W O R K I N G P A P E R S

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L I N G U I S T I C S

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UNIVERSAL 20 AND WORD-ORDER VARIATION IN KOREAN

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This study examines the acceptable internal orderings of Korean noun phrases (NPs) when there are demonstratives, numerals, adjectives, and nouns in the NP. In the current study, word-order flexibility is reanalyzed in terms of a processing efficiency account. The basic assumption for the internal structure of the NP is that the preferred phrase sounds natural and is easy to process, and it would be expected that people would rate it as having the highest acceptability and respond to it more quickly than to a less preferred phrase. To investigate this assumption, two experiments were conducted. In Experiment 1, an off-line acceptability judgment task with six types of NPs, participants were asked to rate the naturalness of each phrase on a five-point scale. The results indicate that there is a ranking in the naturalness of the structures. The most acceptable NP is DEM+A+N+NUM, and the least acceptable is A+DEM+NUM+N. In the follow-up self-paced reading task, Experiment 2 finds that there is a relation between ease of processing and preference for a specific pattern. The most preferred NP, DEM+A+N+NUM, shows the fastest response times, while the least preferred phrase, A+DEM+NUM+N, takes more time to respond to. Findings of the current study indicate that processing of Korean NPs is facilitated when two conditions are satisfied: domain minimization and compositionality.

1. INTRODUCTION. Languages have demonstratives, numerals, adjectives, and nouns. Since there are four elements, mathematically, 24 orderings are possible. Previous typological studies, however, reported that there are specific patterns that are commonly used in the world's languages. For example, Greenberg (1963:87) acknowledged three patterns among the 30 languages he examined. In the generalization known as Universal 20, he reported that when all three other items precede the noun, they are always found in the order DEM+NUM+A+N; if they follow the noun, the order is either N+DEM+NUM+A or N+A+NUM+DEM.[1] Subsequently, Hawkins (1983:119–20) found three more postnominal patterns, including N+NUM+A+DEM, N+A+DEM+NUM, and N+DEM+A+NUM, undermining the formulation of the Universal 20.

More recently, Cinque (2005) suggested 14 typologically available orders, including one prenominal and 13 postnominal patterns. See table 1.

TABLE 1. Fourteen available orders proposed by Cinque (2005)

Category	Patterns
Prenominal ordering (n = 1)	DEM+Num+A+N
Postnominal ordering (n = 13)	DEM+NUM+N+A, DEM+N+NUM+A, N+DEM+NUM+A, A+N+DEM+NUM, N+A+DEM+NUM, DEM+A+N+NUM, DEM+N+A+NUM, N+DEM+A+NUM, NUM+A+N+DEM, NUM+N+A+DEM, N+NUM+A+DEM, A+N+NUM+DEM, N+A+NUM+DEM

Cinque proposed that a key feature to explain the word-order phenomenon is a movement operation in the syntactic structure. He acknowledged that if the noun appears at the end of the NP, the order of certain modifiers is rigid (DEM+NUM+A+N); however, in languages in which N is initial, he observed significant ordering variation. Based on this finding, he claimed that noun movement is a fundamental mechanism in determining reordering. His account can be summarized as follows: First, the base-generated syntactic structure is DEM+NUM+A+N, which is the prenominal ordering as seen in figure 1 (from Cinque, 2005: 317–21). Second, all movements move a subtree containing N. Third, all movements target a c-commanding position. Fourth, there is successive movement to each Spec with the pied-piped category. A

[1] Abbreviations used in glosses in the present study are as follows: A 'adjective', DEM 'demonstrative', CL 'classifier', GEN 'genitive', N 'noun', NUM 'numeral'.

specific example of the movement is as follows. First, the NP *books* moves to Spec of Agr_yP, as illustrated in the first step in figure 1. This gives the order DEM(P) – NUM(P) – N(P) – A(P), as in (1); *t* = trace of movement.

(1) the two books big *t*

Second, the NP can move again, this time to Spec of Agr_xP. If this happens, the NP brings with it the entire Agr_yP *books big* (hence the term ‘pied-piping), giving the order DEM(P) – N(P) – A(P) – NUM(P), as in (2).

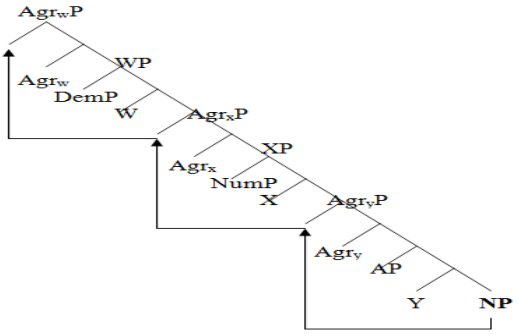
(2) the books big two *t*

Finally, the whole phrase including the NP, the AP and the NUMP (*books big two*), moves as a single unit to the spec of Agr_wP across the DEMP. This results in the sequence of N(P) – A(P) – NUM(P) – DEM(P), as exemplified in (3). Here, the NP pied-pipes both the AP and the NUMP (Cinque 2005).

(3) books big two the *t*

Note that the 14 orderings that Cinque proposed are what this movement operation allows.

FIGURE 1. Cinque’s base generated tree structure



A question arises: Is Cinque’s account compatible with the orderings in Korean? According to Cinque, there is only one prenominal ordering, i.e., DEM+NUM+A+N. Cinque’s proposal does not allow prenominal orderings such as DEM+A+NUM+N, since the nouns are in their original position and other elements are reordered. Korean, however, allows (4a–b), which are DEM+NUM+A+ N and DEM+A+NUM+N, respectively.

(4) a. ce twu-kay-uy ppalkan sakwa
that two-CL-GEN red apple
‘those two red apples’ [DEM+NUM+A+N: possible order in Cinque’s proposal]

b. ce ppalkan twu-kay-uy sakwa
that red two-CL-GEN apple
‘those two red apples’ [DEM+A+NUM+N: Impossible order in Cinque’s proposal]

Perhaps Cinque’s proponents may predict that there would be a significant difference between the possible patterns (e.g., 4a) and the impossible patterns (e.g., 4b) in terms of acceptability. Thus, the first experiment was designed to test this prediction.

2. EXPERIMENT 1: OFF-LINE JUDGMENT TASK. The goal of this written preliminary survey study was to examine Korean-speaking adults’ judgments on multiple possible word orderings with four elements: determiners, adjectives, numbers, and nouns.

2.1 METHODS. Sixty native Korean-speaking adults, both male and female, participated in the study. All of them were between the ages of 20 and 29, and they were all university students in Seoul, Korea. As

testing items for a Korean Universal 20, among the 24 mathematical possibilities, six phrases were included. Thus, the design of this task used each of the six conditions with four tokens, yielding a total of six lists. The number of syllables was seven to eight across all of the test items. Fillers used 48 words, including inflectional particles, such as *uysa-man* 'doctor-ONLY'; among the 48 fillers, the form of 12 fillers was a noun followed by a particle; in the rest of them, a particle preceded the noun, such as *man-uysa* 'ONLY-doctor'. In total, 72 phrases, including fillers, were presented to each participant. The presentation order of the items was randomized. Participants sat in a quiet room to complete the pencil-and-paper task, in which they were asked to rate the naturalness of each phrase based on a five-point scale (1: very unnatural; 2: unnatural; 3: intermediate; 4: natural; 5: very natural). The task lasted less than 15 minutes. Examples of test items can be seen in table 2.

TABLE 2. Six types of test items

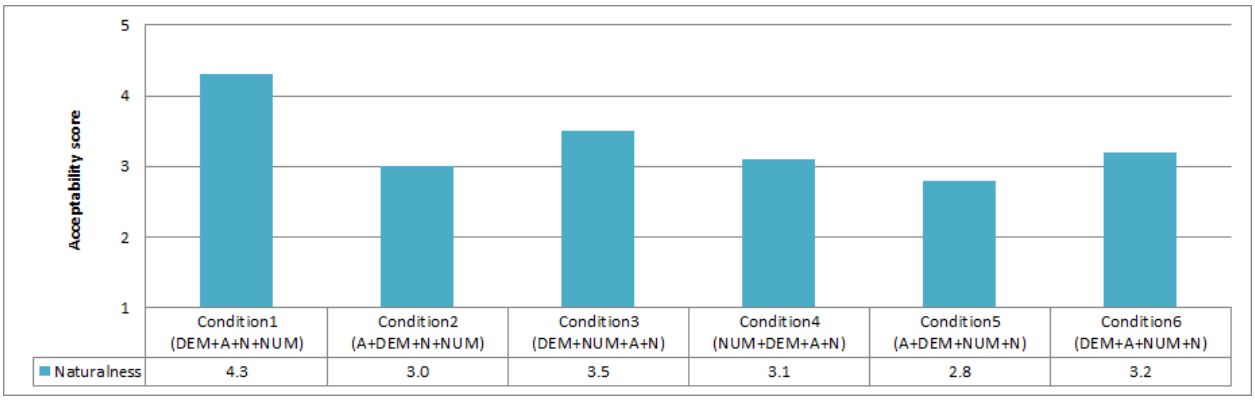
#	Conditions	An example set of experiment Conditions	Cinque's proposal
1	DEM+A+N+NUM	ce ppalkan sakwa twu-kay that red apple two-CL[2] 'that two red apples'	Possible
2	A+DEM+N+NUM	ppalkan ce sakwa twu-kay red that apple two-CL 'that two red apples'	Impossible
3	DEM+NUM+A+N	ce twu-kay-uy ppalkan sakwa that two-CL-GEN red apple 'that two red apples'	Possible
4	NUM+DEM+A+N	twu-kay-uy ce ppalkan sakwa two-CL-GEN that red apple 'that two red apples'	Impossible
5	A+DEM+NUM+N	ppalkan ce sakwa twu-kay red that apple two-CL 'that two red apples'	Impossible
6	DEM+A+NUM+N	ce ppalkan twu-kay-uy sakwa that red two-CL-GEN apple 'that two red apples'	Impossible

2.2 PREDICTIONS. If a given phrase sounds natural to native Korean speakers, it is expected that this will be affected in high acceptability rating scores. If Cinque's proposal is correct, any of the impossible phrases should have a significantly lower rating than the possible phrase.

2.3 RESULTS. Figure 2 shows the average ratings of the acceptability of the six NPs. As can be seen in the figure, average ratings of the six phrases vary from 2.8 to 4.3 (out of 5). The variations in the ratings were compared using a repeated-measures ANOVA test, which shows that there is a difference in the acceptability of the given phrases ($F_1(5,295) = 484.579$, $p < .001$ by subject analysis; $F_2(5,115) = 1548.499$, $p < .001$ by item analysis). Among the six test items, the mean acceptability score of Condition 1 (DEM+A+N+NUM) is the highest at 4.3; Condition 5 (A+DEM+NUM+N) gets the lowest score of 2.8. A pairwise *t*-test confirms that between these two conditions, there is a significant difference ($t(59) = 44.401$, $p < .001$). A notable result is that Condition 3 (DEM+NUM+A+N), Cinque's (2005) basic word-order pattern, showed a 3.5 mean score—exactly intermediate between the highest acceptability and the lowest acceptability. It is important to note that all impossible phrases (conditions 2, 4, 5, 6) showed a significant difference in rating with the possible phrase, i.e., condition 3.

[2] Korean is a language that uses classifiers when counting objects. Classifiers are always followed by numbers. The existence of the classifiers is not a significant factor for the study, and so for the sake of convenience, they are not mentioned in the paper except in the example phrases given.

FIGURE 2. Acceptability scores in the off-line study



The results of Experiment 1 suggest that there should be an account other than Cinque's proposal to explain the ordering variations in Korean. One alternative has been proposed by Hawkins (2004), who stated that there is no straightforward grammatical account for preferred and less preferred language structures. The patterns found in a language are the reflection of degrees of preference that are related to performance and ease of processing. That is, the more natural something sounds, the easier it is to process. A subsequent experiment is designed to test Hawkins's processing-based account.

3. EXPERIMENT 2: ON-LINE JUDGMENT TASK. Experiment 2 aims to address the following research questions: What word order type is easiest to process, and how does it fit into the processing-based account of Hawkins (2004)?

3.1 METHODS. Thirty native Korean-speaking adults, both male and female, took part in this on-line study. They were all between 22 and 29 years old, and were recruited in Seoul, Korea. All participants received $8 as compensation for their time.

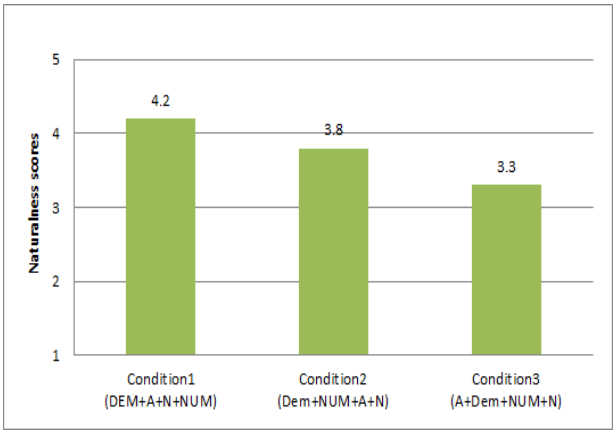
For the stimuli, the most acceptable (DEM+A+N+NUM) and the least acceptable (A+DEM+NUM+N) phrases from Experiment 1 were chosen in order to investigate the relationship between the acceptability of the given phrases and the speed of processing. Cinque's (2005) base-generated fixed word-order structure (DEM+NUM+A+N) was tested as well. Hence, three types of test items were used in this on-line experiment, along with fillers; the task's stimuli were composed of 36 phrases. Unlike the pencil-and-paper method of Experiment 1, this experiment was designed to use E-Prime 2.0, which measures the response time of each participant; each stimulus was presented on a laptop computer screen, one at a time, and the participants moved through the task by pressing a button. Participants were individually tested in front of a computer. They were first presented with both written and verbal instructions explaining the procedure of the experiment. They were informed that their task was to rate how natural the stimuli sounded, based on a 5-point Likert scale, by pressing one of the buttons on the keyboard. In addition, when they judged the test materials, they were asked to rely on their first intuitive reaction to these phrases. Before the main test, participants were given five training tests. Throughout the training tests and main test, all of the procedures were the same. First, a fixation mark "+" appeared on the screen. When participants pressed the spacebar, they automatically moved to the next screen, and the stimulus appeared. When they saw a test item on the screen, they were told to rate the item by pressing one of five keys on the keyboard. On average, the task took less than 20 minutes.

3.2 PREDICTIONS. If Hawkins (2004) was correct, the fastest response time was expected with the most preferred NP, while the least acceptable phrase should elicit the slowest response times.

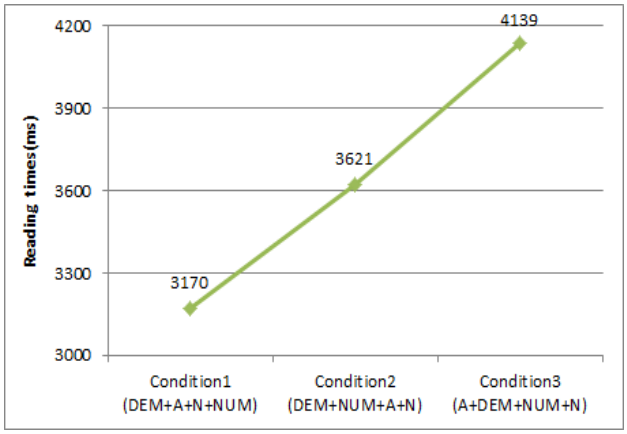
3.3 RESULTS. Analyses were conducted with the acceptability score and response time as dependent measures. Reading times that were more than 2.5 standard deviations above and below the mean were replaced with the 2.5 standard deviation above and below the mean scores. This affected 0.01% of the data. Results of the acceptability scores and reading times in the three conditions are presented in figure 3.

FIGURE 3. Acceptability scores and response times in the on-line study

(a) Acceptability scores



(b) Response times



The means for the acceptability scores for the three constructions are shown in figure 2a. The average ratings of naturalness range from 3.3. to 4.2 (out of 5). As for the overall mean scores, the same patterns as in the off-line experiment are found: the most highly rated pattern in the off-line judgment task, Condition 1 (DEM+A+N+NUM), is the most preferred word order (mean acceptability score: 4.2); Condition 2 (DEM+NUM+A+N) again has an intermediate acceptability score, 3.8; the pattern with the lowest score in the off-line research, Condition 3 (A+DEM+NUM+N), is also selected as the least preferred pattern in the on-line study (mean acceptability score: 3.3).

A repeated-measures ANOVA was conducted to analyze the data, and overall, participants' naturalness scores (n = 30) were not consistent across the three conditions ($F_1(2, 58) = 33.150$, $p < .001$; $F_2(2, 46) = 16.126$, $p < .001$). The results were reanalyzed using a paired-measures t-test, and significant differences were found among the three conditions: Condition 1 (DEM+A+N+NUM) and Condition 2 (DEM+NUM+A+N): $t(29) = 4.732$, $p < .001$; Condition 1 (DEM+A+N+NUM) and Condition 3 (DEM+NUM+A+N): $t(29) = 6.831$, $p < .001$; Condition 2 (Dem+Num+A+N) and Condition 3 (DEM+NUM+A+N): $t(29) = 4.540$, $p < .001$. Response times in the three conditions are shown in figure 3b. Condition 1 (DEM+A+N+NUM), which gets the highest acceptability score, shows the fastest response times, with an average of 3170 milliseconds. Responses to Condition 3 (DEM+NUM+A+N), with the lowest acceptability, took longer, at an average of 4139 milliseconds. The average response time for Condition 2 (DEM+NUM+A+N) is between those for Condition 1 and Condition 3 at 3621 milliseconds.

The response time results for the three conditions were compared using a repeated-measures ANOVA test. The test found a significant difference in the response times among the three conditions ($F_1(2,58) = 6,804$, $p = .002$ by subject analysis; $F_2(2, 46) = 13.580$, $p < .001$ by item analysis). Also, a paired-measures t-test shows that the differences among these three conditions are significant (Condition 1 (DEM+A+N+NUM) and Condition 2 (DEM+NUM+A+N): $t(29) = -2.487$, $p = .019$; Condition 1 (DEM+A+N+NUM) and Condition 3 (DEM+NUM+A+N): $t(29) = -4.703$, $p < .001$; Condition 2 (DEM+NUM+A+N) and Condition 3 (DEM+NUM+A+N): $t(29) = -1.131$, $p = .267$).

The results of the experiment revealed that there is a strong correlation between the acceptability scores and ease of processing. That is, in sum, the highest acceptability leads to the fastest response times,

and the lowest acceptability causes the slowest response times.

4. GENERAL DISCUSSION. The findings from Experiment 1, the off-line acceptability judgment study, show that in Korean NPs, with demonstrative, numeral, adjective, and noun, six word orders are possible. However, the acceptability scores judging naturalness were not consistent for all six NPs. The differences in the different word orders' acceptability demonstrate that different preferences for word order exist: DEM+A+N+NUM was the most acceptable, and A+DEM+NUM+N was the least acceptable. And DEM+NUM+A+N, the basic word order for all languages according to Cinque (2005), fell between these two extremes in acceptability. In addition, this order does not show a significant difference with the "impossible" word orders in terms of acceptability ratings.

The follow-up on-line study, Experiment 2, which deals with both naturalness and response times, showed that if the given NP is easy to process, it gets high acceptability scores, whereas if it is difficult to process, it gets a lower acceptability rating. In order to explain these findings, there are two possible accounts: domain minimizing theory and the compositionality hypothesis.

The key concept of domain minimization theory is that a language seeks to minimize the distance between the verb and the head of its dependent phrase (Hawkins 2004). That is to say, a smaller distance between the verb and the head of its dependent phrase is easier to process. As a result, constructions with smaller distances between these elements' positions become the preferred patterns (Hawkins 2004). As the first step, let us apply the domain minimization theory to the four examples in (5):

(5) a. vp[went pp[to the movies]]
|----------|
0

b. [[the movies to]pp went]vp
|----------|
0

c. vp[went[the movies to]pp]
|--------------------|
2

d.[pp[to the movies]went]vp
|--------------------|
2

1a and 1c show structures for head initial (or VO) languages. These two phrases contain the same number of immediate constituents (henceforth, IC) as VP and PP. However, they differ in terms of the number of words between the verb and the head of the PP. More specifically, in the case of 4a, there is no intervening word between the verb and P, the lexical head of the PP; and in 4c, there are two intervening elements. These differences between the two phrases lead to the following results: the lack of intervening elements in 1a makes the phrase optimally efficient to process, so it is preferred over 1c, which has two intervening elements. The same phenomenon can be found in 1b and 1d: due to the short distance between the head and the verb of 1b, 1b is preferred over 1d, which has two intervening words (Hawkins 2004:124).

In the same vein, the distance theory is applied to the NP structures[3] of the three experimental Conditions in the examples below:

(6) a. Condition 1
DEM+A+N+NUM
|--------|----||-------|
1 + 0 + 0 = 1

b. Condition 2
DEM+NUM+A+N
|--------|-------|-----|
2 + 1 + 0 = 3

c. Condition 3
A+DEM+NUM+N
|------|--------|------|
2 + 1 + 0 = 3

As an example of how the processing cost is related to the acceptability of the given phrases, see Condition 1, DEM+A+N+NUM. Before the head noun, there are two preceding elements: the determiner

[3] In interpreting the data, the concept of domain minimization theory of Hawkins (2004) is applied, but it is slightly different from the original idea. The test items here are word orders in NPs. Thus, instead of the distance between the head noun and the verb, for these NPs it is the distance between the dependent and the head noun that is significant.

and the adjective. Because the adjective appears between the determiner and the noun, the distance from the determiner to the noun is counted as 1; on the other hand, the distance from the adjective to the head noun is 0 because there is no intervening element. The distance between the number and the noun is also 0 because there is no intervening element. In sum, the overall distance of DEM+A+N+NUM is 1. Likewise, applying the same rule to the other two conditions, both Condition 2 and Condition 3 have a distance of 3.

Now, as the second step, let us see how the semantic compositionality hypothesis explains the results of Experiment 2. According to Groenendijk and Stokhof (2004), semantic compositionality is at the very heart of the syntactic structure. They point out that there can be no semantics without syntax. The importance of compositionality is emphasized by Chomsky as well (cited in Boeckx, Foder, Gleitman, and Rizzi 2009:219). His main argument is that when we compose a NP with determiner, adjective, noun, and number, there is a rule for how to put them together. In brief, first, the elements expressing properties of a noun tend to be closer to the noun (e.g., *big apple*); second, the determiner closes off the phrase (e.g., these+three+nice+books).

The compositionality hypothesis can be applied to the three NP structures as below:

(7) a. Condition 1 DEM+[[A+N]+NUM] (✓)
b. Condition 2 DEM+[NUM+[A+N]] (✓)
c. Condition 3 A+DEM+NUM+N (✗)

As seen here, in the case of Condition 1, the adjective is closer to the noun, and the demonstrative closes off the phrase. Thus, it satisfies the requirements of the compositionality hypothesis. By the same token, Condition 2 conforms to the hypothesis in that the preceding determiner modifies the whole phrase, and the adjective is closely linked to the noun. However, in the case of Condition 3, the adjective is placed further away from the noun, and the determiner is placed between the adjective and the noun. Thus, it becomes an intervening element and cannot modify the whole phrase at a distance. For this reason, Condition 3 does not follow the compositionality hypothesis. In sum, when the compositionality hypothesis is applied to these three conditions, Conditions 1 and 2 satisfy the requirements, but Condition 3 does not.

Next, let us apply the compositionality hypothesis and the distance theory together to the three NP structures.

TABLE 3. The distance theory and the compositionality

	Condition 1	Condition 2	Condition 3
Distance theory	DEM+A+N+NUM |--------|----||-------| 1 + 0 + 0 = **1**	DEM+NUM+A+N |--------|-------|-----| 2 + 1 + 0 = **3**	A+DEM+NUM+N |------|--------|------| 2 + 1 + 0 = **3**
Compositionality	DEM+[[A+N]+NUM] (✓)	DEM+[NUM+[A+N]] (✓)	A+DEM+NUM+N (✗)
Acceptability	4.2	3.8	3.3
Response times(ms)	3170	3621	4139

In this comparison of the three conditions, Condition 1 has the shortest distance between the head noun and the dependent. It also complies with the compositionality hypothesis. Thus, it is understandable why the results for the acceptability judgments showed Condition 1 to be the most preferred word order. Because the preferred word order is easier to process, it affects how quickly people respond to the given NPs; thus, the response times for the highly acceptable phrase, DEM+A+N+NUM, were the quickest. As for Condition 2 and Condition 3, they share the same distance (3), but they differ in that Condition 2 satisfies the compositionality hypothesis and Condition 3 does not. This provides a reason why two patterns that have the same processing cost were regarded differently in terms of acceptability (Condition 2: 3.8 and Condition 3: 3.3) and had different response times (Condition 2: 3621ms and Condition 3: 4139ms).

In sum, when we investigate the two phrases that conform to compositionality but differ in the distance between the head and the dependent, DEM+A+N+NUM vs. DEM+NUM+A+N, it becomes clear that to be both highly acceptable and to evoke a fast response, satisfying the two conditions is a crucial factor. On the other hand, investigating two phrases that differ in the distance between the head noun and

dependent as well as in conformity to compositionality (e.g., DEM+A+N+NUM vs. A+DEM+NUM+N) shows that not satisfying both conditions leads to low acceptability and slow response times.

5. CONCLUDING REMARKS. The results of real-time processing, taken together, show that there is a relationship between the ease of processing and degree of acceptability. Ease of processing requires two conditions: conformity to compositionality and short distance between the head noun and dependent. According to the proponents of the processing account, real-time processing is at the heart of linguistic phenomena; if a pattern is easy to process, people prefer that pattern. Thus, in this study, the relation between ease of processing and preference was investigated, and it was found that language can be shaped by non-grammatical features such as semantic compositionality and processing burden.

In addition, one interesting finding was the result that DEM+NUM+A+N, while not rated lowest for acceptability, was not rated high, but fell in the middle. Considering its reputation as the universal underlying structure, the question arises of why it does not get the highest acceptability rating.

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