This line of analysis essentially revolves on a scalar component to the semantics of *any*. By uttering *I don't have any friends*, the speaker means that he doesn't have even a usual friend (not to mention a close friend), or even one single friend (not to mention more than one). The exact scalar dimension is conditioned by context. The (implicit) scalar component in English *any* is encoded by a morphological exponent in some other languages. For example, in Hindi, an overt morpheme *ek-bhii* 'even' is realized as part of the NPI form (Lahiri, 1998). Strengthening with domain widening tends to arise in DE environments: the assertion with a larger/widened domain that is quantified over by a DE operator entails the assertion with a smaller domain.

Turning to Korean, Choe (1988) argued that this language has a syntactic clause-mate condition on NPI licensing. In turn, the distribution of NPIs in Korean, representatively *amwu* 'any' + NP, suggests that its syntax needs a notion of "negative clause", regardless of scope of negation (Sells 2001, 2006). One formulation of NPI licensing in Korean along this line is in (2), from Sells (2006):

(2) Syntactic Licensing:
Each Korean NPI must be licensed by the syntactic clausal feature [NEG +]; otherwise the structure is ungrammatical. (cf. the "clausemate condition" of Choe (1988)).

The examples in (3) involve an NPI in an embedded clause with negation in the matrix clause.

(3) a. %na-nun [amwu haksayng-to ku moim-ey ka-ss-ta-ko]
I-TOP [any student-even that meeting-to go-PST-DCL-Comp]
sayngkakha-ci anh-nunta
think-Comp NEG.do-PRS.DCL
'I do not think that any students went to the meeting.'

b. *na-nun [chelswu-ka amwu chayk-to iIk-ess-ta-ko]
I-TO [Chelswu-Nom any book read-PST-DCL-Comp]
sayngkakha-ci
think-Comp
anh-nunta
NEG.do-PRS.DCL
'I do not think that Chelsoo read any books.'

Both examples in (3) are ruled out since the NPI and its licensor are not in the same clause.

As pointed out above, Ladusaw's (1979) downward entailment is not effective enough to capture the distributional patterns of sundry NPIs (van der Wouden, 1997; van der Wouden and Zwarts, 1993; Zwarts, 1986, among others). Addressing this challenge, Zwarts (1986; 1998) distinguishes three kind of DE licensors and proposes the notion of semantic strength to account for their heterogeneous NPI-licensing properties. This semantic approach has also been adopted to account for Korean NPI licensing (Nam, 1994; Chung, 1993, 1997; Hwang, 2009). Shin and Chung (2009), however, argue that Zwarts's and Nam's (1994) boolean semantic approach for negation is not appropriate in characterizing the properties of Korean negative (-like) elements and explaining the contexts of licensing Korean NPIs. The big stumbling block with Korean NPIs is that they are not licensed in the scope of negation, and hence they cannot serve as arguments of negated predicates (Kim, 1999; Lee, 2001; Sells, 2006; Kim and Sells, 2007). Put succinctly, the Korean NPI *amwu* 'any' + NP that is above the immediate scope of negation should be analyzed as a universal quantified NP. The supporting evidence for this analysis comes from the fact that in (5), *amwuto* in subject position can be licensed by lexical negation that cannot scope over the subject as in (4).

(4) motun haksayng-i Cheli-lul molu-nta
all students-NOM Cheli-ACC not.know-PRS.DCL
'All the students do not know Cheli.' (ALL > NOT, *NOT> ALL)

(5) amwuto Cheli-lul molu-n-ta
anyone Cheli-ACC not.know-PRS-DCL
'No one knew it.'

Moreover, *amwuto* can be modified by *keuy* `almost' unlike the English NPI *any* (Kim, 1999: 408).

(6) *John did not meet almost anyone.

(7) Cheli-nun keuy amwuto manna-ci anh-ass-ta.
Cheli-TOP almost anyone meet-VI NOT.do-PST-DCL
'Cheli did not meet almost all people.'

According to Carlson (1981), the modification of *almost* renders evidence whether a given quantified expression is existential or universal: English *almost* can modify universal *every*, but it cannot modify existential NPI *any*. By contrast, the grammaticality of (7) indicates that *amwuto* is not an existential QP. In short, mainly due to this idiosyncratic property of Korean NPIs, it is difficult to define the contexts of licensing Korean NPIs in terms of three different levels of negation.

Hwang (2014) entertains the notion of (non-)veridicality sensitivity. Hwang argues that though non-nominal NPIs in Korean are licensed in non-veridical contexts, morphologically complex nominal NPIs in Korean comprised of NPI particle *-to* 'even' are licensed in more restricted 'anti-veridical' ones. Hwang goes on to account for a group of NPIs in Korean which are allowed in contexts which are not defined as non-veridical. She finally suggests that there are two ways of ruling in NPIs, licensing by non-veridicality and 'rescuing' (Giannakidou, 2006) by negative implicature, and that rescuing applies as a secondary option to permit NPIs only if contexts give rise to appropriate negative implicatures.

The quick overview in this sub-section demonstrates that NPI licensing involves not just one level but multiple levels associated with syntactic, semantic, and pragmatic conditions. Each of the proposals summarized above highlights a particular aspect of NPI licensing, but we certainly employ more than one single condition to explain the full gamut of data. The multi-dimensionality of NPI licensing also becomes even more evident when we take into account how NPIs are processed and comprehended in real time. The experimental studies we review in the next sub-section will indicate that to successfully integrate an NPI into its sentential context, the language processer recruits multiple different mechanisms, dichotomously speaking, both grammatical and extra-grammatical ones.

2.2. An ERP Study of NPI Processing

To discern the fine-grained time course of processing NPIs during sentence comprehension, not a few studies have employed the Event-Related Potentials (ERP) technique, thanks to its excellent temporal resolution. The particular ERP component known as a neural marker of the NPI licensing process is the N400 response. Under the general view that N400 functionally signals the degree of semantic feature (mis-)match between a word and its preceding context, the 'reduced' N400 on a properly licensed NPI (and conversely the enlarged N400 amplitude on an unlicensed NPI) indicates that some semantic properties of the sentential context like negation are pre-activated and match the corresponding ones of an NPI. Since the previous studies (Saddy et al., 2004; Drenhaus et al., 2005, 2006; Drenhaus et al., 2007) manipulated whether the sentential context contains negation or not, the results indicate that some feature of negation is responsible for NPI licensing. To be fair, however, we do not have sufficient information to identify exactly what induced the N400 effect in NPI licensing. For example, is it the [+Neg] feature that is implicated in the NPI licensing process, or is it downward entailment, or is it non-veridicality? All of these scenarios are compatible with the current findings. Thus, to resolve this issue, one would need to examine other NPI licensors than negation, and see how they are involved in NPI licensing in the N400 time window.

It is also to be noted that NPIs undergo licensing during sentence comprehension in languages where they occur linearly before their licensors. Pablos et al. (2012) found that when in Dutch the NPI *ook maar iets* is followed by a negation in a sentence, language processors actively expect the downstream negation after encountering the NPI, resulting in larger central anterior negativity on the negation if the distance between them is long. Furthermore, such an effect is most prominent when the negation c-commands and properly licenses the NPI, but the effect lessens with the non-c-commanding negation (see also Yanilmaz & Drury, 2013).

In addition, most of the previous studies on NPIs also reported a P600-like late positivity effect on unlicensed NPIs relative to licensed ones. The P600 component represents a positive-going waveform whose peak arises at about 600 ms after the onset of a stimulus. This effect was originally interpreted as signaling a syntactic process, since it has been repeatedly engendered by syntactic errors (Hagoort et al., 1993; Osterhout & Holcomb, 1992) or grammatical but syntactically complex structures (Osterhout et al., 1994; Kaan et al., 2000; Phillips et al., 2005; Gouvea et al., 2010). Nevertheless, there has been a more recent attempt to reinterpret it

as the "semantic P600" effect (Kim & Osterhout, 2005; Kuperberg, 2007; Bornkessel-Schlesewsky & Schlesewsky, 2008; Van de Meerendonk et al., 2009; Brouwer et al., 2012; Paczynski & Kuperberg, 2012; Chow & Phillips, 2013), since words that are semantically implausible in a sentence context can also register a large P600. Although the etiology of the P600 is still being debated, there is a broad consensus that it reflects integration-related cognitive costs in constructing coherent representation (Friederici & Weissenborn, 2007; Kuperberg, 2007; Bornkessel & Schlesewsky, 2008; Van Petten & Luka, 2012). In other words, increased P600 amplitudes reflect the detection of an integration error or integration difficulty, as well as a reanalysis attempt. Particularly concerning NPI licensing, multiple sources of information -- syntactic, semantic, and pragmatic -- are employed to engender a grammatical representation that can properly license NPIs. In an ungrammatical sentence that does not contain a proper NPI licensor, the sentence processer fails to integrate the NPI into the current sentence context, producing a large P600.

Against the background of the discussions in this section, in this paper we will bring up and investigate the research questions as follows.

Research interrogatives:

Q1: Whether Korean native speakers comprehend the two negative polarity items (NPIs): the argument NPI *amwu*-NP-*to* 'any-NP-also' and the adverbial *te isang* 'still more/longer/further' in different NPI-licensing environments.

Q2: How different NPI-licensing environments affect the real time course of processing the two NPIs in question by Korean native speakers.

Q3. At which level of linguistic representation (syntactic/semantic/pragmatic) the argument NPI *amwu*-NP-*to* and the adverbial NPI *te isang* are resolved in the course of processing them in real time.

3. Experiment

The goal of the present experiment is to investigate how Korean native speakers process different types of negation, employing an ERP paradigm to examine the

time course of processing the negation-sensitivity of negative polarity items (NPIs).

3.1. Participants

Eighteen (10 males) Korean native speakers participated in the ERP study. Their ages ranged from 20 to 29 years (mean age, 24 years). They had no English immersion in an English-speaking country and had normal or corrected-to-normal vision. They gave a written informed consent to participate in the experiment and were paid for their participation.

3.2. Materials

We conducted two ERP experiments, employing four types of clauses that contain or do not contain a proper licensor for the preceding NPI; these different clauses may or may not license the NPI in them. The experimental materials of each experiment (EXP) consisted of 120 sets of four conditions. They are given in Table 1, represented by one set of four conditions for each EXP.

Specifically, in experiment 1 (EXP 1) we manipulated four types of environments: (A) the negation on the main verb (e.g., 못 먹었다고) which can properly license NPI (아무-NP-도), (B) the positive clause (e.g., 먹었다고) which cannot license the NPI, (C) the interrogative morpheme on the main verb (e.g., 먹었는지) which in Korean is known not to be able to license NPI (아무-NP-도), and (D) the *-기 전에* 'adverbial-'before'' subordinator (e.g., 먹기 전에) which arguably licenses the NPI (Chung, 1997; Nam, 1998).

In experiment 2 (EXP 2), we also used the same set of four environments/ conditions, this time not with the argument NPI in EXP 1, but with the adverbial NPI (더 이상) 'any more/longer'.

Table 1. The design of the experimental materials. The critical regions are highlighted.

EXP 1						
A: negative clause						
경미가	아무 요리도	레스토랑에서	못 먹었다고	친구가	생각했다.	
Kyengmi-ka	amwu yoli-to	leysutholang-eyse	mos mekess-tako	chinkwu-ka	sayngkakhayss-ta.	
Kyengmi-NOM	any food-also	restaurant-in	not ate-DCL	friend-NOM	thought-DCL	
'Her friend thought that Kyengmi didn't eat any food in the restaurant.'						
B: positive clause						
경미가	아무	요리도	레스토랑에서	먹었다고	친구가	생각했다.
Kyengmi-ka	amwu	yoli-to	leysutholang-eyse	**mekess-tako**	chinkwu-ka	sayngkakhayssta.

Kyengmi-NOM **ate-DCL** friend-NOM thought-DCL
'*Her friend thought that Kyengmi was ordering any food in the restaurant.'

C: interrogative clause
경미가 아무 요리도 레스토랑에서 **먹었는지** 친구가 질문했다.
kyengmi-ka amwu yoli-to leysutholang-eyse **mekess-nunci** chinkwu-ka cilmwunhayss-ta.
Kyengmi-NOM **ate-Q** friend-NOM asked-DCL
'Her friend asked whether Kyengmi was ordering any food in the restaurant.'

D: adverbial-'before' **clause**
경미가 아무 요리도 레스토랑에서 **먹기 전에** 친구가 도착했다.
Kyengmi-ka amwu yoli-to leysutholang-eyse **mek-ki cen-ey** chinkwu-ka tochakhayss-ta.
Kyengmi-NOM **eat-NM BEFORE-at** friend-Nom arrived-DCL
'Her friend arrived adverbial-'before' Kyengmi ordered any food in the restaurant.'

EXP 2

A: negative clause
경미가 더 이상 요리를 못 먹었다고 친구가 말했다.
Kyengmi-ka te isang yoli-lul mos mekess-tako chinkwu-ka malhayss-ta.
Kyengmi-NOM still more food-ACC not ate-DCL friend-NOM said-DCL
'Her friend said that Kyengmi didn't eat any more food.'

B: positive clause
경미가 더 이상 요리를 **먹었다고** 친구가 말했다.
Kyengmi-ka te isang yoli-lul **mekess-tako** chinkwu-ka malhayss-ta.
Kyengmi-NOM **ate-DCL** said-DCL
'Her friend said that Kyengmi was ordering any more food.'

C: interrogative clause
경미가 더 이상 요리를 **먹었는지** 친구가 문의했다.
Kyengmi-ka te isang yoli-lul **mekess-nunci** chinkwu-ka mwunuyhayss-ta.
Kyengmi-NOM **ate-Q** asked-DCL
'Her friend asked whether Kyengmi was ordering any more food.'

D: adverbial-'before' **clause**
경미가 더 이상 요리를 **먹기 전에** 친구가 떠났다.
Kyengmi-ka te isang yoli-lul **mek-ki cen-ey** chinkwu-ka ttenass-ta.
eat-NM BEFORE-at -NOM left-DCL
'Her friend left the place adverbial-'before' Kyengmi ordered any more food.'

The 120 sets of experimental materials for each EXP were distributed across 4 lists in a Latin Square design. Each list contained 30 sentences of each condition and 120 fillers. Each list was split into three blocks. Each participant read one list.

3.3. Procedure

The participants sat in a dimly lit, sound-attenuating room. They were asked to press a button to begin each trial with the presentation of a fixation point at the center of the screen. Each sentence was presented phrase-by-phrase in a rapid serial visual presentation (RSVP) paradigm and run with E-Prime (Psychology software

tools Inc.). Each phrase appeared for 400 ms (e.g., *정미가*) or 600 ms (e.g., *못 먹었다고*), followed by a 200 ms interstimulus interval. After the final word of each sentence followed by a 500 ms blank screen interval, the participants decided whether the sentence they just read was an "acceptable" or "unacceptable" one, pressing one of the two buttons ("Yes" or "No") on the response box. Before the actual experiment, the participants completed a practice block with eight items.

3.4. EEG recording

Brain electrical activity was recorded from 30 Ag/AgCl electrodes (Neuroscan Quikcap, USA), attached on an electrode cap including midline (Fz, FCz, Cz, CPz, Pz, Oz) and lateral (FP1/2, F3/4, F7/8, FC3/4, FT7/8, C3/4, T7/8, CP3/4, TP7/8, P4/5, P7/8, O1/2), and referenced to linked mastoids. Two additional pairs of electrodes were placed above and below the left eye to monitor eye movements and blink, and also on the left and right outer canthus of each eye to monitor eye movements. Impedances at all the electrodes were kept below 5 ㏀. The EEG was amplified using the SynAmps2 EEG amplifier, by using a band-pass from 0.3 to 100 Hz with a sampling rate of 1 kHz.

3.5. Data analysis

Prior to the ERP analysis, the trials contaminated by eye movements and blinks were excluded from the average ERPs. ERP data were time-locked to the critical regions, using a 1,100-ms epoch with a 100-ms pre-stimulus baseline and a 1,000-ms post-stimulus interval.

At the critical regions, we performed analyses for three consecutive time windows which registered the prominent effects: 150-250 ms (P200), 250–450 ms (N400) and 450–600 ms (P600) time windows. The statistical analyses of negation effects were carried out separately for the six regions of interest (ROIs): left anterior (F3, FC3), anterior midline (FZ, FCZ), right anterior (F4, FC4), left posterior (CP3, P3), posterior midline (CPZ, PZ), and right posterior (CP4, P4). These regions were organized into the two topographic factors: anteriority (anterior, posterior) and laterality (left, midline, right). For each time window, we performed repeated-measures ANOVA with three within-subject factors: Type (negative, positive, interrogative, adverbial-'before'), and Anteriority (anterior, posterior) and Laterality (left, midline, right). For significant effects, the Greenhouse-Geisser correction was

applied (Greenhouse and Geisser, 1959), and uncorrected degrees of freedom and corrected *p*-values were reported.

3.6. Results

3.6.1. Offline acceptability task

The participants in the ERP experiment were asked to rate each sentence using a 7-point grading scale (1: not acceptable at all, 7: definitely acceptable). The rating scores were analyzed using the repeated measures ANOVA. As shown in Figure 1, the results of the offline acceptability judgment tasks in the two experiments are displayed, respectively. In EXP 1 with the argument NPI *amwu*-NP-*to*, the negative clause condition made even more sense than the other three conditions. There was a significant main effect of Type ($F_{(3,51)}$=68.29, p<0.001, η^2=0.80), due to a significant difference in each pairwise comparison except for no difference between the positive and the interrogative clause conditions.

In EXP 2 with the adverbial NPI *te isang*, the negative clause condition also made more sense than the other three conditions. There was a significant main effect of Type ($F_{(3,51)}$=29.17, p<0.001, η^2=0.63), due to a significant difference in each pairwise comparison except for no difference between the interrogative and the adverbial 'before' clause condition.

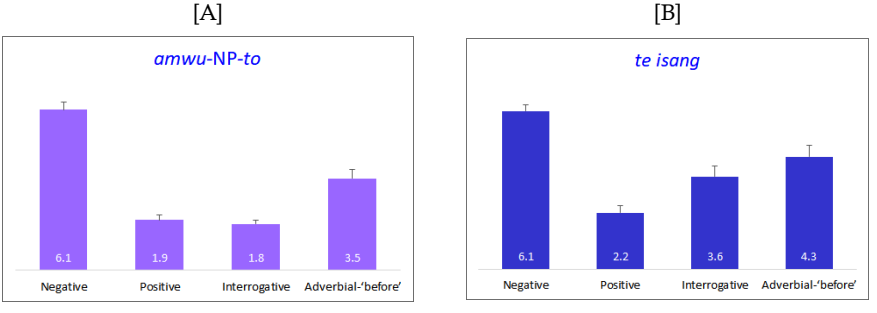

Figure 1. Mean acceptability ratings (1: not acceptable at all, 7: definitely acceptable). The error bar indicates the standard error of the mean. [A] is EXP 1 and [B] is EXP 2.

3.6.2. Online task

The participants also rated the negative clause condition more acceptable than the other three conditions both in EXP 1(94.3%) and EXP 2(87.6%) during the online sentence comprehension, as in Figure 2. In EXP 1 with the NPI *amwu*-NP-*to*, there was a significant main effect of Type ($F_{(3,51)}$=108.57, p<0.001, η^2=0.98), due to a significant difference in each pairwise comparison except for no difference between the positive and the interrogative clause conditions. In EXP 2 with the NPI *te isang*, there was a significant main effect of Type ($F_{(3,51)}$=53.11, p<0.001, η^2=0.63), due to a significant difference in each pairwise comparison.

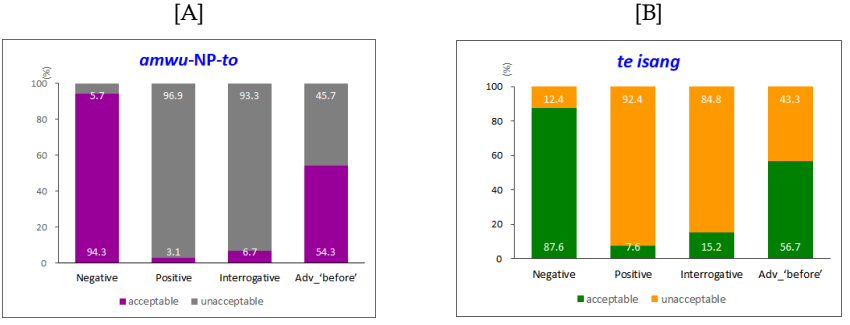

Figure 2. Mean sensicality judgment. [A] is EXP 1, and [B] is EXP 2.

3.6.3. The results of ERPs

3.6.3.1. EXP 1 (with the argument NPI *amwu-NP-to*)

As in Figure 3, the visual inspection of the channel PZ showed that the positive clause condition elicited a more negative-going waveform than the negative clause condition at the critical region, starting at 250 ms. On the other hand, the visual inspection of the channel FZ showed that both the interrogative or adverbial-'before' clause condition is more negatively deflected than the negative clause condition, starting at 150 ms.

For the statistical analysis, we performed a repeated measures ANOVA with the Type (negative, positive, interrogative, and adverbial-'before'), Anteriority (anterior and posterior), and Laterality (left, midline, and right) factors. In the overall ANOVA, there was no significant effect of Type at any internal, but a significant

effect of Laterality, $F_{(3,51)}$=8.77, p<0.01, at the 300-450 ms interval. Furthermore, there was a significant interaction between Type and Anteriority both at the 150-250 ms interval, $F_{(3,51)}$=3.79, p<0.05, and at the 300-450 ms interval, $F_{(3,51)}$=3.43, p<0.05.

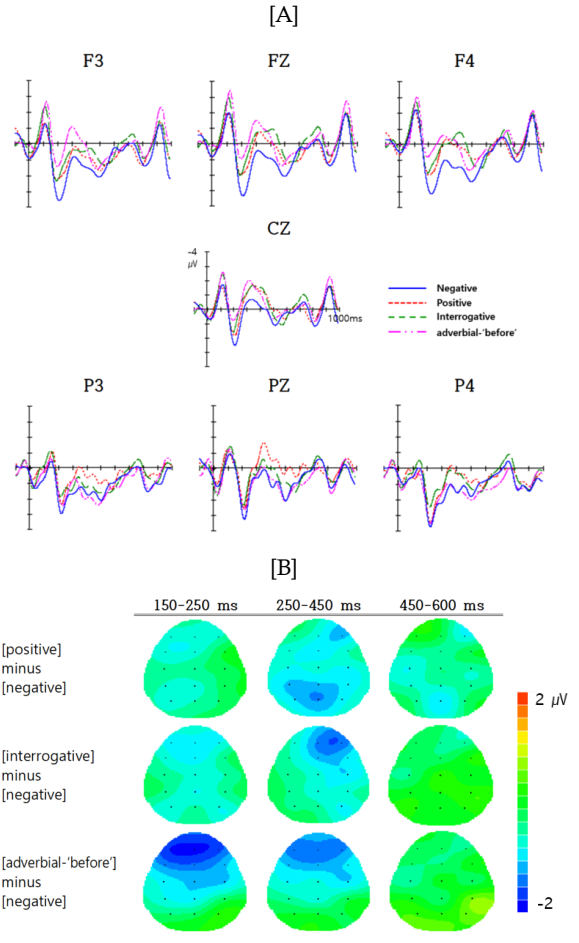

Figure 3. [A] The grand average ERP responses to the critical regions in the four conditions. The onset of each critical verb is indicated by the vertical bar. Each interval represents 100 ms of activity. The positive voltage is plotted down. [B] The topographic scalp voltage maps that compare the responses to the critical regions in the four conditions.

To understand the source of this result, pairwise comparisons and each ROI analysis were carried out. The results of the effects from such factors as Type,

Anteriority, and Laterality are summarized in Table 2. In comparison between the positive and the negative clause conditions, at the 250-450 ms interval there were both a significant effect of Type, $F_{(1,17)}$=5.70, p<0.05, understood as N400 effect, typically occurring at posterior regions (LP: $F_{(1,17)}$=5.23, p<0.05; MP: $F_{(1,17)}$=5.27, p<0.05; RP: $F_{(1,17)}$=4.40, p<0.05), and a significant effect of Laterality, $F_{(2,34)}$=7.01, p<0.01. At the 450-600 ms interval there was a significant interaction between Type and Anteriority, $F_{(1,17)}$=4.31, p<0.05.

Table 2. A summary of ANOVA results for Experiment 1 (*amwu*-NP-to)

	150-250 ms			250-450 ms			450-600 ms		
	N vs P	N vs Q	N vs B	N vs P	N vs Q	N vs B	N vs P	N vs Q	N vs B
Pairwise									
type (1,17)	-	5.28*	4.57*	5.70*	5.23*	3.02†	-	-	-
anteriority (1,17)	-	-	-	-	-	-	-	-	-
laterality (2,34)	-	-	-	7.01**	8.43**	5.50*	-	-	-
type*ant (1,17)	-	-	6.75*	-	-	-	4.31*	-	-
type*lat (2,34)	-	-	-	-	-	-	-	-	-
type*ant*lat (2,34)	-	-	-	-	-	-	-	-	-
Individual ROIs									
Left anterior	-	4.92*	7.68*	-	-	6.41*	-	-	-
Midline anterior	-	4.31*	5.83*	-	8.07*	4.82*	-	-	-
Right anterior	-	-	5.92*	-	5.63*	4.55*	-	-	-
Left posterior	-	-	-	5.23*	-	-	-	-	-
Midline posterior	-	-	-	5.27*	-	-	-	-	-
Right posterior	-	-	-	4.40*	-	-	-	-	-

†p<0.1; *p<0.05; **p<0.01; ***p<0.001

N: negative clause; P: positive clause; Q: interrogative clause; B: adverbial 'before' clause

In comparison between the interrogative and the negative clause conditions, at the 150-250 ms interval there was a significant effect of Type, $F_{(1,17)}$=5.28, p<0.05, understood as N200 (reduced P200) at left anterior regions (LA: $F_{(1,17)}$=4.92, p<0.05; MA: $F_{(1,17)}$=4.31, p<0.05). At the 250-450 ms interval there were both a significant effect of Type, $F_{(1,17)}$=5.23, p<0.05, understood as N400 at right anterior regions (MA: $F_{(1,17)}$=8.07, p<0.05; RA: $F_{(1,17)}$=5.63, p<0.05), and a significant effect of Laterality, $F_{(2,34)}$=8.43, p<0.01. At the 450-600 ms interval, there was no effect registered.

In comparison between the adverbial-'before' and the negative clause conditions,

at the 150-250 ms interval there were both a significant effect of Type, $F_{(1,17)}$=4.57, p<0.05, understood as N200 (reduced P200) at anterior regions (LA: $F_{(1,17)}$=7.68, p<0.05; MA: $F_{(1,17)}$=5.83, p<0.05; RA: $F_{(1,17)}$=5.92, p<0.05), and a significant interaction between Type and Anteriority, $F_{(1,17)}$=6.75, p<0.05. At the 250-450 ms interval there were both a marginally significant effect of Type, $F_{(1,17)}$=3.02, p=0.10, with the significant effect arising only at anterior regions (LA: $F_{(1,17)}$=6.41, p<0.05; MA: $F_{(1,17)}$=4.82, p<0.05; RA: $F_{(1,17)}$=4.55, p<0.05), understood as N400, and a significant effect of Laterality, $F_{(2,34)}$=5.50, p<0.01. At the 450-600 ms interval there was no effect induced.

3.6.3.2. EXP 2 (with the adverbial NPI *te isang*)

As shown in Figure 4, the visual inspection of the channel PZ showed that the positive and the interrogative clause conditions were more negatively deflected than the negative clause condition at the critical region, starting at 200 ms.

For the statistical analysis, the mean amplitudes of the four experimental conditions were entered into a repeated measures ANOVA with such factors as Type (negative, positive, interrogative, and adverbial-'before'), Anteriority (anterior and posterior), and Laterality (left, midline, and right). In the overall ANOVA, there were a significant effect of Type $F_{(3,51)}$=2.92, p<0.05, a marginal effect of Anteriority, $F_{(1,17)}$=4.16, p=0.057, a significant effect of Laterality, $F_{(3,51)}$=2.92, p<0.01, and a significant interaction between Type and Anteriority, $F_{(1,17)}$=4.16, p<0.05 at the 250-450 ms internal. There was no effect of Type at the 150-250 ms and the 450-600 ms internals.

To identify the sources of these results, pairwise comparisons and each ROI analysis were performed. The results of the effects due to such factors as Type, Anteriority, and Laterality are summarized in Table 3. In comparison between the positive and the negative clause conditions, at the 250-450 ms interval there were (i) a significant effect of Type, $F_{(1,17)}$=7.36, p<0.05, understood as N400, typically recorded at posterior regions (LP: $F_{(1,17)}$=10.87, p<0.01; MP: $F_{(1,17)}$=10.06, p<0.01; RP: $F_{(1,17)}$=8.77, p<0.01), (ii) a significant effect of anteriority, $F_{(1,17)}$=6.36, p<0.05, (iii) a significant effect of Laterality, $F_{(2,34)}$=12.28, p<0.001, and (iv) a significant interaction between Type and Anteriority, $F_{(1,17)}$=6.52, p<0.05. At the 450-600 ms interval there were both a significant interaction between Type and Anteriority, $F_{(1,17)}$=5.45, p<0.05, and a significant Type*Anteriority*Laterality interaction, $F_{(2,34)}$= 8.43, p<0.01.

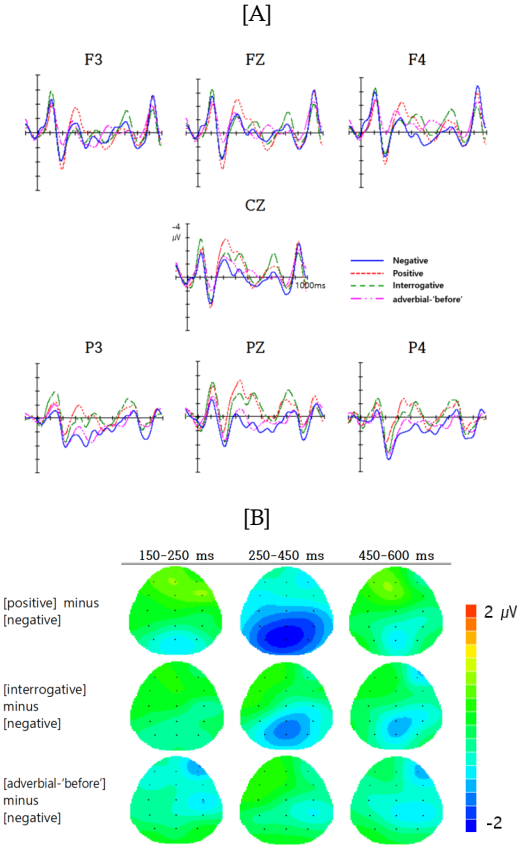

Figure 4. [A] The grand average ERP responses to the critical regions in the four conditions. The onset of each critical verb is indicated by the vertical bar. Each interval represents 100 ms of activity. The positive voltage is plotted down. [B] The topographic scalp voltage maps that compare the responses to the critical regions in the four conditions.

In comparison between the interrogative and the negative clause conditions, at the 250-450 ms interval there was no effect of type factor, but additional comparisons within individual ROIs revealed a significant effect only at posterior regions (MP: $F_{(1,17)}$=5.33, p<0.05; RP: $F_{(1,17)}$=4.18, p=0.057), understood as N400 effect. At the same time, in this interval there were both a significant effect of Laterality, $F_{(2,34)}$=11.38, p<0.05, and a significant interaction between Type and Anteriority, $F_{(1,17)}$=12.55, p<0.01. At the 450-600 ms interval there was no effect of Type, but additional comparisons within individual ROIs revealed a significant effect only at

the midline posterior region (MP: $F_{(1,17)}$=5.99, p<0.05), understood as N600 (reduced P600). Likewise, there were both a significant effect of Laterality, $F_{(2,34)}$=3.60, p<0.05, a significant interaction between Type and Laterality, $F_{(2,34)}$=4.71, p<0.05, and a significant Type*Anteriority*Laterality interaction, $F_{(2,34)}$=4.97, p<0.05.

In comparison between the adverbial-'before' and the negative clause conditions, there was no effect of Type at any interval. At the 250-450 ms interval there were both a significant effect of Anteriority, $F_{(1,17)}$=9.97, p<0.01, and a significant effect of Laterality, $F_{(2,34)}$=7.17, p<0.01. At the 450-600 ms interval there were both a significant effect of Laterality, $F_{(2,40)}$=5.14, p<0.05, and a significant interaction between Type and Laterality, $F_{(2,34)}$=3.49, p<0.05.

Table 3. A summary of the ANOVA results for Experiment 2 (*te isang*)

	150-250 ms			250-450 ms			450-600 ms		
	N vs P	N vs Q	N vs B	N vs P	N vs Q	N vs B	N vs P	N vs Q	N vs B
Pairwise									
type (1,17)	-	-	-	7.36*	-	-	-	-	-
anteriority (1,17)	-	-	-	6.36*	4.11†	9.97**	-	-	-
laterality (2,34)	-	-	-	12.3***	11.4***	7.17**	3.37†	3.60*	5.14*
type*ant (1,17)	-	-	-	6.52*	12.25**	-	5.45*	3.43†	-
type*lat (2,34)	-	-	-	-	-	-	-	4.71*	3.49*
type*ant*lat (2,34)	-	-	-	-	-	-	8.43**	4.97*	-
Individual ROIs									
Left anterior	-	-	-	-	-	-	-	-	-
Midline anterior	-	-	-	-	-	-	-	-	-
Right anterior	-	-	-	-	-	-	-	-	-
Left posterior	-	-	-	10.87**	-	-	-	-	-
Midline posterior	-	-	-	10.06**	5.33*	-	-	5.99*	-
Right posterior	-	-	-	8.77**	4.18†	-	-	-	-

$^{\dagger}p$<0.1; $^{*}p$<0.05; $^{**}p$<0.01; $^{***}p$<0.001

N: negative clause; P: positive clause; Q: interrogative clause ; B: adverbial 'before' clause

4. Discussion and conclusion

This section is to elaborate in more details on the results from the experiment 1 and 2. They can be summarized as in Table 4.

Table 4. Summary of the results from EXP 1 and EXP 2

EXP / Time window / Condition	EXP 1: *amwu-NP-to*			EXP 2: *te isang*		
	150-250 ms (P200)	250-450 ms (N400)	450-600 ms (P600)	150-250 ms (P200)	250-450 ms (N400)	450-600 ms (P600)
P vs. N	-	N400 effect at posterior regions	-	-	N400 effect at posterior regions	-
Q vs. N	N200 (reduced P200) effect at left anterior regions	N400 effect at right anterior regions	-	-	N400 effect at midline posterior regions	N600 (reduced P600) effect at midline posterior regions
B vs. N	N200 (reduced P200) effect at anterior regions	N400 effect at anterior regions	-	-	-	-

It is to be recollected that from theoretic perspectives, NPIs undergo a sequence of processing phases involving multiple neural networks since they need to abide by the licensing conditions at different linguistic levels. NPIs are syntactically within the scope of a licensing element like negation. Semantically, they occur in downward entailing/non-veridical environments. Pragmatically, they are distributed in domain widening/emphatic assertion contexts. Violations have thus been taken to stem from multiple sources involving syntactic, semantic, and pragmatic processing.

Employing the two Korean NPIs: nominal *amwu+N+to* and adverbial *te isang*, we have found that relative to the *mos* 'not'-marked verb complex, a positive form of verb complex (as well as a verb complex ending either with the interrogative particle or *-ki cen-ey* 'before' for the nominal NPI *amwu+N+to*) evoked the same N400. The findings in this paper are in keeping with those of the previous experimental works on NPIs in German and English (Drenhaus et al., 2006; Saddy et al., 2004; Shao & Neville, 1998) in light of the ERP component that a failure in NPI licensing gives rise to. Specifically, the current study also shows that NPI anomaly is attributed to semantic or pragmatic integration in the course of sentence processing. Because the NPIs in the materials occur across the trial sentences with the clause-final verb

complexes manipulated, it is implausible that the N400 effect observed here reflects differences in lexical-level semantic properties across the anomalous and control conditions. The current results lend strong support to the compositional analysis of the N400 effect, which indicates that N400 is evoked when the semantic/pragmatic context of a sentence does not provide a proper licensor for the NPI in it. In a nutshell, the more salient N400 effect in the anomalous NPI conditions in the current study is rooted in the difficulty in integrating the preceding NPI with semantic/pragmatic information from an inappropriate licensor.

We are now about to compare the conditions in EXP 1 and EXP 2. In EXP 1, all the conditions aside from the negative clause condition do not have a licensing element for the preceding NPI *amwu+N+to*. The three unlicensed conditions such as positive, interrogative, and *-ki cen-ey* 'before' clauses thus consistently evoked N400, but they differ in details in light of (onset) latency and response region. The positive clause condition registered the typical N400 elicited at posterior regions. On the other hand, the interrogative clause condition recorded N400 (onset latency: 150 ms) starting at left anterior regions and ending at right anterior regions. The 'before' clause condition recorded N400 (onset latency: 150 ms) at anterior regions. We suspect that as for the categorically illegal positive clause condition, the language comprehenders dismiss it as anomalous once and for all. By contrast, as for the interrogative and 'before' clause conditions, the language comprehenders take time in attempting to integrate the question particle or the negative implicature-inducing 'before' particle to the preceding nominal NPI. Still, the two conditions diverge in terms of response region. The 'before' clause condition elicits 'anterior N400'; since the participants in the acceptability tasks rated this condition as marginally acceptable (3.5/7.0 in Likert score), we take this component to reflect difficulty rather than complete anomaly in semantic integration during NPI processing.[1] On the other hand, the interrogative clause condition evokes 'right anterior N400': since the participants in acceptability tasks rated this condition as unacceptable (1.8/7.0 in Likert score), we take this component to represent ultimate failure rather than difficulty in semantic integration for NPI processing.

We now turn to EXP 2. The positive and interrogative clause conditions containing the adverbial NPI *te isang* evoked N400 as a neural marker of

1) As is well-known, one of the two neurophysiologically distinct semantic integration mechanisms, reflected by the anterior N400-like negativity, maps the incoming information onto the connections of various strengths between concepts in semantic memory. The other mechanism, reflected by the posterior late positivity (canonical P600), evaluates the incoming information against the discrete requirements of real-world actions (cf. Sitnikova et al., 2008).

semantic/pragmatic anomaly. But the other 'before' clause condition didn't. Note that in the acceptability tasks, the 'before' clause condition were rated as fairly acceptable (4.3/7.0 in Likert score). In this regard, the ERP response to 'before' clause condition, relative to the control negative clause condition, is consonant with their acceptability rating made offline. Regarding the interrogative clause condition, it was rated as marginally acceptable (3.6/7.0 in Likert score), which is commensurate to the rating for the 'before' clause condition with the nominal NPI of EXP 1. This condition evoked N400 followed by N600 (reduced P600) at midline posterior regions. We take this sustained negativity to reflect that though *te isang* is not initially licensed by the question particle per se, it can be after the ordinary question converts into a negatively-construed rhetorical question. This is why this conversion process in the interrogative clause condition is responsible for the sustained negativity in both 400 ms and 600 ms time windows. In sum, the unlicensed condition(s) in EXP 1 and EXP 2 consistently recorded N400, whereas the licensed 'before' clause condition in EXP 2 did not differ from the control negative clause condition.

Let's now directly compare the two NPIs, nominal *amwu+N+to* and adverbial *te isang* in light of neural profiles. It seems to be most interesting to make a comparison between the two apparently unlicensed conditions, hence we choose the interrogative clause conditions in EXP 1 and EXP 2. As the neural profiles of one experimental condition are identified in comparison to those of the corresponding control condition, we return to what we have discussed in the preceding paragraphs. On the one hand, the interrogative clause condition relative to the control condition in EXP 1 elicited N400 (onset latency: 150 ms) starting at left anterior regions and ending at right anterior regions. On the other hand, the interrogative clause condition relative to the control condition in EXP 2 elicited N400 followed by N600 (reduced P600) at midline posterior regions. In this comparison, first, though they both elicited N400, they diverge in light of its topographical distribution. The interrogative clause condition in EXP 1 elicited N400 at right anterior regions, and that in EXP 2 at midline posterior regions. Second, the N400 in the former was preceded by N200 (reduced P200) as a reflection of an ultimate failure in semantic/pragmatic integration, but the N400 in the latter was followed by N600 (reduced P600) as a manifestation of successful semantic/pragmatic licensing in the wake of the conversion from an ordinary question to a rhetorical question. Thus, though semantic anomaly in the interrogative clause condition of EXP 1 is simpler in light of neural profiles than its counterpart of EXP 2, it is reasonable to claim that the language comprehenders are more decisive and resolute in processing the stronger

type of nominal NPI *amwu+N+to* than the weaker type of adverbial NPI *te isang*.

Taken together, the present study not only shows that NPI licensing in Korean stems from multiple sources of information but it also offers fodder for cross-linguistic comparison. The ERP results from the current study put forth neural correlates of NPIs in Korean, which can be compared with those of NPIs in Indo-European languages. Such results are in line with the proposal that semantic and pragmatic processing are likely to be a universal feature of NPI processing (Drenhaus et al., 2006; Saddy et al., 2004; Shao & Neville, 1998). In conclusion, the present findings add to the understanding of NPI processing/licensing, indicating that the processing of NPIs hinges on semantic/pragmatic integration as well as syntactic dependency formation; semantic/pragmatic effects arise in neural signatures evoked by varied NPI-licensor relations.

References

Baker, C. L. (1970). Double negatives. *Linguistic Inquiry*, *1*, 169-186.

Bornkessel-Schlesewsky, I., & Schlesewsky, M. (2008). An alternative perspective on 'semantic P600' effects in language comprehension. *Brain Research Reviews*, *59*(1), 55-73.

Brouwer, H., Fitz, H., & Hoeks, J. (2012). Getting real about semantic illusions: rethinking the functional role of the P600 in language comprehension. *Brain Research*, 1446, 127-143.

Carlson, G. (1981). Distribution of free-choice any. *CLS 17* 8.23.

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

Choe, H. S. (1988). *Restructuring Parameters and Complex Predicates: A Transformational Approach*. Doctoral dissertation, MIT.

Chow, W.-Y. & Phillips, C. (2013). No semantic illusions in the 'Semantic P600' phenomenon: ERP evidence from Mandarin Chinese. *Brain Research*, 1506, 76-93.

Chung, D.-H. (1993). *Negative Polarity Items in Korean: Formal and Distributional Types*. Ms. University of Southern California.

Chung, D.-H. (1997). NPI types based on the trigger strength. *Proceedings of International Conference on Cognitive Science '97*, Seoul, 101-105.

Drenhaus, H., beim Graben, P., Saddy, D., & Frisch, S. (2006). Diagnosis and repair of negative polarity constructions in the light of symbolic resonance analysis. *Brain and Language*, *96*(3), 255-268.

Drenhaus, H., Blaszczak, J., & Schütte, J. (2007). Some psycholinguistic comments on NPI

licensing. In Estela Puig-Waldmüller (ed.), *Proceedings of Sinn und Bedeutung 11*. Barcelona: Universitat Pompeu Fabra. 180-193.

Drenhaus, H., Saddy, D., & Frisch, S. (2005). Processing negative polarity items: when negation comes through the backdoor. In Stephan Kepser and Marga Reis (eds.), *Linguistic evidence: Empirical, theoretical, and computational perspectives*. Berlin: De Gruyter Mouton. 145-165.

Fauconnier, G. (1974). Polarity and the scale principle. *Chicago Linguistic Society 13,* 188–199.

Fauconnier, G. (1975). Polarity and the scale principle. In Robin E. Grossman (ed.) *Papers from the eleventh meeting of the Chicago Linguistic Society*. Chicago Linguistic Society. 188-199.

Friederici, A. D., & Weissenborn, J. (2007). Mapping sentence form onto meaning: the syntax –semantic interface. *Brain Research,* 1146, 50-58.

Giannakidou, A. (1998). *Polarity sensitivity as (non)veridical dependency*. Amsterdam, Philadelphia: John Benjamins.

Giannakidou, A. (1999). Affective dependencies. *Linguistics and Philosophy*, *22*(4), 367-421.

Giannakidou, A. (2006). Only, emotive factive verbs, and the dual nature of polarity dependency. *Language, 82,* 575-603.

Giannakidou, A., & Yoon, S. (2016). Scalar marking without scalar meaning: Nonscalar, nonexhaustive even-marked NPIs in Greek and Korean. *Language*, *92*(3), 522-556.

Gouvea, Ana C., Phillips, C., Kazanina, N., & Poeppel, D. (2010). The linguistic processes underlying the P600. *Language and Cognitive Processes*, *25*(2), 149-188.

Greenhouse, S. W., & Geisser, S. (1959). On methods in the analysis of profile data. *Psychometrika*, *24*, 95–112.

Hagoort, P., Brown, C. M., & Groothusen, J. (1993). The syntactic positive shift (SPS) as an ERP measure of syntactic processing. *Language and Cognitive Processes*, *8*(4), 439-483.

Hoeksema, J. (1994). On the grammaticalization of negative polarity items. *Proceedings of the Berkeley Linguistics Society* XX.

Hwang, J. (2013). Typology of NPIs in Korean: Variation and licensing. *Language Research 49*(3), 829-856.

Hwang, J. (2009). Semantic function of three forms of negation in Korean. *Korean Journal of Linguistics, 34*, 197-220.

Kaan, E., Harris, A., Gibson, E., & Holcomb, P. (2000). The P600 as an index of syntactic integration difficulty. *Language and Cognitive Processes*, *15*(2), 159-201.

Kadmon, N., & Landman, F. (1993). Any. *Linguistics and Philosophy*, *16*(4), 353-422.

Kim, A., & Osterhout, L. (2005). The independence of combinatory semantic processing: evidence from event-related potentials. *Journal of Memory and Language*, *52*(2), 205-225.

Kim, K.-S. (1999). A Paradox in Korean NPI Licensing. *Studies in Generative Grammar,* 9, 403-428.

Kim, S.-S., & Sells, P. (2007). Generalizing the Immediate Scope Constraint on NPI

Licensing. In *Proceedings of the Workshop on Negation and Polarity*.
Klima, E. S. (1964). Negation in English. In Jerry A. Fodor and Jerrold J. Katz (eds.), *The structure of language*. Englewood Cliffs, NJ: Prentice-Hall.
Krifka, M. (1995). The semantics and pragmatics of polarity items. *Linguistic Analysis*, *25*, 209-257.
Kuperberg, G. R. (2007). Neural mechanisms of language comprehension: challenges to syntax. *Brain Research*, *1146*, 23-49.
Ladusaw, W. A. (1979). *Polarity Sensitivity as Inherent Scope Relations*. PhD thesis. University of Texas at Austin.
Ladusaw, W. A. (1980). On the notion 'affective' in the analysis of Negative Polarity Items. *Journal of Linguistic Research*, *1*, 1-16.
Lahiri, U. (1998). Focus and negative polarity in Hindi. *Natural Language Semantics*, *6*(1), 57-123.
Lee, H. (2001). The Morphology-Based Semantics of "Any" in English and Korean. *Enehak*, *31*, 127-158.
Linebarger, M. C. (1980). *The Grammar of Negative Polarity*. PhD thesis. MIT, Cambridge, MA.
Linebarger, M. C. (1987). Negative polarity and grammatical representation. *Linguistics and Philosophy*, *10*(3), 325-387.
Nam, S. (1994). Another type of negative polarity item. In Makoto Kanazawa & Christopher J. Pinon (eds.), *Dynamics, polarity and quantification,* Stanford: CSLI, 3-15.
Nam, S. (1998). The typology and licensing conditions of negative polarity items in Korean (Hankwuke pwucengkukeuy yuhyengkwa ku hekacoken). *Linguistics, 22*, 217-244.
Osterhout, L., & Holcomb, P. J. (1992). Event-related brain potentials elicited by syntactic anomaly. *Journal of Memory and Language*, *31*(6), 785-806.
Osterhout, L., Holcomb, P. J., & Swinney, D. A. (1994). Brain potentials elicited by garden-path sentences: evidence of the application of verb information during parsing. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *20*(4), 786-803.
Pablos, L., Doetjes, J., Ruijgrok, B., & Cheng, L. (2012). Backward NPI dependencies in Dutch: an ERP investigation. *Poster presented at the 25th Annual CUNY Sentence Processing Conference*, CUNY Graduate Center, New York.
Paczynski, M., & Kuperberg, G. R. (2012). Multiple influences of semantic memory on sentence processing: Distinct effects of semantic relatedness on violations of real-world event/state knowledge and animacy selection restrictions. *Journal of Memory and Language 67*(4), 426-448.
Phillips, C., Kazanina, N., & Abada, S. H. (2005). ERP effects of the processing of syntactic long-distance dependencies. *Cognitive Brain Research*, *22*(3), 407-428.
Saddy, D., Drenhaus, H. & Frisch, S. (2014). Processing polarity items: Contrastive licensing costs. *Brain and Language*, *90*(1), 495-502.
Sells, P. (2001). Negative polarity licensing and interpretation. In S. Kuno et al., ed., *Harvard*

Studies in Korean Linguistics, *9*, 3-22. Dept. of Linguistics, Harvard University.
Sells, P. (2006). Interactions of negative polarity items in Korean. *Harvard Studies in Korean Linguistics, 11*, 724-737.
Shin, K. Y., & Chung, D.-H. (2009). Remarks on defining Korean NPIs in terms of negation strength. *Language and Information*, *13*(2), 45-57.
Sitnikova, T., Holcomb, P. J., Kiyonaga, K. A., & Kuperberg, G. R. (2008). Two neurocognitive mechanisms of semantic integration during the comprehension of visual real-world events. *Journal of Cognitive Neuroscience, 20*, 2037-57.
van de Meerendonk, N., Kolk, H. H. J., Vissers, C. T. W. M., & Chwilla, D. J. (2009). Monitoring in language perception: mild and strong conflicts elicit different ERP patterns. *Journal of Cognitive Neuroscience*, *22*(1), 67-82.
van der Wouden, T. (1997). *Negative contexts: Collation, polarity, and multiple negation*. Routledge.
van der Wouden, T., & Zwarts, F. (1993). A semantic analysis of negative concord. In *Proceedings of the 3rd Conference on Semantics and Linguistic Theory*, pp. 202-219.
Van Petten, C., & Luka, B. J. (2012). Prediction during language comprehension: benefits, costs, and ERP components. *International Journal of Psychophysiology*, *83*(2), 176-190.
Von Fintel, K. (1999). NPI-licensing, Strawson-entailment, and context-dependency. *Journal of Semantics*, *16*, 97-148.
Yanılmaz, A., & Drury, J. E. (2013). Licensing in Turkish: an ERP study. *Poster presented at the 20th Cognitive Neuroscience Society Meeting*, San Francisco.
Zwarts, F. (1995). Nonveridical contexts. *Linguistic Analysis*, 25, 286-312.
Zwarts, F. (1996). A hierarchy of negative expressions. In Heinrich Wansing (ed.), *Negation: A Notion in Focus*. Berlin: De Gruyter, 169-194.
Zwarts, F. (1986). *Categoriale Grammatica en Algebrásche Semantiek: Een Onderzoeknaar Negatie en Polariteit in het Nederlands*. Ph.D. thesis, University of Groningen.
Zwarts, F. (1998). Three Types of Polarity. In F. Hamm and E. Hinrichs (eds.), *Plurality and quantication*. Kluwer Academic Publishers, pp. 177-238.

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