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The Advantage of First Mention in Korean The Temporal Contributions of Syntactic, Semantic, and Pragmatic Factors

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Using Korean, we investigated how syntactic, semantic, and pragmatic factors influence the representation of a sentence, in particular, the relative accessibility of different components of a sentence representation. In six experiments, participants performed a probe recognition task after reading each of a series of sentences. We manipulated the rate at which each word of the sentence was presented (250 and 500 ms) and the interval between the sentence-final word and the probe-recognition test word (immediate, 500 ms delay, and 1000 ms delay). We also manipulated the syntactic position (subject versus object), semantic role (agent versus patient), and order of mention (first- versus second-mentioned participant) of the probed item. Pragmatic factors (the order of mention) strongly influenced accessibility immediately and through the longest delay, whereas syntactic and semantic factors had little effect.

KEY WORDS: first mention; syntax; semantics; pragmatics; Korean; structure building framework; time course; sentence representation.

INTRODUCTION

When we read or hear a sentence, we construct a mental representation of it. The representation comprises different components, and these different components vary in their accessibility. What factors affect the accessibility of the different components of a mental representation of a sentence? We investigated three factors: syntactic, semantic, and pragmatic. We used

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Korean because it allowed us to orthogonally manipulate these three factors in ways not possible with other languages.

Previously, McKoon *et al*. (1993) had demonstrated one syntactic factor that affects the accessibility of English sentence components. Participants read sentence (1), either of sentence (2a) or (2b), and then sentence (3).

(1) George is having second thoughts about his new job.
(2a) His demanding boss is critical.
(2b) His critical boss is demanding.
(3) George is thinking of quitting.

When participants were asked whether the word *demanding* occurred in the set of sentences, they responded considerably faster if they read sentence (2a) than if they read sentence (2b). The lexical item, *demanding*, plays a different syntactic role in the two sentences: In sentence (2a), *demanding* is a modifier; in sentence (2b) it is a predicate. Thus, syntactic position appears to affect the accessibility of the sentence components.

Semantic factors, such as semantic role (e.g., whether the entity is the semantic agent who causes the action or the semantic patient who receives the action) might also affect accessibility of sentence components. Agents are more likely to be animates than inanimates (Clark, 1965; Johnson, 1967), are likely to be more active (Osgood, 1971), and are likely to attract more attention (Zubin, 1979) than are semantic patients. Agents tend to match the speaker's or listener's perspective (MacWhinney, 1977).

Many pragmatic factors might affect the accessibility of components of sentences (see also Green, 1989). The most widely investigated has been order of mention. First-mentioned entities appear to have a privileged status in many aspects of sentence and text representation. For example, initial sentences take longer to read than the subsequent sentences (e.g., Cirilo & Foss, 1980; Haberlandt & Graesser, 1985) and initial words take longer to read than the later-occurring words (e.g., Aaronson & Ferres, 1983; Chang, 1980), suggesting that initial sentences and words are encoded more thoroughly. Givón (1986) argues that first-mentioned information provides importance and summons attention. According to such a functional account, speakers and writers use the passive voice or grammatical inversion to emphasize the patient or object of a sentence. For example, in the case of spoken English, speakers usually put the important constituent—the focus, topic, or theme of the sentence—first, and listeners are assumed to construct a representation of the sentence based on the shared pragmatic knowledge of language use (Birch & Garnsey, 1995; Green, 1989).

For example, Gernsbacher and Hargreaves (1988) presented the following sentences and measured participants' recognition latencies for the probe word, *Tina*.

(4) Tina beat Lisa in the state tennis match.
(5) Lisa beat Tina in the state tennis match.

Participants' probe recognition latencies were faster to *Tina* after reading sentence (4) than after reading sentence (5). These data demonstrate the phenomenon we investigated in the present research: that different components of the representation of a sentence are represented with different degrees of accessibility.

Gernsbacher's (1990) Structure Building Framework attempts to account for this privilege of primacy. According to the Structure Building Framework, comprehension involves laying a foundation for a mental representation of a clause, sentence, or passage, and then mapping subsequent information onto that foundation. According to the Structure Building Framework, first-mentioned information is more accessible because it forms the foundation for its representation and serves as a cornerstone to enable integration (mapping) of further information. The phenomenon of greater accessibility of first-mentioned information has been termed the advantage of first mention, and has been empirically demonstrated and tested by Gernsbacher and her colleagues (Gernsbacher, 1997).

However, in English, first mention is typically confounded with syntactic position and semantic role. For example, in sentence (4), *Tina* is not only the first-mentioned character, she is also the subject of the sentence (syntactic position) and the agent of the action (semantic role). In contrast, in sentence (5), *Tina* is now not only the second-mentioned character, but she is also the object of the sentence and the patient of the action (semantic role). The faster probe recognition time for *Tina* after participants read sentence (4) versus sentence (5) might be due to pragmatic (order of mention), syntactic (subject versus object position), or semantic (agent versus patient role) factors or an interaction among these three factors.

To dissociate the effect of syntactic position from semantic role, Gernsbacher and Hargreaves (1988) manipulated active versus passive English voice. Participants read one of the following four sentences:

(6) Tina beat Lisa in the state tennis match
(7) Lisa was beaten by Tina in the state tennis match.
(8) Tina was beaten by Lisa in the state tennis match.
(9) Lisa beat Tina in the state tennis match.

Recognition latencies for the probe name *Tina* were faster after participants read sentences (6) and (8) than after they read sentences (7) and (9), with no effect of or interaction with the active versus passive manipulation. Gernsbacher and Hargreaves (1988) concluded that order of mention is a critical factor underlying the relative accessibility of components of

a sentence representation. However, in their study, order of mention was confounded with syntactic position; first-mentioned characters were always the syntactic subjects.

To separate the advantage of first mention from the advantage of syntactic subject, Gernsbacher and Hargreaves (1988) removed one of the characters from its main clause and placed it as the object of a prepositional phrase. These prepositional phrases were either preposed as in sentences (10) and (11), or postposed as in sentences (12) and (13).

(10) Because of Tina, Lisa was evicted from the apartment.
(11) Because of Lisa, Tina was evicted from the apartment.
(12) Tina was evicted from the apartment because of Lisa.
(13) Lisa was evicted from the apartment because of Tina.

Recognition latencies for the probe name *Tina* were faster after participants read sentences (10) and (12) than after they read sentences (11) and (13); thus, there was no advantage of syntactic subject.

In English, it is impossible to dissociate completely syntactic position from order of mention. Because English has a strongly preferred S (subject)–V (verb)–O (object) word order, the subject of a sentence is typically mentioned first (i.e., before the object). To solve this problem, Carreiras *et al.* (1995) replicated one of Gernsbacher and Hargreaves' (1988) experiments using Spanish. Spanish differs from English in its flexibility of word order. While English is relatively rigid about the ordering of words in a sentence, Spanish is more flexible; indeed, the syntactic object can be placed before the syntactic subject.

In Carreiras *et al.*'s (1995) experiment, after reading the following sentences, participants were asked to recognize the probe name, *Maria*.

(14) Maria y Diana fueron al restaurante.
(Maria and Diana went to the restaurant.)
(15) Diana y Maria fueron al restaurante.
(Diana and Maria went to the restaurant.)
(16) A Maria la invito Diana a cenar en casa.
(Maria, Diana invited to eat dinner at home.)
(17) A Diana la invito Maria a cenar en casa.
(Diana, Maria invited to eat dinner at home.)

The results demonstrated that the advantage of first mention occurs in Spanish. For example, the probe name, *Maria*, was recognized considerably faster after participants read sentence (14) than after they read sentence (15). Moreover, recognition times to the probe name, *Maria*, were considerably faster after participants read sentence (16), an O–V–S structure, than after they read sentence (17). Thus, the advantage of first mention occurs even when the

first-mentioned character is the syntactic object, and indeed, there was no reliable effect of syntactic position on relative accessibility.

In order to investigate the time course of the first mention effect, Gernsbacher *et al*. (1989) measured the accessibility of sentence participants in two-clause sentences, such as sentence (18) and (19) below.

(18) Tina gathered the kindling, and Lisa set up the tent.
(19) Lisa gathered the kindling, and Tina set up the tent.

At the shortest test interval, when the probe word was presented coincident with the last word of the sentence, Gernsbacher *et al*. (1989) observed an advantage of clause recency: the second-mentioned character in (19) was more accessible than the first-mentioned character in (18). At a very brief (150 ms) test interval, the two characters were equal in accessibility. At longer delays (1400 and 2000 ms), the first-mentioned characters were considerably more accessible than the second-mentioned characters.

To investigate further the advantage of first mention cross-linguistically, to examine the relative contributions of syntactic versus pragmatic factors, and to chart the time-course of these influences, Kim and Lee (1995) conducted two experiments using Korean. One of the major differences between Korean and English is word order. In English, S–V–O is the typical structure of a sentence, whereas in Korean, S–O–V is the typical structure. Korean is a verb-ending language, and the word order is not as strict as it is in English. In Korean, the particles (case markers) at the end of a noun indicate the case of the noun. Therefore, the particles (e.g., subject particle such as *-nun* and direct particle such as *-lul*) play a critical role in determining the syntactic role of each constituent of a sentence regardless of the word order.

Kim and Lee (1995) dissociated the syntactic role of the probe name, *Hansu*, from the order of mention by using inversion form of a sentence such as (21) and (23), in which the syntactic object was placed before the syntactic subject. For example, (20) and (21) convey exactly the same meaning even though the word order was not the same. They also varied the interval between the offset of the last word of each sentence and onset of the probe name (Inter-Stimulus Interval; hereafter called the ISI) to 255 and 1540 ms to compare the changes of accessibility over time. The short ISI (255 ms) was introduced because Gernsbacher and Hargreaves' (1988) finding of no advantage of syntactic subject might be due to the relatively long ISI (1400 ms). Participants read one of the following sentences and were given a probe recognition test on the probe name, *Hansu*.

(20)	Kukjang-eseo	Hansu-nun	Junho-lul	kkojipe-ss-ta.
	'theater-*loc*'	'Hansu-*subj*'	'Junho-*dir obj*'	'pinched'
	(At the theater Hansu pinched Junho.)			
(21)	Kukjang-eseo	Junho-lul	Hansu-nun	kkojipe-ss-ta.

'theater-*loc*' 'Junho-*dir obj*' 'Hansu-*subj*' 'pinched'
(At the theater Hansu pinched Junho.)

(22) Kukjang-eseo Junho-nun Hansu-lul kkojipe-ss-ta.
'theater-*loc*' 'Junho-*subj*' 'Hansu-o*bj*' 'pinched'
(At the theater Junho pinched Hansu.)

(23) Kukjang-eseo Hansu-lul Junho-nun kkojipe-ss-ta.
'theater-*loc*' 'Hansu-*dir obj*' 'Junho-s*ubj*' 'pinched'
(At the theater Junho pinched Hansu.)

At a short ISI (255 ms), they found both an effect of syntactic position and order of mention. The subjects in sentences (20) and (21) were accessed more easily than the objects in sentences (22) and (23), and the first-mentioned characters in sentences (20) and (23) were accessed more easily than the second-mentioned characters in sentences (21) and (22). These data suggest that syntactic and pragmatic factors affect the relative accessibility of the components of a sentence representation immediately. However, when the ISI was extended to 1540 ms, Kim and Lee (1995) no longer observed an effect of syntactic position on the relative accessibility, but they observed a much stronger effect of order of mention than they had observed with a shorter test interval.

However, in Kim and Lee's (1995) experiments, syntactic position was confounded with semantic role; syntactic subjects were always semantic agents, and syntactic objects were always semantic patients. In order to get the independent effect of each factor on the sentence representation, it is essential to dissociate the effects of syntactic position, semantic role, and pragmatic order of mention.

Korean is an ideal language with which to factorially manipulate the three factors in which we are interested: syntactic position, semantic role, and pragmatic order of mention. In Korean, it is possible to make a passive-voice sentence by using the passive form of the verb without changing the word order. For example, an active sentence (24) can be transformed into a passive sentence (25) by adding a passive morpheme (i.e., *-hye*) to the transitive verb 'kkojipe-ss-ta' (i.e., '*kkojiphye-ss-ta*') and by changing the particles at the end of each character (i.e., changing the subject particle, *-nun*, to the indirect object particle, *-eykey*, and changing the direct object particle, *-lul*, to the subject particle, *-nun*).

(24) Hansu-nun Junho-lul kkojipe-ss-ta.
'Hansu-*subj*' 'Junho-*dir obj*' 'pinched'
(Hansu pinched Junho.)

(25) Hansu-eykey Junho-nun kkojiphye-ss-ta.
'Hansu-*indir obj*' 'Junho-s*ubj*' 'was pinched'
(Junho was pinched by Hansu.)

The present study extended Gernsbacher and Hargreaves' (1988) and Kim and Lee's (1995) studies by factorially manipulating syntactic position, semantic role, and pragmatic order of mention and by manipulating two parameters of timing of the stimulus presentation, that is ISI and the presentation rate for each word within the sentence (hereafter called the RSVP rate). Although there were some previous research findings on sentence representation at the ISI of 150 and 1400 ms (Gernsbacher & Hargreaves, 1988) and ISI of 255 and 1540 ms (Kim & Lee, 1995), it has not been shown at the intermediate level of ISI. In order to determine the systematic time-course of the effect of three factors on the relative accessibility of different components of a sentence representation, we manipulated the ISI of 0, 500, and 1000 ms. In addition to ISI, RSVP rate may influence the effects of syntactic and pragmatic factors on accessibility. Since structure building is a time-consuming process, it is important to examine how the limited amount of processing time (i.e., fast RSVP rate of 250 ms) changes the relative accessibility.

GENERAL METHOD

A series of six experiments was conducted. The experimental method was exactly identical in all experiments except for variations in presentation timing. We varied both the RSVP rate (250 ms or 500 ms) and the ISI (0, 500, or 1000 ms) across the six experiments as shown in Table I.

Participants

In each experiment, 64 undergraduate students from Korea University participated in partial fulfillment of a course requirement for introductory psychology. All participants recruited were native Korean speakers.

Design

In each experiment, a 2 (semantic role: agent versus patient) $\times$ 2 (syntactic position: subject versus object) $\times$ 2 (order of mention: first- versus second-mentioned participant) repeated-measures design was used.

Table I. RSVP Rate and ISI in Six Experiments

	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6
RSVP (ms)	250	250	250	500	500	500
ISI (ms)	0	500	1000	0	500	1000

Materials

A set of 32 experimental sentences was constructed with eight versions of each experimental sentence. An example set of experimental sentences is shown in Table II. The eight versions reflected the combination of semantic role (agent versus patient), syntactic position (subject versus object), and order of mention (first- versus second-mentioned participant). To reduce the primacy effect, a prepositional phrase was introduced at the beginning of each experimental sentence. A set of 32 filler sentences was also constructed so that the correct response to the probe name following

Table II. Examples of Experimental Materials

Subject Agent First:	Kukjang-eseo 'theater-*loc*' (At the theater Hansu	Hansu-nun 'Hansu-*subj*' pinched Junho.)	Junho-lul 'Junho-*dir obj*'	kkojipe-ss-ta. 'pinched'
Subject Agent Second:	Kukjang-eseo 'theater-*loc*' (At the theater Hansu	Junho-lul 'Junho-*dir obj*' pinched Junho.)	Hansu-nun 'Hansu-*subj*'	kkojipe-ss-ta. 'pinched'
Subject Patient First:	Kukjang-eseo 'theater-*loc*' (At the theater Hansu	Hansu-nun 'Hansu-*subj*' was pinched by Junho.)	Junho-eykey 'Junho-*indir obj*'	kkojiphye-ss-ta. 'was pinched'
Subject Patient Second:	Kukjang-eseo 'theater-*loc*' (At the theater Hansu	Junho-eykey 'Junho-*indir obj*' was pinched by Junho.)	Hansu-nun 'Hansu-*subj*'	kkojiphye-ss-ta. 'was pinched'
Object Agent First:	Kukjang-eseo 'theater-*loc*' (At the theater Junho	Hansu-eykey 'Hansu-*indir obj*' was pinched by Hansu.)	Junho-nun 'Junho-*subj*'	kkojiphye-ss-ta. 'was pinched'
Object Agent Second:	Kukjang-eseo 'theater-*loc*' (At the theater Junho	Junho-nun 'Junho-*subj*' was pinched by Hansu.)	Hansu-eykey 'Hansu-*indir obj*'	kkojiphye-ss-ta. 'was pinched'
Object Patient First:	Kukjang-eseo 'theater-*loc*' (At the theater Junho	Hansu-lul 'Hansu-*dir obj*' pinched Hansu.)	Junho-nun 'Junho-*subj*'	kkojipe-ss-ta. 'pinched'
Object Patient Second:	Kukjang-eseo 'theater-*loc*' (At the theater Junho	Junho-nun 'Junho-*subj*' pinched Hansu.)	Hansu-lul 'Hansu-*obj*'	kkojipe-ss-ta. 'pinched'
	Target: Hansu			

-eseo: locative particle (postposition)
-nun: subject particle
-lul: direct object particle
-eykey: indirect object particle
kukjang: theater
kkojipta: pinch
-hye: passive morpheme
-ss-ta: past tense-declarative suffixes

these filler sentences should be "no" response. The experimental sentences were intermixed with 32 filler sentences and were presented in random order.

Procedure

Participants read sentences that were presented one word at a time on the center of a computer monitor. Both RSVP and ISI rates were varied across the experiment (see Table I). After the last word of each sentence disappeared, a probe name appeared. The participants' task was to verify as rapidly and accurately as possible whether the probe name had occurred in the sentence they just finished reading. They responded by pressing the designated "yes" or "no" key. Response times were measured from the onset of the probe name to the onset of the participant's response. Following the instructions, participants were presented with 12 practice sentences to get accustomed to using the computer keys. To keep participants from attending to only the names, each probe recognition test was followed by a pair of comprehension question and provided answer. The comprehension question was one of four different kinds of comprehension questions, and answers were either correct or wrong to each question (e.g., *Who pinched?—Hansu, What did Hansu do?—pinch, Where did Hansu pinch?—at the mall, Whom did Hansu pinch?—Taejin)*. Participants were asked to decide whether the presented answer to each comprehension question was correct or not. Half of the comprehension questions were presented with the correct answers and the other half were presented with wrong answers. Following the "yes" or "no" response to each comprehension question, "******" were presented on the center of the screen during 500 ms and then the first word of the next experimental sentence was presented. The experiments were run on the IBM PC and the experimental program was constructed by QBASIC. Two participants were run together in each experimental session, which took approximately 20–25 min.

RESULTS

The accuracy data and response times for the comprehension questions were not included in the analysis because the main purpose of the comprehension test was to prevent participants from attending only to the names in the experimental sentences and because difficulty levels of four types of comprehension questions differed among conditions.

Experiment 1 (RSVP 250 ms; ISI 0 ms)

The mean recognition accuracy was 97.0% and there was no significant difference among conditions. The mean probe recognition times appear in Table III and Fig. 1. An analysis of variance (ANOVA) revealed no reliable main effects or interactions.

Experiment 2 (RSVP 250 ms; ISI 500 ms)

The mean recognition accuracy was 95.9% and there was no significant difference among conditions. The mean probe recognition times

Table III. Mean Recognition Time (ms) and Standard Error in Experiments 1–3 (RSVP 250 ms)

		Subject		Object	
Experiment	Mentioned order	Agent	Patient	Agent	Patient
Experiment 1	First	1031 (32.9)	1043 (33.0)	1045 (31.4)	1012 (37.2)
(ISI 0 ms)	Second	1058 (36.4)	1043 (35.9)	1037 (36.3)	1013 (30.3)
Experiment 2	First	964 (28.0)	1004 (28.9)	981 (28.4)	939 (30.2)
(ISI 500 ms)	Second	1026 (30.3)	1012 (31.0)	1005 (26.7)	995 (28.6)
Experiment 3	First	868 (21.5)	847 (22.4)	859 (22.9)	867 (20.8)
(ISI 1000 ms)	Second	892 (23.0)	876 (25.4)	893 (23.1)	872 (22.0)

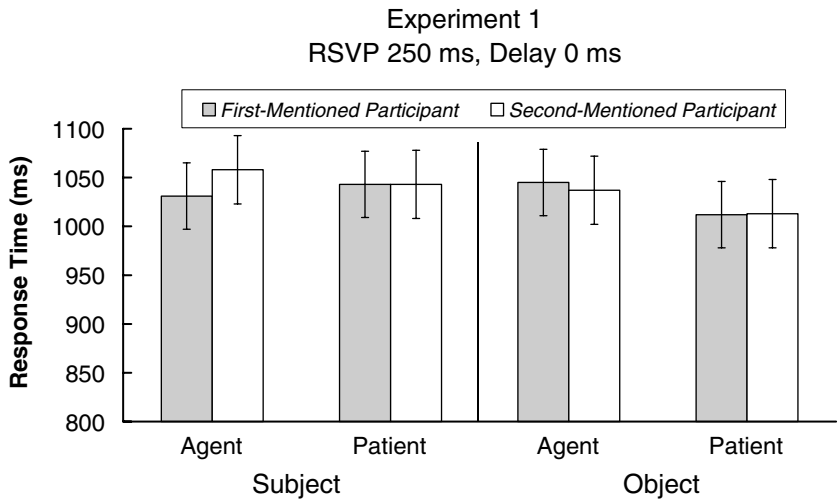

Fig. 1. Mean recognition time in Experiment 1.

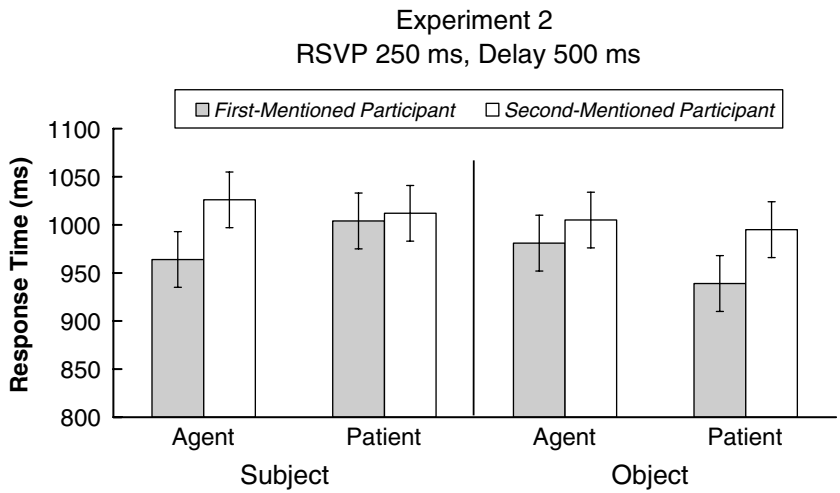

Fig. 2. Mean recognition time in Experiment 2.

appear in Table III and Fig. 2. ANOVA revealed a reliable main effect of order of mention, $F_1(1, 63) = 8.39$, $p < .01$; $F_2(1, 31) = 5.16$, $p < .05$: first-mentioned characters were responded to more rapidly ($M = 972$ ms; SE = 25 ms) than second-mentioned characters ($M = 1009$ ms; SE = 26 ms). A reliable main effect of syntactic position was also found in the analysis by participants, $F_1(1, 63) = 4.32$, $p < .05$, but not the analysis by items, $F_2(1, 31) = 2.61$, $p > .10$. The main effect of syntactic position was qualified by an interaction between semantic role and syntactic position that approached significance in the analysis by participants, $F_1(1, 63) = 3.18$, $p < .10$, but not in the analysis by items, $F_2(1, 31) = 1.78$, $p > .10$. The interaction suggested that semantic patients were more accessible when they were syntactic objects ($M = 967$ ms; SE = 27 ms) than when they were syntactic subjects ($M = 1008$ ms; SE = 28 ms), $F_1(1, 63) = 7.58$, $p < .01$; $F_2(1, 31) = 4.08$, $p < .05$, but for agents there was no effect of their syntactic role.

Experiment 3 (RSVP 250 ms; ISI 1000 ms)

The mean recognition accuracy was 94.6% and there was no significant difference among conditions. The mean probe recognition times appear in Table III and Fig. 3. ANOVA revealed a reliable main effect of order of mention, $F_1(1, 63) = 5.05$, $p < .05$, and $F_2(1, 31) = 5.68$, $p < .05$: first-mentioned characters were responded to more rapidly ($M = 861$ ms;

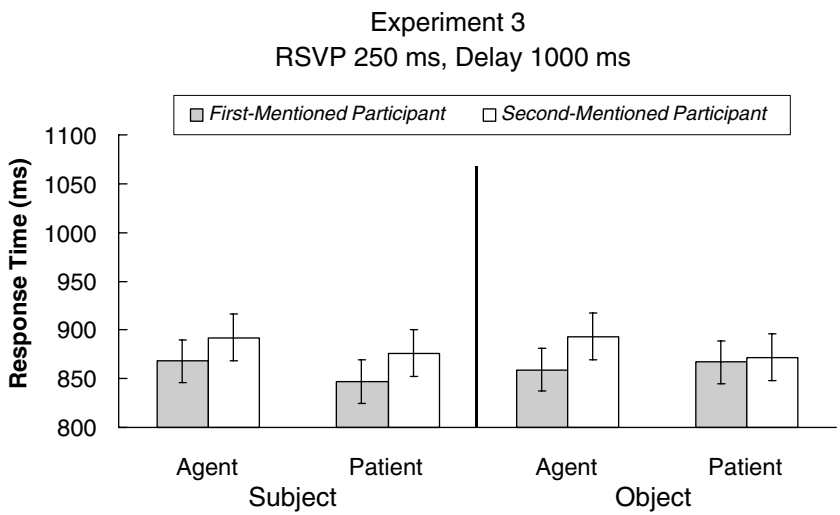

Fig. 3. Mean recognition time in Experiment 3.

SE = 19 ms) than second-mentioned characters ($M = 883$ ms; SE = 21 ms). No other effects were reliable.

Experiment 4 (RSVP 500 ms; ISI 0 ms)

The mean recognition accuracy was 97.7% and there was no significant difference among conditions. The mean probe recognition times appear in Table IV and Fig. 4. ANOVA revealed a reliable interaction between semantic role and order of mention for the analysis by participants, $F_1(1, 63) = 4.40$, $p < .05$, but the interaction was not reli-

Table IV. Mean Recognition Time (ms) and Standard Error in Experiments 4–6 (RSVP 500 ms)

		Subject		Object	
Experiment	Mentioned order	Agent	Patient	Agent	Patient
Experiment 4	First	925 (23.5)	932 (27.7)	915 (26.2)	937 (26.0)
(ISI 0 ms)	Second	934 (24.6)	919 (25.4)	956 (27.6)	904 (24.8)
Experiment 5	First	898 (22.7)	899 (28.5)	931 (26.9)	902 (23.0)
(ISI 500 ms)	Second	940 (24.5)	954 (24.6)	957 (21.2)	938 (26.0)
Experiment 6	First	925 (24.9)	944 (25.2)	963 (31.0)	932 (27.8)
(ISI 1000 ms)	Second	949 (24.0)	981 (30.7)	976 (26.9)	947 (28.0)

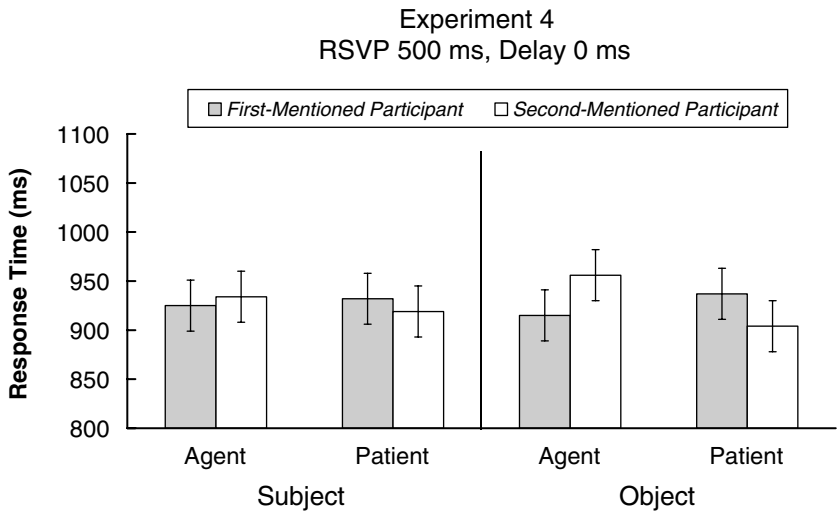

Fig. 4. Mean recognition time in Experiment 4.

able in the analysis by items, $F_2(1, 31) = 2.54$, $p > .10$. This interaction suggested that first-mentioned agents were responded to more rapidly ($M = 920$ ms; SE = 21 ms) than the second-mentioned agents ($M = 945$ ms; SE = 23 ms), whereas first-mentioned patients ($M = 935$ ms; SE = 24 ms) were responded to less rapidly than second-mentioned patients ($M = 912$ ms; SE = 23 ms); however, neither difference was statistically reliable.

Experiment 5 (RSVP 500 ms; ISI 500 ms)

The mean recognition accuracy was 96.5% and there was no significant difference among conditions. The mean probe recognition times appear in Table IV and Fig. 5. ANOVA revealed a reliable main effect of order of mention, $F_1(1, 63) = 10.75$, $p < .01$, and $F_2(1, 31) = 10.68$, $p < .01$. First-mentioned characters were responded to more rapidly ($M = 908$ ms; SE = 21 ms) than second-mentioned characters ($M = 947$ ms; SE = 21 ms). No other effects were reliable.

Experiment 6 (RSVP 500 ms; ISI 1000 ms)

The mean recognition accuracy was 95.9% and there was no significant difference among conditions. The mean probe recognition times appear in Table IV and Fig. 6. ANOVA revealed a reliable main effect of order of mention in the analysis by participants, $F_1(1, 63) = 5.71$,

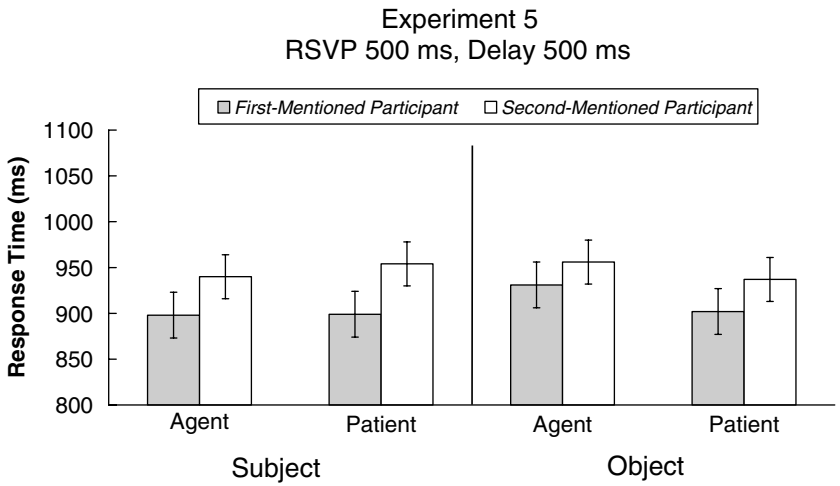

Fig. 5. Mean recognition time in Experiment 5.

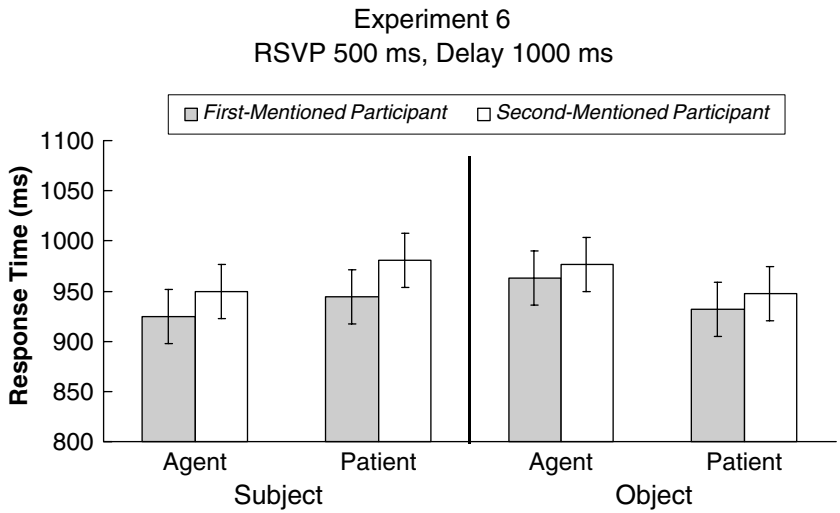

Fig. 6. Mean Recognition Time in Experiment 6.

$p < .05$, but not reliable in the analysis by items, $F_2(1, 31) = 2.30$, $p > .10$: first-mentioned characters were responded to more rapidly ($M = 941$ ms; SE = 24 ms) than second-mentioned characters ($M = 963$ ms; SE = 24 ms). The two-way interaction between semantic role and syntactic position was reliable in the analysis by items, $F_2(1, 31) = 9.28$, $p < .01$, but not

reliable in the analysis by participants, $F_1(1, 63) = 3.76$, $p > .05$. The interaction suggested that semantic agents were more accessible when they were syntactic subjects ($M = 937$ ms; SE = 23 ms) than when they were syntactic objects ($M = 969$ ms; SE = 27 ms), $F_1(1, 63) = 3.38$, $p < .07$, and $F_2(1, 31) = 5.81$, $p < .02$; in contrast, there was no reliable difference between semantic patients' accessibility when they were syntactic objects ($M = 940$ ms; SE = 26 ms) than when they were syntactic subjects ($M = 963$ ms; SE = 26 ms).

General Discussion

To summarize the main experimental results, the advantage of first mention was consistently found in Experiments 2, 3, 5, and 6. The only empirical situation in which the advantage of first mention was not observed was when the delay between the last word in a sentence and test name was 0 ms (Experiments 1 and 4). This latter result conceptually replicates that of Gernsbacher *et al.* (1989) which showed no advantage of first mention at very brief ISIs (0 ms to 150 ms). Gernsbacher *et al.* (1989) suggested that this pattern indicated that comprehenders have greatest access to the information represented in the substructure that they are currently developing; however, after comprehenders have finished building their mental substructures, information from the first component begins to become more accessible (hence, the diminished accessibility of the most recent component coupled with the increased accessibility of the first component). Kim and Lee (1995) found that pragmatic order of mention strongly influenced accessibility immediately at ISI of 255 ms. Furthermore, Gernsbacher *et al.* (1989) suggested that the advantage of first mention is a relatively long-lived characteristic of the representation of a sentence. It persists (and increased) for the longest duration that we measured in the current experiments (i.e., 1000 ms after participants finish reading a sentence) and it even persists for the longest duration that Gernsbacher *et al.* (1989) measured in their experiments (i.e., 2000 ms after participants finish reading a sentence). Taken together with all these findings, it is suggested that the pragmatic order of mention strongly influenced accessibility immediately and through the longest delay.

In contrast to the effects of pragmatic order of mention, the effects of syntactic position and semantic role were not reliably observed except for the effect of syntactic position in Experiment 2 (with RSVP rate of 250 ms and ISI of 500 ms). The main effect of syntactic position should be interpreted with the interaction effect between semantic role and syntactic position. The results indicated that semantic patients were more accessi-

ble than semantic agents when they were syntactic objects, whereas there was no difference between semantic agents and patients when they were syntactic subjects. This suggests that syntactic factors affect sentence representation immediately (before 500-ms delay) only when the processing time is limited and the component of a sentence is a semantic patient, but their effects disappear shortly. However, with a sufficient amount of processing time in Experiment 6 (with RSVP rate of 500 ms and ISI of 1000 ms), semantic agents became more accessible than semantic patients even though they were syntactic subjects.

It is not clear why the interaction pattern between syntactic position and semantic role has changed over time. Since the interaction effects were often not reliable by item analysis, it would be necessary to replicate these experiments with more experimental material to increase the power and to investigate systematically how the processing strategy changes over time.

Given all the differences between Korean and English, it is very interesting to find the consistent cross-linguistic results, which showed that the advantage of first mention is consistently found in both Korean and English. These data therefore suggest that the differential accessibility of the components in a mental representation of a sentence may be determined by a universal principle.

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