Having a syntactic choice is not always better: the effects of syntactic flexibility on Korean production

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Having a syntactic choice is not always better: the effects of syntactic flexibility on Korean production

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Sentence production requires speakers to select lexical items and a structural frame necessary to communicate a message. The present study examines how Korean speakers choose between alternative syntactic structures. Following the methodology of Ferreira, we conducted a series of production studies investigating the effects of syntactic flexibility in Korean numeral quantifier constructions and active/passive constructions. Two models of sentence production make different predictions regarding the effects of syntactic flexibility. The competitive model predicts that syntactic flexibility should cause production difficulties (e.g. longer production latencies and more errors) because alternative structures compete for selection, restricting one another's availability. In contrast, according to the incremental model, syntactic flexibility should facilitate production (e.g. shorter production latencies and fewer errors) because it allows more accessible lexical items to be accommodated sooner. Ferreira's results support the incremental model in English. Our results, however, show that Korean speakers produced utterances more slowly in the flexible condition, which provides support for the competitive model. We suggest that the different findings in English and Korean are related to how they assign grammatical functions.

Keywords: Korean; sentence production; syntactic flexibility

In order to transform a non-linguistic message into a linguistic form, speakers need to select lexical items and to formulate a structural frame to position them into a well-formed sentence. For example, to convey the message that a fox is chasing a chicken, speakers need to make lexical choices, such as whether to use the noun 'chicken' or 'hen,' and syntactic choices, such as whether to use an active or a passive structure (e.g. 'a fox is chasing a chicken' vs. 'a chicken is being chased by a fox'). An important question for theories of sentence production is whether the presence of these kinds of linguistic choices facilitates or complicates language production.

In terms of lexical choice, prior work shows that the existence of alternative lexical items causes production difficulties. This has been observed in studies investigating the naming of objects that differ in codability (number of alternative names). For example, the entity 'apple' is consistently referred to as 'apple' (high codability), but the piece of furniture called a sofa could also be referred to as a 'couch' (lower codability). Prior research in several languages shows that speakers tend to name objects more slowly when they have a greater number of alternative names (lower codability; see Lachman, 1973; Lachman & Lachman, 1980; Bates et al., 2003 for English, German, Italian, Spanish, Bulgarian, Hungarian and Chinese).

Speakers also make more naming errors with low-codability objects (Mitchell, 1989). Griffin (2001) attributes these difficulties to competition between the alternative labels. This builds on the well-known phenomenon of semantic interference, the finding that it takes longer to name an object in the presence of a semantically related word (e.g. naming a picture of a 'fox' in the presence of the word 'wolf', see Lupker, 1979, for English; Schriefers, Meyer, & Levelt, 1990 for Dutch; Koh & Lee, 1996 for Korean). Given this semantic interference effect, Griffin suggests that alternative names that refer to the same object (e.g. sofa, couch) compete even more for selection, resulting in greater difficulties in production. In sum, existing work suggests that in the domain of lexical choice, having more than one choice complicates language production.

However, the lexical domain is not the only area of language production that involves choices: In the structural domain, speakers also need to select a syntactic structure since a particular message can be often expressed with more than one syntactic structure (*syntactic flexibility*, Ferreira, 1996). For example, English speakers can describe transitive events with an active or a passive structure (e.g. *a fox is chasing a chicken* vs. *a chicken is being chased by a fox*). Similarly, ditransitive events in

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English can be described with a prepositional structure or a double object structure (e.g. *John gave all the money to charity* vs. *John gave charity all the money*). Ferreira (1996) found that presence of syntactic flexibility facilitated production in English; English speakers produced utterances more quickly and with fewer errors when they could choose between syntactic alternatives. This contrasts with the lexical level, where presence of choices has been found to hinder language production.

Syntactic structures, however, are constrained by language-specific grammatical properties to a much greater extent than lexical items. For example, some languages have a fixed word order (e.g. subject-verb-object) and define grammatical functions in terms of word order (often referred to as configurational languages), whereas other languages allow flexible word order and indicate grammatical functions by case-marking on nouns (inflectional languages, e.g. Korean). English is commonly considered as a configurational language (e.g. Bock, 1987). However, it is not yet well understood how syntactic flexibility affects languages that are typologically different from English – that is whether production in those languages is facilitated as in English or hindered in the presence of syntactic flexibility. In light of cross-linguistic evidence showing that language-specific typological properties interact with production mechanisms (see Jaeger & Norcliffe, 2009; Myachykov, Thompson, Scheepers, & Garrod, 2011 for reviews), the present study aims to investigate the effects of syntactic flexibility on the production of Korean, which differs from English in various typological aspects. For example, Korean has a different basic word order from English (Subject Object Verb (SOV) in Korean vs. Subject Verb Object (SVO) in English), allows word order flexibility (English has a fairly fixed word order), and uses extensive case-marking on lexical items (English has virtually no overt case-marking).

Syntactic flexibility in English

In general, there are two main models of how speakers choose between alternative syntactic structures: the *competitive* model and the *incremental* model (Ferreira, 1996). These models assume different mechanisms of syntactic choice and consequently make different predictions regarding the effects of syntactic flexibility on production. The *competitive model* suggests that alternative structures actively compete for selection and that the more activated/available structure is eventually chosen (building on the architecture of interactive activation networks, see e.g. Dell & O'Seaghdha, 1994; McClelland & Rumelhart, 1981). The competitive nature of the model is implemented by assuming that the connections between alternative structures are inhibitory. As a result, the activation of one structure suppresses the activation of the alternative structure. Because competition between alternative structures inhibits or decreases their accessibility, the competitive

model predicts that syntactic flexibility (i.e. when the speaker has a choice between two or more syntactic structures) should cause production difficulties, as indicated by longer production latencies and increased errors. When an alternative structure is not available, however, production is predicted to proceed more smoothly. For example, the use of the verb *give* brings about competition between a prepositional structure (1a) and a double object structure (1b), whereas the verb *donate* only allows one structure – the prepositional structure (2a). Thus, according to the competitive model, speakers should experience less production difficulties with *donate* than with *give*.

(1a). John gave all the money to charity.
                              [prepositional]
(1b). John gave charity all the money.
                              [double object]
(2a). John donated all the money to charity.
                              [prepositional]
(2b). *John donated charity all the money.
                              [*double object]

The *incremental model*, on the other hand, emphasises the availability or accessibility of lexical items – rather than competition between alternative syntactic structures – in determining what syntactic structure speakers produce (see Ferreira, 1996 for discussion). Under this view, the production system builds structures in an incremental fashion, and inserts the most accessible (most activated) lexical item into the syntactic position that is currently being built. For example, when using the verb *give*, a speaker can produce either the prepositional structure in (1a) or the double object structure in (1b). If the theme *money* is more accessible than the goal *charity* at the point when the first post-verbal argument is being produced, the speaker can insert *money* first and thus produce the prepositional structure in (1a). However, if the goal *charity* had been more activated than *money*, the speaker could then have inserted *charity* into the first post-verbal slot, and produced a double object structure as in (1b). In contrast, the verb *donate* only allows a prepositional structure, where the first post-verbal argument is the theme. Thus, if the goal *charity* is more accessible than the theme when the first post-verbal argument is being produced, the production system should delay the selection of the goal until the accessibility of *money* surpasses that of *charity* (see Ferreira, 1996 for details). Because syntactic flexibility allows speakers to choose a structure that can accommodate the more accessible lexical item sooner, the incremental model predicts that syntactic flexibility should result in faster production latencies and fewer errors. In sum, the *competitive model* predicts that syntactic flexibility causes difficulty in production, whereas the *incremental model* predicts that syntactic flexibility facilitates production.

To investigate whether syntactic flexibility makes production easier or harder, Ferreira (1996) had speakers

construct sentences using pre-specified words and compared production latencies and error rates in syntactically flexible and non-flexible conditions. For example, in flexible conditions participants could choose between a prepositional dative and a double object structure, whereas in non-flexible conditions they could only produce a prepositional dative structure. This was done by manipulating (1) verb type (verbs like *give* allowing both constructions vs. verbs like *donate* only allowing a prepositional construction) and (2) the presence/absence of a preposition such as *to*. When presented with a verb like *give* without a preposition (e.g. 'I gave/charity//all the money'), speakers could choose between a prepositional dative as in (1a) and a double object structure as in (1b). However, when the pre-specified words contained the preposition *to* (e.g. 'I gave/charity/to/all the money'), speakers had no syntactic choice and were forced to produce a prepositional sentence. Similarly, a verb like *donate* only allowed speakers to produce a prepositional utterance. By comparing the flexible conditions with the non-flexible ones, Ferreira (1996) found that flexible conditions resulted in faster production latencies and fewer production errors than non-flexible conditions. This supports for the incremental production model for English: speakers choose a syntactic structure that can accommodate more accessible lexical items sooner.

The incremental model for English is compatible with the findings of Bock (1986) and Gleitman, January, Nappa, and Trueswell (2007). Using picture-description tasks, Bock (1986) and Gleitman et al. (2007) found that English speakers' choice of active versus passive structures was influenced by the accessibility of lexical items. When the accessibility of patient referents was increased via semantic prime words (Bock, 1986) or visual attention-capture cues (Gleitman, January, Nappa, & Trueswell, 2007), participants were more likely to produce passive sentences with patient entities in sentence-initial, subject position. That is, English speakers produced a sentence structure that allowed earlier accommodation of more accessible lexical items. The fact that the manipulation of lexical accessibility significantly influenced English speakers' active/passive choice provides further support for incremental production in English.

The findings for English raise the question of whether production in typologically different languages is also incremental – that is whether speakers of typologically different languages also build sentence structures starting with the more accessible lexical items, with the syntactic structure guided by lexical accessibility. Existing research suggests that incremental production may not be a universal mechanism. In Korean, Hwang and Kaiser (2009, 2012) found that Korean speakers' choice of active versus passive was not influenced by lexical accessibility; priming patient entities with semantic prime words or attention-capture cues did not increase the rate of passive sentences (see also

Myachykov & Tomlin, 2008; Myachykov, Garrod, & Scheepers, 2010 for similar findings in Russian and Finnish, which are also inflectional languages like Korean).

Furthermore, using a picture-description task, Myachykov, Scheepers, Garrod, Thompson, and Fedorova (2013) found delayed speech onset latencies in Russian when compared to English. They suggest that this cross-linguistic difference is because Russian is syntactically more flexible than English (Russian allows non-canonical word orders like Object Verb Subject (OVS)). In fact, they argue that syntactic flexibility has an adverse effect on production, regardless of language. This seems to go against the incremental account that Ferreira (1996) advocates for English. However, the methodology of Myachykov et al. (2013) is quite different from that of Ferreira (1996), which makes direct comparisons challenging. In particular, Myachykov et al. (2013) did not experimentally/directly manipulate the availability of syntactic flexibility (either within or across languages), which leaves open the possibility that the flexibility-related difference may have been caused by other factors than syntactic flexibility (e.g. information-structural properties of different constructions). As they note in their conclusion, 'further research is necessary to resolve the debate' concerning competitive versus incremental production mechanisms (Myachykov, Scheepers, Garrod, Thompson, & Fedorova, 2013, p. 1618). Our work strives to take steps in this direction. In order to facilitate between-language comparisons with Ferreira's (1996) original results as well as within-language comparisons, we used a method very similar to his. Because our methodology is similar to Ferreira's, we focus on comparing our findings with his.

In light of the studies that cast doubt on the universality of the incremental mechanism, we tested whether structural choice in a syntactically flexible language, namely Korean, might be accomplished via competition as suggested by the competitive model. To explore this possibility, we investigated how Korean speakers choose between alternative syntactic structures by manipulating syntactic flexibility in numeral quantifier constructions (e.g. *Jiun met three students*; Experiment 1) and active/passive constructions (Experiments 2 and 3).[1]

Experiment 1: numeral quantifier constructions

Following the methodology of Ferreira (1996), we employed a sentence-assembly task where speakers were asked to construct sentences using words shown on the computer screen. In Experiment 1, we had participants construct **numeral quantifier constructions** (e.g. *Jiun [three students] met* or *Jiun [students three] met*).

Numeral quantifiers in Korean are used for counting items and they commonly consist of a numeral (in bold in Example (3)) and a classifier (i.e. a measure word, underlined in Example (3)). When numeral quantifiers

quantify object nouns, they can occur *pre-nominally* (e.g. *three students*) with genitive case as in (3a), or *post-nominally* (e.g. *students three*) with accusative case as in (3b).[2] Although both alternatives are entirely grammatical and natural, post-nominal structures are more frequent in corpora (T. Kim & Lee, 2010) and are often considered to be the canonical/unmarked structure (Choo & Kwak, 2008; Sohn, 1999).

(3a). Prenominal structure:
    numeral + <u>classifier</u>-GEN + *noun*
    Jiun-ika [**sey** <u>myeng</u>-uy/*-ul
    haksayng-ul] manassta.
    Jiun-NOM [**three** CL-GEN/*ACC
    student-ACC] met
    'Jiun met **three** *students*'.
(3b). Postnominal structure:
    noun + **numeral** + <u>classifier</u>-ACC
    Jiun-ika [*haksayng* **sey** <u>myeng</u>-ul/*-uy*] manassta.
    Jiun-NOM [*student* **three** <u>CL</u>-ACC/*GEN] met
    'Jiun met **three** *students*'.

Pre-nominal and post-nominal structures quantifying over indefinite and non-specific nouns as in (3a) and (3b) are largely assumed to be interchangeable in their meanings (Chae, 1983; J.-B. Kim, 2006; Park, 2009 among others).[3] The semantic interchangeability of these two structures is also confirmed by a rating study that we conducted (reported below).

In our experiment, we manipulated syntactic flexibility via case-markers. When quantifying object nouns, <u>genitive-marked</u> numeral quantifiers allow speakers to produce only a pre-nominal structure (*pre-nominal condition*). In contrast, <u>accusative-marked</u> numeral quantifiers allow only a post-nominal structure (*post-nominal condition*). When numeral quantifiers are <u>not case-marked</u>, speakers can choose between a pre-nominal and a post-nominal structure (*flexible condition*). These three conditions are illustrated in Table 1.

Following Ferreira (1996), we measured speakers' production latencies and error rates. We expect that post-nominal constructions should be produced faster and with fewer errors since they occur more frequently than pre-

nominal constructions (T. Kim & Lee, 2010). Importantly, however, this frequency effect should be modulated by the presence/absence of syntactic flexibility. That is, according to the incremental model, both pre-nominal and post-nominal constructions should be produced faster and with fewer errors in the flexible condition than in the non-flexible conditions, as was found in English (Ferreira, 1996). But according to the competitive model, the non-flexible conditions should result in shorter utterance latencies and fewer errors.

Method

Participants

Twenty-one native speakers of Korean from the University of Southern California community participated in the experiment for $10 per hour.

Stimuli

Rating study. In order to assess the semantic comparability of pre-nominal and post-nominal constructions, a rating study was conducted over the Internet on a separate group of 16 Korean speakers. We constructed 12 pairs of sentences similar to (3a–3b) using three nouns (*woman, man, student*) and 8 numerals (*one* to *eight*). Participants rated the semantic comparability of the two structures (pre-nominal and post-nominal) on a 1–7 scale, where 1 is 'completely un-interchangeable' and 7 is 'completely interchangeable' (i.e. semantically equivalent). The mean comparability rating was 5.69 of the 7 (standard deviation [SD] = 0.64). One sample, two-tailed *t*-tests were performed on participant and item means. These analyses showed that although the mean ratings differ from '7' ('completely interchangeable', $df_1 = 15$, $t_1 = -8.03$, $p < 0.01$; $df_2 = 11$, $t_2 = -10.80$, $p < 0.01$), they do not differ from '6' ('mostly interchangeable', $df_1 = 15$, $t_1 = -1.86$, $p > 0.05$; $df_2 = 11$, $t_2 = -1.74$, $p > 0.1$). In other words, the two structures used in the present experiment are judged to be largely interchangeable in their meanings. *Experimental stimuli.* We constructed three sets of 24 sentences consisting of a subject noun (e.g. *Jiun*), a

Table 1. Conditions of the experiment.

Condition	Case-marking on classifier	Example: Mary/met/three/students	Choices that speakers have:
Non-flexible	-*uy* (**GEN**)	Mary-ka/sey myeng-**uy**/ haksayng/manassata Mary-NOM/three CL-**GEN**/ student/met	Pre-nominal structure only
	-*ul* (**ACC**)	Mary-ka/ sey myeng-**ul**/ haksayng/manassata Mary-NOM /three CL-**ACC**/ student/ met	Post-nominal structure only
Flexible	No case marking	Mary-ka/sey myeng/haksayng/manassata Mary-NOM /three CL /student/ met	Both pre-nominal and post-nominal structures available

Note: In the actual experiment, words were shown in the four quadrants of the screen as illustrated in Figure 1.

transitive verb (e.g. *met*), a numeral + quantifier sequence (e.g. *five CL-acc*) and an object noun (e.g. *student*). The numeral quantifier phrases were constructed with the three nouns and eight numerals used in the rating study (*woman, man, student*, and the numbers *one* through *eight*). Each noun occurred once with each numeral. As shown in Table 1, the three versions of each sentence were created by manipulating the case-marker on the numeral quantifier. In the pre-nominal condition, the numeral quantifier was marked with genitive case – *uy*. In the post-nominal condition, it was marked with accusative case – *ul*. In the flexible condition, the numeral quantifier was not case-marked (i.e. speakers could add the case-marker of their choice). The subject noun was always nominative-marked.

Using a Latin square design, three lists were created such that each participant saw a particular item in only one condition but encountered all three conditions across the 24 items. The sentence components – a subject, a verb, a numeral quantifier and a noun that the numeral quantifier modifies – were presented in four boxes on a computer screen as shown in Figure 1. In order to avoid any influence of the component's location on the sentence construction process, the locations of each component were counterbalanced.

The experimental items were presented with 48 filler sentences, and no more than two experimental trials appeared consecutively. All filler sentences used numeral expressions, but none of them occurred in a numeral quantifier structure (e.g. *Jiun-ika 30 pwun-ul kelessta* 'Jiun walked for 30 minutes').

Procedure

The experiment was run with Paradigm (Perception Research Systems). Participants were seated in front of a computer and instructed to construct a well-formed sentence that contained every word shown on the screen. They were told that they sometimes had to add a case-marker to make the sentence grammatical. The addition of a case-marker was required for some filler trials as well as the target trials in the flexible condition. Participants were also told not to change the form of any given word (so if a
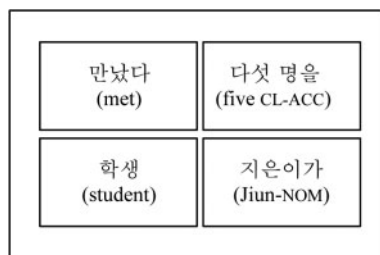

Figure 1.   Display of an experimental trial in the non-flexible post-nominal condition (Only Korean characters were shown in the actual experiment).

noun is provided with a case-marker, that marker should not be changed). Participants were encouraged to produce utterances as quickly as possible without making mistakes or being disfluent. Before proceeding to the main experiment, two example items and four practice items were presented, none of which involved numeral quantifier structures.

Participants initiated each trial by pressing the space bar. On each trial, they first focused on a crosshair for 500 ms. Then, a display like Figure 1 immediately followed and stayed on the screen until participants finished saying the sentence. When they were done speaking, participants pressed the space bar to proceed to the next trial. Participants' speech was recorded with a head-mounted USB microphone.

After the experiment, participants were asked what they thought the experiment was about. Most participants noticed that the experiment was about numbers, but no participant was able to correctly guess the purpose of the study.

Coding and analyses

Participants' responses were transcribed and categorised into three main categories: (1) correct utterances, (2) errors and (3) deviations. This tri-partite distinction follows Ferreira's (1996) coding procedure. **Correct utterances** corresponded to the sentence frames shown in Example (3). Following Ferreira (1996), incorrect responses were categorised as 'errors' or as 'deviations'. Incorrect responses were labelled as **errors** if they could occur in all conditions of the experiment. More specifically, the error subcategories included the following three situations: (1) If participants' utterances contained disfluencies (fillers or repairs); (2) If participants used the nominative case-marker – *i* for numeral classifiers and (3) if participants used incorrect numerals (e.g. ordinal numerals [*third*] instead of cardinal numerals [*three*]). About 7% of the trials were categorised as errors for one of the above reasons (36 of the 504 trials). Following Ferreira (1996), incorrect responses were analysed as **deviations** if the difference between a deviant response and a correct response could only logically occur in a particular experimental condition. If participants created an alternative structure modifying the given case-marker in the non-flexible condition, their responses were considered as deviations, as they could not occur in all conditions of the experiment. About 3% of the trials were categorised as deviations (17 of the 504 trials). Separating incorrect responses into errors (incorrect responses that could in principle occur in all conditions) and deviations (incorrect responses that could only occur in some conditions) was also done by Ferreira (1996). This distinction is important in order to allow for proper comparisons of error rates between conditions.

For correct trials, utterance onset latencies were manually determined using the phonetic software package *Praat* (Boersma & Weenink, 1992). Eighteen trials with outlier production latencies were further removed from the analyses using the MAD (Median Absolute Deviation)-median rule (e.g. Wilcox, 2012).

We report three different sets of results: (1) the proportion of pre-nominal and post-nominal constructions in the flexible condition, (2) the number of errors made in each condition and (3) the production latencies. The first set of results is used to evaluate whether participants exploited the syntactic flexibility available to them. The latter two sets of results are used to evaluate production difficulty in the non-flexible and the flexible conditions. In order to enable comparable comparison between the two conditions, incorrect responses that could have occurred in all experimental conditions and were non-trivially deviant from the target sentence frames – error responses – were used to evaluate production difficulty. For production latencies, only correct utterances were analysed. In both of these respects, we are following Ferreira (1996).

The results were analysed with mixed-effects logit models (Baayen, 2008; Bates & Sarkar, 2007; Jaeger, 2008). To specify the structure of random effects, fully crossed and fully specified random effects were reduced until the model converged. Then, following Baayen (2008), only those effects which were found to contribute significantly to the model were included in the final analyses. All final models contained the experimental conditions (pre-nominal, post-nominal and flexible) as a fixed effect, as well as random intercepts for subject and item.[4]

Results

Proportion of pre-nominal and post-nominal structures in the flexible condition

Participants produced both pre-nominal and post-nominal structures in the flexible condition, which shows that speakers indeed took advantage of the syntactic flexibility available to them. However, consistent with previous corpus work (T. Kim & Lee, 2010), post-nominal structures were more frequent than pre-nominal structures (84% vs. 16%).

Production errors

In the syntactically non-flexible conditions, participants made significantly more errors when they produced pre-nominal utterances (9%, 16 of the 168 trials) than post-nominal utterances (3%, 6 of the 168 trials; $\beta = -1.3359$, $z = -2.585$, $p < 0.01$, SE = 0.5167). This is expected, given that the pre-nominal construction is less frequent and thus presumably harder to produce. The flexible

condition resulted in about 8% errors (14 of the 168 trials).

Importantly, however, we did not find a main effect of flexibility on error rates. That is, the error rates for pre- and post-nominal utterances did not significantly differ between the non-flexible and the flexible conditions (pre-nominal: $\beta = -0.6405$, $z = -1.525$, $p > 0.1$, SE = 0.4199; post-nominal: $\beta = -0.3778$, $z = -0.640$, $p > 0.1$, SE = 0.5904). Thus, the error rate data do not provide support for either the competitive or the incremental model.

Production latencies

Figure 2 shows the mean utterance onset latencies of pre-nominal and post-nominal structures in the flexible and non-flexible conditions.[5] As expected, speakers produced pre-nominal constructions significantly more slowly than post-nominal constructions; the mean latency of pre-nominal structures was 3001 ms, whereas the mean latency of post-nominal structures was 2580 ms ($\beta = 426.21$, $t = 5.139$, $p < 0.001$, SE = 82.94). Crucially, however, both pre-nominal and post-nominal structures were produced *faster in the non-flexible condition*:

The mean latency of post-nominal structures was significantly shorter in the non-flexible condition (2521 ms) than in the flexible condition (2642 ms; $\beta = 172.21$, $t = 2.036$, $p < 0.05$, SE = 84.56). Pre-nominal constructions were also produced numerically faster in the non-flexible condition (2980 ms) than in the flexible condition (3084 ms), but the difference did not reach significance ($\beta = 95.61$, $t = 0.44$, $p > 0.1$, SE = 215.38). This could be due to a ceiling effect: Because pre-nominal structures are less frequent and thus slower to produce, it may well be that the overall slowdown masks a potential flexibility-related slowdown. The key observation here is that we clearly find <u>no indication of any kind of flexibility-induced facilitation</u>, as would be predicted by the incremental model. Rather, what we observe points towards the
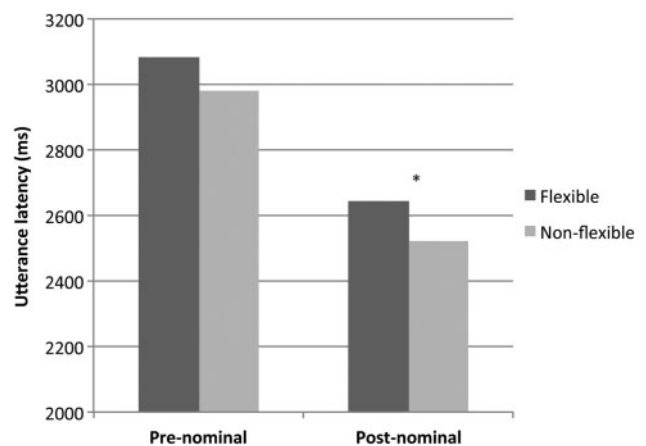

Figure 2.   Production latencies of pre-nominal and post-nominal structures in the flexible and non-flexible conditions.

competitive model: When syntactic flexibility is present, there is a significant slowdown with post-nominal constructions and a numerical slowdown with pre-nominal constructions.

In sum, speech onset latencies in Korean provide no evidence for syntactic flexibility having a facilitatory effect on language production (the incremental model). Rather, the data suggest the very opposite, that is that syntactic flexibility incurs a cost and it slows down speech onset in Korean (the competitive model).

Discussion

The analyses of production latencies showed that Korean speakers overall produced post-nominal structures faster than pre-nominal structures, as predicted by the frequency of these constructions. But crucially, we found no evidence that flexibility speeds up production contrary to what has been observed for English. Instead, Korean speakers produced both pre-nominal and post-nominal structures faster in the *non-flexible* conditions than in the flexible condition.[6] Thus, speech onset latencies in Korean provide no evidence for syntactic flexibility having a facilitatory effect on Korean production. Rather, the fact that the syntactic flexibility delayed speech onset provides support for the competitive model, according to which alternative syntactic structures compete with each other and slow down speech onset.

Unlike the latency results, the outcomes of the error analyses show no clear effect of flexibility. The error rates of pre- and post-nominal structures did not significantly differ between the flexible condition and the non-flexible conditions. Thus, the results provide no indication of flexibility affecting production in either a negative or a positive way. However, the error rates in the two conditions are low and thus it is possible that a potential floor effect is obscuring the effects of flexibility.

In sum, while the error rates do not provide clear evidence in favour of either the incremental or the competitive model, we find no evidence supporting the incremental model. Rather, the production latency data point towards the competitive model.

Experiment 2: active/passive constructions – case-marker manipulation

In order to see whether the findings in Experiment 1 extend to other syntactic constructions, we manipulated syntactic flexibility in active/passive constructions in Korean in Experiment 2. Transitive verbs allow speakers to choose between active and passive structure by assigning either the agent or the patient to the subject function. For example, speakers can produce the active sentence in (4a), assigning the agent *misinformation* to the subject function or the passive sentence in (4b), assigning the patient *John* to the subject function.

(4a). Misinformation confused John.
[active]
(4b). John was confused by misinformation.
[passive]

Ferreira ([1996](#)) investigated effects of syntactic flexibility in active/passive alternation by manipulating the presence/absence of case-marking on nouns. For example, when speakers are presented with names like 'John' or case-invariant pronouns like 'you' (e.g. 'misinformation/confused/John'), they can produce either the active structure in (4a) or the passive structure in (4b) and thus, syntactic flexibility exists. However, when presented with pronouns like 'him' (e.g. 'misinformation/confused/him'), speakers can only produce the active structure as seen in (5a), and thus syntactic flexibility does not exist.

(5a). Misinformation confused him.
[active]
(5b). *Him was confused by misinformation.
[*passive]

Similar to Ferreira ([1996](#)), we manipulated syntactic flexibility in active/passive alternation in Korean via case marking on the nouns. When the agent noun or the patient noun is case-marked, Korean speakers are forced to produce one sentence structure. For example, when the patient noun *yang* 'sheep' is marked with accusative marker – *(l)ul*, only the active structure (6a) is available.

(6a). Nuktay-ka   yang-<u>ul</u>   capassta.
      wolf-NOM   sheep-<u>ACC</u>   caught
      'A wolf caught a sheep'.
[active]

(6b). *Nuktay-eykey yang-<u>ul</u>   caphyessta.
      wolf-DAT   sheep-<u>ACC</u>   caught-PASS
      'A sheep was caught by a wolf'.
[*passive]

Similarly, when the agent noun *nuktay* 'wolf' is marked with dative marker – *eykey*, Korean speakers are only allowed to produce the passive structure (7a).

(7a). Yang-i   nuktay-<u>eykey</u> caphyessta.
      sheep-NOM   wolf-<u>DAT</u>   caught-PASS
      'A sheep was caught by a wolf'.
[passive]

(7b). *Nuktay-eykey yang-ul   capassta.
      wolf-DAT   sheep-ACC   caught
      'A wolf caught a sheep'.
[*active]

However, when neither noun is case-marked, Korean speakers can choose between the active and the passive structure; they can mark the nouns with the case of their own choice. Thus, we manipulated syntactic flexibility by presenting nouns with or without case-markers: An accusative-marked patient noun or a dative-marked agent

noun permits only an active or a passive structure respectively and thus, results in syntactic non-flexibility. Nouns without case-markers, however, can be used in an active and a passive structure and thus result in syntactic flexibility.

In order to evaluate production difficulty, we measured speakers' production latencies and error rates as in Experiment 1. We expect that active utterances should be produced faster and with fewer errors than passive utterances, as an active structure is more frequent, acquired earlier, and more accessible than a passive structure (e.g. Gleitman et al., 2007; Lee, 1969). Crucially, all else being equal, the incremental model predicts that both active and passive utterances should be produced faster and with fewer errors in the flexible condition than in the non-flexible conditions. The competitive model, however, predicts the opposite, that is the non-flexible conditions should result in shorter utterance latencies and fewer errors.

Method

Participants

Eighteen native speakers of Korean from Kyungnam University (in Changwon, Korea) participated in the study in exchange for course credit.

Stimuli

Rating study. Active and passive constructions in Korean commonly require the subject to be animate. The use of two animate entities, however, is likely to result in semantic flexibility in addition to syntactic flexibility. That is, when the nouns are not case-marked, speakers could choose either of the two nouns to be the agent of the event (e.g. *a dog chases a cat* vs. *a cat chases a dog*, see Huang, 2012 on the effects of semantic flexibility on production). In order to constrain semantic flexibility and ensure that only one meaningful sentence could be created in the flexible as well as non-flexible condition, a rating study was conducted over the Internet on a separate group of 18 Korean speakers. We constructed four lists of sentences, where a particular sentence appeared with either a plausible or an implausible agent in an active or a passive structure (e.g. Active with a plausible agent: 'a hunter caught a rabbit'; Active with an implausible agent: 'a rabbit caught a hunter'; Passive with a plausible agent: 'a rabbit was caught by a hunter'; Passive with an implausible agent: 'a hunter was caught by a rabbit'). Participants rated the plausibility of the sentences on a 1–7 scale, where 1 is 'completely implausible' and 7 is 'completely plausible'. The mean plausibility rating for plausible sentences was 6.78 ($SD = 0.28$) and 1.65 of the 7 ($SD = 0.52$) for implausible sentences. One sample, two-tailed t-tests showed that the mean rating for the

implausible sentences was greater than '1' ('completely implausible', $t_{1(17)} = 5.29$, $p < 0.001$; $t_{2(20)} = -6.12$, $p < .001$), but did not significantly differ from '2' ($t_{1(17)} = -2.81$, $p < 0.05$; $t_{2(20)} = -0.312$, $p = 0.75$). The mean rating for the plausible sentences was less than '7' ('completely plausible' $t_{1(17)} = -3.205$, $p < 0.01$; $t_{2(20)} = -4.099$, $p < 0.001$), but greater than '6' ($t_{1(17)} = 11.84$, $p < 0.001$; $t_{2(20)} = 11.12$, $p < 0.001$). That is, the sentences with an implausible agent were judged to be very implausible, and those with a plausible agent were judged to be very plausible.

Experimental stimuli. Three sets of 21 sentences were constructed on the basis of the results of the norming study. Each set contained an agent noun, a patient noun, and a transitive verb from the rating study. The three versions of each sentence were created by varying the case-marker on the agent noun or the patient noun. In the non-flexible conditions, the agent noun was marked with dative case (resulting in a passive structure) or the patient noun was marked with accusative case (resulting in an active structure). In the flexible condition, neither nouns were case-marked (i.e. speakers could add the case-marker of their choice). The verb was always given in the (uninflected) dictionary form and speakers were asked to conjugate it to form a grammatical sentence.

We did not mark the agent or the patient with nominative case – *i/ka* in the non-flexible conditions, but instead marked them with dative or accusative case. This was done in order to maximise the production of the intended sentence frames (i.e. active/passive). When the agent or the patient is marked with the nominative marker, speakers can add to the un-case-marked noun a range of case-markers such as the conjunctive marker – *(k)wa* 'and', producing sentences with a different sentence frame and a different meaning than the intended one (e.g. 'a thief and a policeman [pro] caught' meaning that 'a thief and a policeman caught someone' instead of 'a policeman caught a thief'). However, marking the agent with the dative and the patient with the accusative forces speakers to assign the nominative case to un-case-marked noun, resulting in the production of the intended sentence frame and meaning.

The 21 critical items were assigned to conditions by means of a Latin square design. The sentence components – an agent noun, a patient noun, and a verb – were presented on a computer screen similarly as in Experiment 1, and the locations of each component were counterbalanced. The experimental sentences were combined with 48 filler sentences. All filler sentences required speakers to add a case-marker and to conjugate the verb to form a grammatical sentence.

Procedure

The experimental set-up and procedures were identical to those in Experiment 1.

Coding and analysis

Participants' responses were categorised into correct utterances, errors, and deviations as in Experiment 1. Correct responses correspond to the sentence frames shown in Examples (6a) and (7a). As in Experiment 1, utterances containing disfluencies (fillers or repairs) were analysed as errors. (Some of the error categories from Experiment 1, such as use of an incorrect case-marker or ordinal numeral, are not relevant for Experiment 2.) Incorrect responses were analysed as deviations if participants used a non-canonical Object Subject Verb (OSV) word order (e.g. *sheep-ACC wolf-NOM caught* 'a sheep, a wolf caught') or the topic marker on the subject noun (e.g. *wolf-TOP sheep-ACC caught* 'as for the wolf, it caught a sheep'). We categorised these responses as deviations since the sentence frames of these sentences did not result in significant changes in the meaning (e.g. 'a sheep, a wolf caught' instead of 'a wolf caught a sheep') unlike the sentence frames used in the error category (e.g. 'a sheep caught a wolf'), and they might involve different cognitive processes than the target frames. Ferreira (1996) also categorised only the sentence frames nontrivially deviant from the target frames as errors. Otherwise, criteria for coding and analyses were identical to those used in Experiment 1. In total, about 3% of the trials were categorised as errors (12 of the 378 trials) and 5% as deviations (18 trials).

Results

Proportion of the active and the passive structure in the flexible condition

It is important for the logic of the experiment that both an active and a passive structure be observed in the syntactically flexible condition. Participants indeed produced both utterance types in the flexible condition. However, the production of actives was dominant compared to that of passives (85% vs. 15%). This is expected given the marked nature of passives.

Production errors

The error rates overall were low (4%, 12 of the 378 trials). In the syntactically non-flexible condition, participants were more likely to make errors when they were forced to produce a passive structure (5%, 6 of the 126 trials) than an active structure (0.8%, 1 of the 126 trials; $\beta = -1.953$, $z = -1.794$, $p = 0.07$, SE = 1.088). The flexible condition resulted in 4% errors (5 of the 126 trials).

Crucially, we did not find a main effect of syntactic flexibility on error rates, that is the error rates for actives and passives did not significantly differ between the non-flexible and the flexible conditions (actives: $\beta = -1.447$, $z = -1.058$, $p > 0.1$, SE = 1.369; passives: $\beta = -.5469$, $z = -0.801$, $p > 0.1$, SE = 0.6832). Thus, similar to

Experiment 1, the error rate data do not provide support for either the competitive or the incremental model.

Production latencies

Figure 3 shows the mean utterance onset latencies of active and passive sentences in the flexible and non-flexible conditions.

Consistent with previous research (Flores d'Arcais, 1975; Gleitman et al., 2007; Hwang & Kaiser, 2012), speakers initiated passive utterances significantly more slowly than active utterances; the mean latency of actives was 2393 ms, whereas the mean latency of passives was 2854 ms ($\beta = 448.8$, $t = 4.955$, $p < 0.001$, SE = 90.58). Crucially, both actives and passives were produced *faster in the non-flexible condition*. That is, when speakers could choose between an active and a passive structure in the syntactically flexible condition, they had more difficulty in producing sentences, as predicted by the competitive model. The mean latency of actives was significantly shorter in the non-flexible condition (2287 ms) than in the flexible condition (2577 ms; $\beta = 232.12$, $t = 2.574$, $p < 0.05$ (0107), SE = 90.16). Passives were also produced numerically faster in the non-flexible condition (2577 ms) than in the flexible condition (2822 ms), but the difference did not reach significance ($\beta = -242.1$, $t = -0.906$, $p > .1$, SE = 267.3).

Discussion

Consistent with the results of Experiment 1, the analyses of production latencies showed that Korean speakers could construct sentences faster in the syntactically non-flexible conditions, as predicted by the competitive model. The production errors, however, did not significantly differ between the flexible and the non-flexible conditions, and thus showed no clear effect of syntactic flexibility.
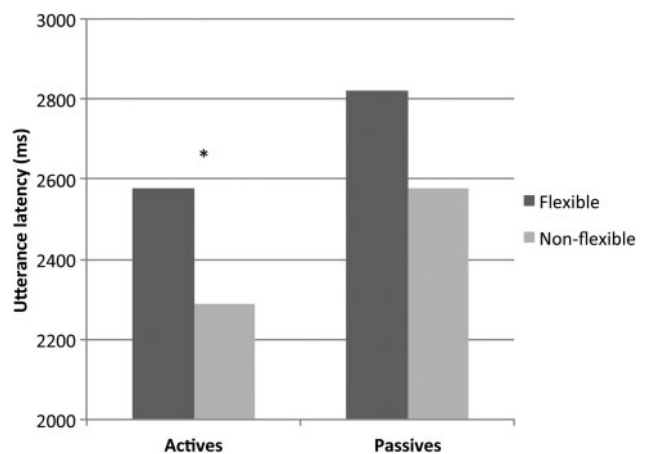

Figure 3. Production latencies of active and passive sentences in the flexible and non-flexible conditions in Experiment 2.

Whereas the error rates do not provide support for either model, the results of production latency analyses are incompatible with the predictions of the incremental model. That is, the incremental model predicts that the syntactically flexible condition should result in shorter production latencies than the non-flexible condition, which is opposite to the observed main effect. The overall slowdown in the flexible condition rather points toward the competitive model, which predicts production difficulty with syntactic flexibility.

Experiment 3: active/passive constructions – verb manipulation

Experiment 3 manipulates syntactic flexibility in active/passive constructions in Korean via the form of a verb rather than case on the nouns. The syntactic structure of a transitive sentence can be constrained by verb forms as well as case. For example, *capassta* 'caught' only allows the active structure (8a), whereas *caphyessta* 'caught-PASSIVE' with the passive morpheme *hi* only permits the passive structure (9a).

(8a). Nuktay-ka yang-ul capassta.
　　　wolf-NOM sheep-ACC caught
　　　'A wolf caught a sheep'.
　　　　　　　　　　　　　　　[active]

(8b). *Yang-i nuktay-eykey capassta.
　　　sheep-NOM wolf-DAT caught
　　　'A sheep was caught by a wolf'.
　　　　　　　　　　　　　　　[*passive]

(9a). Yang-i nuktay-eykey caphyessta.
　　　sheep-NOM wolf-DAT caught-PASS
　　　'A sheep was caught by a wolf'.
　　　　　　　　　　　　　　　[passive]

(9b). *Nuktay-ka yang-ul caphyessta.
　　　wolf-NOM sheep-ACC caught-PASS
　　　'A wolf caught a sheep'.
　　　　　　　　　　　　　　　[*active]

Thus, if participants are given inflected verb forms like *capassta* 'caught' (active form) and *caphyessta* 'was caught' (passive form) to create sentences with (e.g. 'wolf/sheep/was caught'), an active and a passive structure are not available simultaneously, and thus syntactic flexibility does not exist (*non-flexible condition*). However, if verbs are given in a bare dictionary form like *capta* 'to catch' (e. g. 'wolf/sheep/to catch'), speakers can choose to use either an active or a passive structure by adding a passive morpheme (*flexible condition*).

Other things being equal, the incremental model predicts that speakers should have more difficulty in producing sentences in the syntactically non-flexible conditions with inflected verbs than in the flexible condition with uninflected verbs. The competitive model predicts the opposite – production should be easier in the non-flexible conditions.

Method
Participants
Twenty-four native speakers of Korean from Kyungnam University (Changwon, Korea) participated in the study in exchange for course credit.

Stimuli
The experimental stimuli used in Experiment 3 are identical to those used in Experiment 2.

Procedure
The experimental set-up and procedures were identical to those in Experiments 1 and 2.

Coding and analysis
Three items were excluded from the analysis as the active and the passive forms of the verb were highly confusable (e.g. *kkoessta* 'lured' and *kkoyessta* 'was lured') and resulted in fewer than 60% correct utterances. We also excluded two participants who made more than 40% errors in critical trials (None of the participants in Experiments 1 and 2 made more than 25% errors).

Participants' utterances were categorised as in Experiment 2, with the following difference: Production of implausible sentences such as 'a sheep caught a wolf' was analysed as an error since it could have occurred in all conditions of the experiment. The deviation category included responses where participants created an alternative structure modifying the given verb form in the non-flexible condition. These responses were considered as deviations, as they could not occur in all conditions of the experiment. Otherwise, the criteria for coding and analyses were identical to those used in Experiment 2. In total, about 5% of the trials were categorized as errors (20 of the 396 trials) and 13% as deviations (52 trials).

Results
Proportion of the active and the passive structure in the flexible condition
Participants produced both the active and the passive structure in the flexible condition, exploiting the syntactic flexibility available to them. However, as in Experiment 2, participants produced predominantly more active sentences (90%) than passive sentences (10%).

Production errors
In the syntactically non-flexible condition, participants made significantly more errors when the condition required them to produce a passive structure (8%, 11 of

the 132 trials) than an active structure (3%, 4 of the 132 trials; $\beta = -1.2664$, $z = -2.062$, $p < .05$, SE = 0.6141). The flexible condition resulted in 4% errors (5 of the 132 trials).

Crucially, we did not find a main effect of syntactic flexibility on the errors. The error rates for the active and the passive utterances did not significantly differ between the non-flexible and the flexible conditions (actives: $\beta = -0.1382$, $z = -0.189$, $p > 0.1$, SE = 0.7304; passives: $\beta = -1.0904$, $z = -1.911$, $p > 0.05$, SE = 0.5706). Thus, similar to Experiments 1 and 2, the pattern of errors does not provide support for either the incremental or the competitive model.

Production latencies

Figure 4 shows the mean utterance onset latencies of active and passive sentences in the flexible and non-flexible conditions. As in Experiment 1, the use of a passive structure led to delayed utterance onset (2598 ms) as compared to that of an active structure (2177 ms; $\beta = 323.42$, $t = 4.112$, $p < 0.001$, SE = 78.66). Crucially, the syntactically flexible condition resulted in significantly longer production latencies than the non-flexible condition for both the active and the passive structure, as can be seen in Figure 4 (actives: $\beta = 171.22$, $t = 2.146$, $p < 0.05$, SE = 79.78; passives: $\beta = -897.1$, $t = -3.762$, $p < 0.001$, SE = 238.5). Thus, the pattern of production latencies provides strong support for the competitive model for Korean.

Discussion

The competitive model predicts slower production under the flexible condition, whereas the incremental model predicts faster production with flexibility. The analyses of production latencies in Experiment 3 showed that the flexible condition resulted in delayed production latencies
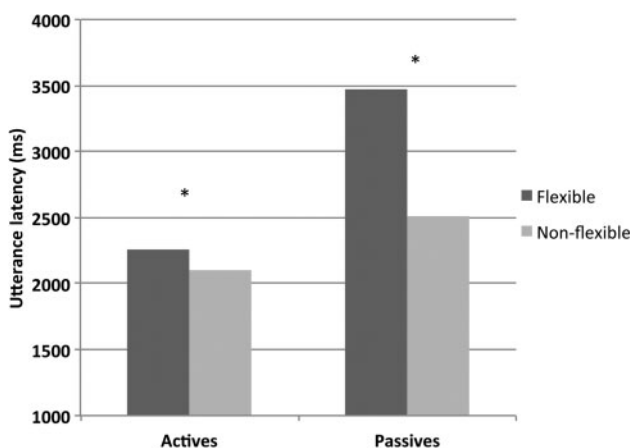

Figure 4.　Production latencies of active and passive sentences in the flexible and non-flexible conditions in Experiment 3.

for both active and passive sentences. These results are precisely what the competitive model predicts.

The competitive model also predicts error-prone production in the presence of syntactic flexibility, whereas the incremental model predicts the opposite. The error rates, however, did not differ significantly between the flexible and the non-flexible conditions.

Although the error rates do not support either the incremental or the competitive model, the pattern of production latencies is incompatible with the incremental model. Contrary to the incremental model, the significant slowdown in the flexible condition showed that syntactic flexibility had an adverse effect on Korean production. The overall pattern of results then provides support for the competitive model for Korean.

General discussion

The present study investigated how Korean speakers choose between alternative syntactic structures by means of manipulating syntactic flexibility in numeral quantifier constructions (Experiment 1) and active/passive constructions (Experiments 2 and 3). An *incremental* view of language production, supported by Ferreira's (1996) findings for English, predicts that Korean speakers should produce sentences more quickly and with fewer errors in the flexible condition than in the non-flexible conditions. In contrast, if language production proceeds in a *competitive* manner (i.e. available structures compete with each other thereby inhibiting each other), the prediction is that the non-flexible conditions in Korean should result in faster production latencies and fewer errors than the flexible condition.

Across three experiments on Korean, we found that syntactic flexibility delayed speech onsets: Speakers initiated utterances more slowly in the syntactically flexible conditions than the non-flexible conditions. Thus, these results provide strong support for the competitive model for Korean.

The results of the error analyses, however, do not show clear effect of syntactic flexibility. Across the experiments, the error rates between the flexible and non-flexible conditions did not differ significantly. However, the fact that the error rates in the two conditions are overall low points to a potential floor effect that could be obscuring the effects of flexibility. This suggests that, for the constructions we investigated, the error rates do not offer a good measure of how syntactic flexibility affects production.

Overall, we found no evidence that flexibility facilitated production in Korean. Rather, the delayed speech onsets in the flexible conditions suggest that speakers had more difficulty with syntactic flexibility, as predicted by the competitive model. This contrasts strikingly with the findings of Ferreira (1996), obtained using a very similar

method, which support the incremental production model for English. In our opinion, the finding that syntactic flexibility delayed production in Korean, whereas it facilitated production in English, suggests that the nature of the mechanisms involved in the selection and/or activation of syntactic structures are not cross-linguistically universal and can vary in fundamental ways from language to language.

Exploring possible sources of cross-linguistic differences

The finding that flexibility clearly does *not* facilitate but in fact hinders language production in Korean – in contrast to Ferreira's findings for English – suggests that the mechanisms underlying the selection of syntactic structures may differ cross-linguistically.[7] In this section, we discuss how the differences between Korean and English may follow naturally from the grammatical properties of these two typologically different languages. Broadly speaking, we suggest that the different mechanisms by which syntactic structures are selected during the production of English and Korean are related to the flexibility that these languages offer in grammatical function assignment, which is closely linked to how they indicate grammatical functions – word order (English) or case-marking (Korean).

In **English**, word order is relatively fixed and grammatical functions are defined in terms of word order. For example, when English speakers encounter a Noun-Verb-Noun sequence, the default processing strategy is to assume that the first noun is the subject and the second noun is the object (Bever, 1970). The rather rigid word order of English can cause trouble for English speakers as lexical items can vary in terms of how accessible they are at different points in time (see Ferreira, 1996 for discussion). For example, if the word linked to the subject is not accessible, it could interfere with launching an utterance (Bock & Ferreira, to appear). Syntactic flexibility, however, allows more accessible words to be mentioned earlier and assigned to grammatical functions sooner. Thus, by providing the rigid word order system with recourse against variability in lexical accessibility, syntactic flexibility facilitates English production. That is, speakers can produce utterances faster and with fewer errors when syntactic flexibility is available.

Unlike English, **Korean** indicates grammatical functions by case-markers and not by word order. Since grammatical functions are signaled by case-markers, word order is relatively free in Korean. For example, active sentences can begin with either the agent or the patient (SOV: *fox-NOM chicken-ACC chase* or OSV: *chicken-ACC fox-NOM chase*), and the same holds true of passives. Because word order does not constrain grammatical functions or sentence structures in Korean,

the availability of a particular lexical item or lexical retrieval *per se* does not determine a sentence structure in Korean. For example, even if the noun 'chicken' is more accessible than the noun 'fox', this does not mean that the speaker *has* to use a passive structure, as she could also produce an active structure with OSV word order.

Consistent with the idea that the accessibility of individual lexical items does not determine structural choice in Korean, Hwang and Kaiser (2009, 2012) found that priming patient entities with semantic prime words or attention-capture cues did not increase the use of passive sentences in Korean, in stark contrast to what is known in English (e.g. Bock, 1986; Gleitman et al., 2007). In fact, these findings make sense when we consider the typological properties of Korean: Since word order is flexible, it is the case marking on nouns (nominative, accusative, etc), not word order that indicates grammatical roles and syntactic structures in Korean.[8] This means that Korean speakers, in order to assign case, must 'decide' what grammatical function a word will have in the sentence. For example, even if Korean speakers begin to plan a sentence with a more accessible word, they could assign it either to the object function (producing an active structure with SOV or OSV word order) or to the subject function (producing a passive sentence). We assume that production proceeds in two stages, namely function assignment and constituent assembly (e.g. Bock & Levelt, 1994) and that assignment of grammatical functions does not necessarily determine constituent structure (i.e. the order of the arguments, following Tanaka, Branigan, McLean, & Pickering, 2011, Hartsuiker & Westenberg, 2000 and others, though see Pickering, Branigan, & McLean, 2002 for evidence for a single-stage account of the formulation of constituent structure).

If Korean speakers experience competition between two different grammatical function assignments (and, accordingly, competition between alternative syntactic frames) *in the presence of syntactic flexibility*, then the expectation is that syntactic flexibility should slow down speech onset. But when the nouns are case-marked and syntactic flexibility is *not* present (as in our non-flexible conditions), Korean speakers should experience less difficulty because only the appropriate grammatical function and frame accrue activation and thus less competition ensues. Indeed, this is what our results show.

Recall that in our experiments, in the non-flexible conditions, the case or verb form indicates the relationship between sentence elements, for example, who did what to whom. In essence, then, our findings hint that Korean speakers take as their starting point the structural relations between arguments or event entities ('structure-driven sentence production', Bock & Ferreira, to appear), rather than individual lexical items ('word-driven sentence production') – as this allows them to assign grammatical

functions more efficiently and thus allows for smoother production (see Hwang & Kaiser, under revision; under revision for more converging evidence).

Returning now to the asymmetry between the effects of syntactic flexibility on the production of English and Korean, the different findings for these two languages can be reconciled if we consider them in light of how the two languages signal grammatical functions (by word order or by case-marking). Syntactic flexibility has facilitatory effects in English – and presumably other typologically similar languages – because it allows speakers to cope with a rather rigid relationship between word order and grammatical function by accommodating more accessible nouns and to assign grammatical functions as early as possible (see Ferreira, 1996 for details). But syntactic flexibility hinders utterance formulation in Korean when speakers have to choose between alternative grammatical function assignments and alternative syntactic frames. In sum, function assignment (or 'structural scaffolding' in Bock & Ferreira, to appear) can proceed more smoothly (1) in the presence of syntactic flexibility in English as it offers a backup to the configurational system, and (2) in the absence of syntactic flexibility in Korean as it minimises uncertainty in the inflectional system. Thus, the different mechanisms of syntactic choice between English and Korean can be connected to the typological differences between these two languages.[9]

Our results point to a competitive mechanism in the choice of syntactic structure for Korean, whereas Ferreira's (1996) point to an incremental mechanism for English. These results, however, should not be taken to mean that in Korean, lexical accessibility does not play *any* role, or that in English, competition between alternative structures or structural relations play no role. In fact, earlier work showed that in Korean, lexical accessibility could affect the choice of phrase order when phrase ordering was independent of grammatical function assignment. For example, when ordering the theme and the goal in the dative structure (e.g. John-NOM Mary-DAT book-ACC gave 'John gave Mary a book'), Korean speakers were more likely to put an animate noun before an animate noun in the dative structure (e.g. Dennison, 2008).

For English, Stallings, MacDonald, and O'Seaghdha's results (1998) suggest that structural competition might occur when speakers have to choose between shifted and basic phrase orders in heavy-NP shift, (e.g. 'Janet revealed to Leigh some more specific plans for a brand new defense plant' vs. 'Janet revealed some more specific plans for a brand new defense plant to Leigh'). The view that competition between structural alternatives does play a role in English also fits with Myachykov et al.'s (2013) findings that syntactic flexibility slows down speech onset in English (as well as in Russian).

Furthermore, Kuchinsky (2009) and Kuchinsky and Bock (2010) suggest that when speakers describe a pictured event, the degree to which lexical accessibility as compared to structural relation drives sentence production is modulated by how easy (or hard) an event is to interpret (i.e. event codability; see Bock & Ferreira, to appear for a review).

As a whole, these findings in combination with our results suggest that (1) a language can employ both incremental and competitive production mechanism, that (2) both lexical and structural information can contribute to sentence production in a particular language and that (3) the grammar of a language is a factor that modulates the extent to which the two mechanisms/types of information influence sentence production (as we found for English and Korean). However, it is not yet clear what mechanism or information a language prioritizes under what circumstance. As noted by Bock and Ferreira (to appear), many interesting questions remain open in this area.

The idea that English and Korean differ in the extent to which lexical and structural information guide grammatical function assignment receives further support from work on language comprehension. During the comprehension of English sentences, *lexically based* constraints such as the subcategorisation frames and argument-structural properties of verbs constrain structural analyses or grammatical function assignments to such a great extent that they can result in garden-pathing (e.g. Britt, 1994; Garnsey, Pearlmutter, Myers, & Lotocky, 1997; Snedeker & Trueswell, 2004). For example, in a sentence such as *Put the frog on the napkin into the box*, the PP 'on the napkin' is initially often misinterpreted as a Goal for the verb *put* because *put* has a strong subcategorisation bias in favour of a goal thematic role (Tanenhaus, Spivey-Knowlton, Eberhard, & Sedivy, 1995; Trueswell, Sekerina, Hill, & Logrip, 1999).

In contrast to English speakers who use lexical information (e.g. subcategorisation frames and frequency patterns) to constrain structural alternatives or grammatical function assignments, a recent study by Choi and Trueswell (2010) suggests that Korean speakers use structural (morpho-syntactic) cues such as case-markers to guide structural analyses or grammatical function assignments. For example, sentence (10) contains a temporal ambiguity because the case-marker – *ey* is ambiguous between the genitive and the locative marker. The sentence-initial *napkin-ey* can be interpreted either as a modifier of *frog* ('the frog on the napkin') or a goal of the upcoming verb ('put the frog on the napkin'). The temporal ambiguity is resolved either in favour of the modifier interpretation upon hearing *pick up* ('pick up the frog on the napkin') or the goal interpretation upon hearing *put* ('put the frog on the napkin'; see also Kamide, Altmann, & Haywood, 2003 for related work on Japanese)

(10) Naypkhin-ey   kaykwuli-lul   nohu-sey-
      yo / cipu-sey-yo.
      Napkin-ey   frog-ACC   put / pick up
      'Put / Pick up the frog on the napkin'.
(from Choi & Trueswell, 2010)

Crucially, – *ey* is used much more frequently as the locative case than as the genitive case and Choi and Trueswell (2010) found that Korean speakers tended to initially anticipate verbs like *put* which require a goal thematic role. This suggests that case-markers exert great influence on structural analyses or grammatical function assignments in comprehension in Korean.

In sum, our experimental findings showed that syntactic flexibility clearly does not facilitate production in Korean – if anything it hinders production, which contrasts strikingly with Ferreira's findings for English. In this section, we have suggested that this difference between English and Korean may in fact be a natural consequence of the typological properties of these two languages.

Implications for existing work on other languages

The results of the present study may provide new insights into why Myachykov and Tomlin (2008) and Myachykov, Garrod, and Scheepers (2010) did not find effects of visual attention-capture cueing on language production in Russian and Finnish. Russian and Finnish are similar to Korean in that they are case-marking languages with flexible word order. If Russian and Finnish speakers also select a grammatical function (and accordingly, a syntactic frame) rather than starting with the most accessible lexical item, we expect that the attention-capture cues should not influence speakers' syntactic choice in these languages, just like Korean speakers' syntactic choice was not influenced by semantic priming or attention-capture cueing (Hwang & Kaiser, 2009, 2012). Broadly speaking, this line of reasoning is also compatible with the Russian data from Myachykov et al. (2013), who provides evidence for the competitive model, albeit using different methods and different kinds of data than Ferreira (1996).

Conclusions

The production study reported here found that the presence of syntactic flexibility does not facilitate language production in Korean but in fact leads to a slowdown in speech latencies. This is in striking contrast to the facilitatory effects observed in English by Ferreira (1996), and suggests that in Korean, syntactic selection involves a competitive rather than an incremental process. These cross-linguistic differences suggest that languages can differ in their syntactic selection mechanisms, and that the (lexically) incremental architecture proposed by Ferreira (1996) is not a cross-linguistic universal. We discuss the possible underlying reasons for this cross-linguistic difference, and suggest that the difference between English and Korean

may be derivable from the typological properties of these two languages, in particular the way in which they mark grammatical functions (by word order or by case-marking). In general, the present study contributes to our understanding of the broad question of whether and how the specific grammatical properties of a language influence the architecture of real-time language production.

Notes

1. Ditransitive sentences in Korean are not suitable for our purposes because, although they allow two different word orders similar to English (*give the book to the boy* vs. *give the boy the book*), these two word orders in Korean have identical case marking (*give book-ACC boy-DAT* vs. *give boy-DAT book-ACC*). As a result, in Korean where a syntactic structure is contingent on case marking, it is difficult to manipulate syntactic flexibility with ditransitive constructions in Korean (i.e. hard to force Korean speakers to produce a certain ditransitive structure).
2. In Korean, the realisation of the plural morpheme -*tul* is not obligatory, unlike English plural marking -*s*.
3. In English, the active/passive and the ditransitive alternation (the two structures investigated by Ferreira in his seminal 1996 paper) are commonly regarded as conveying the same core meaning, although they are not always semantically fully equivalent. For example, *Every boy kissed at least one girl* does not entail that *At least one girl was kissed by every boy*, and *John taught the students Spanish* implies that students learned Spanish, whereas *John taught Spanish to the students* does not. Similarly, Korean pre-nominal and post-nominal structures are not always fully equivalent; unlike pre-nominal structures, post-nominal structures can convey a part-whole relationship as seen in (1) (see Han, 1999; Y.-H. Kim, 1983; Shin, 2007).

    (1) Twu tay-uy   olaytoyn cha-ka
        kocangnassta.
        two CL-GEN   old   car-NOM
        broke down
        'Two old cars broke down'.
    (2) Olaytoyn cha twu   tay-ka
        kocangnassta.
        old   car   two   CL-NOM broke
        down
        'Two old cars broke down'.
        'Two of the old cars broke down'.

4. Other factors such as list and the order of presentation did not have any effect on the error rates or the production latencies, as shown by model comparison.
5. Overall, the onset latencies that we observed for Korean in our experiments are longer than those found by Ferreira (1996) for English. While this could be due to Korean speakers adopting a more deliberate attitude towards the task (considering their options more explicitly than Ferreira's English speakers), it is not clear what would be driving this kind of cross-linguistic difference in level of deliberation. In fact, this difference may well be due to the

fact that the average syllable length of the initial nouns in our studies is longer than in Ferreira's. It is well known that utterance latencies correlate with the length of the initial noun phrases (e.g. Levelt & Maassen, 1981). In Ferreira (1996), the average syllable number of the initial nouns in canonical sentence structures ranges from 1 (Experiment 1) to 1.95 (Experiments 2 and 3), whereas in our study, the average syllable number (including the subject case particle) ranges from 3.3 (Experiments 2 and 3) to 4 (Experiment 1).

6. One may wonder whether the faster production latencies in the non-flexible conditions could simply be due to speakers not needing to retrieve the case-markers, since the case-markers were already given/present in the non-flexible conditions. However, this explanation is not likely. If the overt presence of a case-marker were the reason for the faster production latencies in non-flexible conditions, English speakers should also produce prepositional structures faster in the non-flexible condition with the overt preposition than in the flexible condition without the preposition, by the same reasoning. But Ferreira (1996) found that English speakers produced prepositional structures faster in the flexible condition despite the absence of the preposition (i.e. not needing to retrieve the preposition did not speed things up). Although English speakers did not need to choose between 'to' and another preposition, they still needed to choose whether to use the preposition 'to' or not. Korean speakers needed to choose between two case-markers, but they did not need to choose whether to use a case-marker or not – since case marking was obligatory in the experiments (the experimental stimuli without case-markers sound unnatural). That is, both English and Korean speakers were given two choices in the flexible condition. Thus, Korean speakers' faster production in the non-flexible conditions cannot be attributed to the simple presence of case-markers in the non-flexible condition or the availability of two case-markers in the flexible condition.

7. It is important to note that Myachykov et al. (2013)'s results go against Ferreira's original (1996) findings because Myachykov et al. argue that syntactic flexibility is costly in English. However, due to differences in the methodologies in these two studies, one should take care when comparing their results. Because our method is closer to Ferreira's, we focus on comparing our findings with his. Furthermore, as will become clear later in this section, we do *not* claim that incremental processing plays no role in Korean, or that competitive processing plays no role in English. Instead, we suggest that a particular language can employ both incremental and competitive mechanisms and that the grammar of a language is a factor that modulates the extent to which the two mechanisms influence sentence production.

8. Korean speakers may omit case-markers in colloquial speech (i.e. case ellipsis, e.g. T. Kim, 2008; Sohn, 1999). This may seem to challenge our motivation for the competitive production for Korean. Crucially, however, whether case is phonologically realised or not does not change the degree of flexibility in function assignment. For example, despite case ellipsis, Korean speakers could nonetheless assign the initial noun to the subject or the object as seen below (in contrast to English speakers).

   (a) Ne   ku   yenghwa boassni?
       you   that   movie   watched
   (b) Ku   yenghwa ne   boassni?
       that movie   you   watched
       'Did you watch that movie?'

Thus, in our opinion, the phenomenon of case ellipsis does not pose a challenge to our account of Korean production. We assume that (1) case-markers are represented at constituent assembly stage as affixes are in English (e.g. Ferreira & Slevc, 2007), and that (2) Korean speakers may omit case-markers for 'economic reason' at the level of phonological encoding. Similarly, we also suggest that whether case is abstract or morphological *per se* does not impact how a speaker plans a particular sentence (e.g. 'Peter saw John' vs. 'Peter saw him'). We suggest that what matters might be the typological properties of the language as a whole, in particular, how flexible a language is in the mapping of word order and grammatical function.

9. Another way of looking at these issues is through the lens of Uniform Information Density (UID). According to UID, the choices speakers have to make are at least partially determined by information density: if one way to convey a message leads to more uniform information density than another way to convey the same message, the variant with a more uniform distribution of information should be preferred (Jaeger, 2006; Levy & Jaeger, 2007). Indeed, speakers' productions have been shown to be consistent with a UID strategy (e.g. rates of complementiser *that* use vs. omission of *that*, Jaeger, 2006; Levy & Jaeger, 2007). English speakers are also likely to use full forms instead of contractions (e.g. *you are* vs. *you're*) at points of high information thereby extending the time during which the high information element is uttered (Frank & Jaeger, 2008). However, the questions of (1) whether the syntactic variants described in this paper vary systematically in terms of their information density and (2) which elements in the sentence are more versus less informative, are not straightforward. Thus, in our opinion, it is not clear how to apply UID to the findings of the current study, although it provides an interesting perspective for a future production study.

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