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Research Article

Cross-Linguistic Differences in a Picture-Description Task Between Korean- and English-Speaking Individuals With Aphasia

Jee Eun Sung,[a] Gayle DeDe,[b] and Soo Eun Lee[a]

Purpose: The purpose of the study was to examine cross-linguistic differences in a picture-description task between Korean- and English-speaking individuals with Broca's and anomic aphasia to determine whether a variation exists in the use of verbs and nouns across the language and aphasia groups.
Method: Forty-eight individuals (male = 29; female = 19) participated in the study (*n* = 28 for aphasic group and *n* = 20 healthy controls). Data for English speakers were obtained from the Aphasia Bank Project. We used the picture-description task to obtain connected speech samples and analyzed noun- and verb-related linguistic variables.
Results: Korean speakers with aphasia produced more verbs per utterance and a lower noun-to-verb ratio than

English speakers with aphasia, whereas English speakers produced more nouns than Korean speakers. The Korean anomic group produced more verbs than Korean speakers with Broca's aphasia, whereas no effects were significant for English speakers with aphasia depending on the type of aphasia.
Conclusions: Aphasia symptoms vary as a function of linguistic features of languages that individuals with aphasia used premorbidly. Furthermore, the linguistic characteristics of the individual's language influenced aphasia symptoms more strongly than the type of aphasia. It is theoretically and clinically important that this cross-linguistic study provides different perspectives, and that noun–verb deficits may vary depending on linguistic features.

Word-retrieval deficits are ubiquitous in aphasia, but they do not affect all word classes equally. Many researchers have reported that people with aphasia have more difficulty retrieving verbs than nouns, both in picture-naming tasks and in spontaneous speech samples (e.g., Basso, Razzano, Faglioni, & Zanobio, 1990; Berndt, Haendiges, Mitchum, & Sandson, 1997; Berndt, Mitchum, Haendiges, & Sandson, 1997; Druks, 2002; M. Kim & Thompson, 2000; J. Lee & Thompson, 2015; Miceli, Silveri, Villa, & Caramazza, 1984; Williams & Canter, 1987). However, these studies leave many unanswered questions about the noun–verb dissociation, including whether it is consistent across aphasia types and languages. The purpose of the present study was to examine the

noun–verb dissociation in Korean and English speakers with anomic and Broca's aphasia.

The underlying cause of the noun–verb dissociation remains a matter of debate. According to the semantic-conceptual hypothesis (e.g., Bates, Chen, Tzeng, Li, & Opie, 1991; Aggujaro, Crepaldi, Pistarini, Taricco, & Luzzatti, 2006, but cf. Crepaldi, Berlingeri, Paulesu, & Luzzatti, 2011), noun–verb dissociations reflect underlying semantic representations. On this view, semantic representations associated with verbs lie in or near the motor cortex, and thus individuals with Broca's aphasia show greater impairments in naming verbs than nouns. In contrast, individuals with Wernicke's aphasia have impaired representations of nouns, which are stored around sensory areas (Bates et al., 1991). There are also accounts that focus on the syntactic and semantic features of verbs. For example, lexical properties of verbs and nouns, such as word frequency and imageability, may contribute to the dissociation. Luzzatti and Chierchia (2002) suggested that individuals who have more difficulty naming low imageability items are more likely to show an advantage for nouns. Their rationale was that nouns tend to be more imageable than verbs, so effects of imageability are more likely to affect verbs than nouns (also cf. Bird, Howard, & Franklin, 2003; Druks,

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2002). In addition, individuals with agrammatism retrieve semantically heavy verbs more easily than semantically light verbs, possibly due to disruptions in the syntactic input to verb retrieval (Barde, Schwartz, & Boronat, 2006). Another view is that verb deficits reflect damage to representations of argument structure, such that verbs with more complex argument structure are more difficult to retrieve (cf. M. Kim & Thompson, 2000).

In general, evidence exists that the noun–verb dissociation is attributable to both semantic and syntactic properties of different word classes. This raises the question of whether the noun–verb dissociation is observed across languages. If all languages show the noun–verb dissociation, then it should be attributable to properties shown by nouns and verbs across languages. In contrast, differing effects of word class across languages would suggest that the noun–verb dissociation is not reducible to universal semantic features of verbs and nouns.

To date, most research has found that the noun–verb dissociation is consistent across languages. Studies in multiple languages, for example Dutch, Chinese, English, Italian, and Palestinian Arabic, have reported an advantage for noun versus verb naming (Adam, 2014; Bates et al., 1991; Berndt, Haendiges, et al., 1997, Berndt, Mitchum, et al., 1997; Jonkers & Bastiaanse, 1998; J. Lee & Thompson, 2015; Miceli et al., 1984).[1] One language-specific property that could influence verb retrieval is grammatical complexity, operationalized as the extent of obligatory morphology. The languages that have been studied previously represent a continuum with respect to verb morphology: Chinese reportedly has no productive inflectional morphology marking verbs (Bates et al., 1991), English has relatively limited morphological markings on the verb, and Italian shows a rich system of morphological markings on verbs. The noun–verb dissociation has been reported in all of these languages, suggesting that grammatical complexity of the verb does not affect the relative difficulty of retrieving nouns and verbs.

Another language-specific property is the extent to which nouns can be omitted in grammatical sentences. For example, Italian verb morphology, like many Romance languages, captures enough morphological information that the subject of the sentence becomes optional (e.g., Dryer, 2008). Thus, a sentence such as *"Ho freddo,"* meaning *"I am cold"* is grammatically correct in Italian even though there is no explicit subject (i.e., it is not necessary to specify *"Io ho freddo"*). Nonetheless, studies of Italian-speaking individuals with aphasia have reported that verb retrieval deficits are more common than noun retrieval deficits (e.g., Aggujaro et al., 2006; Miceli et al., 1984).

The Korean language allows all of a verb's arguments to be omitted in certain contexts, rather than only allowing the sentential subject to be dropped. Korean is referred to as a discourse-oriented language because arguments are realized in the discourse context rather than through rich

morphological case markings (e.g., Y. J. Kim, 2000; Kwon & Sturt, 2013). Thus, verbs can formulate a complete and grammatical sentence in Korean, as long as the verb's arguments are realized in the discourse context. Consider a picture-description task in which speakers and listeners look at the same picture, which shows a firefighter coming to rescue a cat in a tree. Korean speakers may say "came to rescue (*kuhale wassta,* 구하러 왔다)" by dropping both the subject and the object, given that who (the firefighter) and whom (the cat) are already realized in the shared picture. According to Y. J. Kim (2000), Korean adults omit the sentential subject 55% to 65% of the time, and omit the sentential object 53% to 56% of the time.

Given that verbs can constitute a full grammatically correct sentence, Korean may be described as a verb-salient language (cf. Choi, 2000). Here, we use verb salience to capture the idea that the informational value of verbs in Korean sentences is relatively high, in part because verbs may be the only overtly produced words. Additional support for the idea that Korean is a verb-salient language comes from studies of verb acquisition of Korean children and their caregivers' language (Clancy, 2009). One study found that Korean children had a larger lexical inventory of verbs than English-speaking children (Choi, 1998; M. Kim, McGregor, & Thompson, 2000). Korean children acquire verbs earlier than nouns in their language development, and this acquisition pattern seems to be influenced by caregivers' input of verb-salient usage (Choi & Gopnik, 1995; Gopnik & Choi, 1995).

Only one previous study has investigated the noun–verb dissociation in Korean speakers with aphasia (Hyun, Kim, Shin, & Seo, 2003). Hyun et al. (2003) used a confrontation-naming task to examine the noun–verb dissociation in Korean-speaking individuals with Broca's and Wernicke's aphasia. Individuals with Broca's and Wernicke's aphasia performed equally poorly on the verb-naming task. Those with Broca's aphasia named more nouns correctly, resulting in a noun–verb dissociation. Those with Wernicke's aphasia did not show the noun–verb dissociation, likely due to overall poorer performance. This result is inconsistent with the prediction that Korean speakers would produce more verbs than nouns. However, Korean speakers might omit more nouns than verbs in spontaneous speech, in part because the discourse context supports omission of nouns.

The idea that the noun–verb dissociation would differ as a function of language-specific characteristics is consistent with the idea of cue validity in the competition model (e.g., Bates, Friederici, & Wulfeck, 1987; Bates, Friederici, Wulfeck, & Juarez, 1988; Bates, Wulfeck, & MacWhinney, 1991; MacWhinney, Bates, & Kliegl, 1984). *Cue validity* refers to the idea that more informative cues in a language are likely to be more resilient to impairments associated with aphasia. Cue validity is sometimes referred to as the "information value" of specific linguistic features (Bates et al., 1991, p. 127). The notion of cue validity accounts for which types of information are most informative for each language. For example, word order is an

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[1]Note that this is not an exhaustive list of languages in which studies have reported an advantage for nouns over verbs.

important cue for syntactic roles in English because sentences typically follow subject–verb–object (SVO) word order. Thus, English speakers with aphasia are unlikely to make errors in word order. Bound morphology is an important indicator of syntactic roles in Italian, so Italian speakers with aphasia are less likely to omit morphological markers than English speakers with aphasia. Thus, speech production patterns in people with aphasia at least partly reflect language-specific differences in cue validity in the competition model. If cue validity applies to grammatical word classes, then verb retrieval impairments might be reduced in a language such as Korean, in which verbs are highly salient and nouns can be omitted altogether.

Another variable that may contribute to the noun–verb dissociation is aphasia type. Many researchers have reported that individuals with agrammatic Broca's aphasia produce more nouns than verbs in spontaneous speech, and name nouns more accurately than verbs on picture-naming tasks (e.g., M. Kim & Thompson, 2000; J. Lee & Thompson, 2015; Miceli et al., 1984; Williams & Canter, 1987). In contrast, some researchers have reported that individuals with fluent aphasia (typically anomic or Wernicke's aphasia type) name verbs more accurately than nouns, though this pattern of results is less consistent across studies (e.g., Kambanaros, 2010; J. Lee & Thompson, 2015; Miceli et al., 1984). Still others have argued that individuals with both nonfluent and fluent aphasia have more difficulty naming verbs than nouns (e.g., Jonkers & Bastiaanse, 1998; Kambanaros, 2009; Luzzatti, Aggujaro, & Crepaldi, 2006; Williams & Canter, 1987; Zingeser & Berndt, 1990). Luzzatti and Chierchia (2002) claimed that the noun–verb dissociation was bidirectional, such that some individuals would show poorer naming performance for nouns than verbs. They suggested that all agrammatic individuals show greater impairments on verbs than nouns, whereas fluent individuals might show either pattern. Thus, the relationship between aphasia type and the noun–verb dissociation remains unclear.

Aims

The purpose of the current study was to examine cross-linguistic variation in how Korean- and English-speaking individuals with Broca's and anomic aphasia use verbs and nouns in a picture-description task.

As reviewed above, one may expect Korean speakers to produce more verbs than nouns, regardless of brain damage. However, to our knowledge, no previous study has examined the noun–verb dissociation in spontaneous speech samples of speakers of Korean and English without brain damage. Therefore, we investigated whether English and Korean speakers without brain damage showed the expected differences between noun and verb production before examining whether people with aphasia in each language group showed the same pattern as controls. For healthy controls, we predicted that Korean speakers would produce more verbs than English speakers.

Our primary focus was whether Korean and English speakers with aphasia showed similar effects of word class

in spontaneous speech samples. On the basis of previous studies (e.g., Basso et al., 1990; Berndt, Haendiges, et al., 1997; Druks, 2002; M. Kim & Thompson, 2000), we predicted that English speakers with aphasia would be more likely to omit verbs than nouns from their picture descriptions. However, the situation is less clear for Korean speakers with aphasia. If lexical properties of verbs make them inherently more difficult than nouns for people with aphasia, then Korean speakers with aphasia should also produce fewer verbs than nouns in their speech samples, despite the salience of verbs in the language. This would be consistent with the Hyun et al. (2003) results. In contrast, if cross-linguistic variation in verb salience matters, then Korean speakers with aphasia might produce more verbs than English speakers with aphasia in spontaneous speech.

We investigated whether individuals with Broca's and anomic aphasia show similar noun–verb ratios in connected speech samples. It was difficult to generate strong predictions regarding the effect of aphasia type for either language group due to the conflicting results in the existing literature (e.g., Jonkers & Bastiaanse, 1998; J. Lee & Thompson, 2015; Luzzatti et al., 2006; Miceli et al., 1984). However, several studies have found that English speakers with Broca's aphasia omit more verbs than nouns and that English speakers with anomic aphasia omit more nouns than verbs (e.g., M. Kim & Thompson, 2000; J. Lee & Thompson, 2015; Williams & Canter, 1987). For this reason, we predicted that the noun–verb dissociation would differ for English speakers with Broca's and anomic aphasia.

We did not anticipate that the noun–verb dissociation would differ in Korean speakers as a function of aphasia type. Hyun et al. (2003) showed that the noun–verb dissociation differed for Korean-speaking individuals with Broca's and Wernicke's aphasia. However, they used a confrontation-naming task, in which there is no discourse context available to support omission of nouns. Further, the competition model suggests that individuals with all aphasia types are sensitive to cue validity. There is no reason to expect that Korean speakers with Broca's aphasia would be less sensitive to the verb-salient features of Korean than Korean speakers with anomic aphasia (e.g., Bates et al., 1991). For these reasons, we predicted that Korean speakers with Broca's and anomic aphasia would show similar noun–verb ratios.[2]

Method
Participants

A total of 48 individuals (male = 29; female = 19) participated in this study, including 28 individuals with aphasia and 20 healthy controls. The 28 individuals with aphasia comprised 14 Korean- and 14 English-speakers with aphasia. Individuals with aphasia had a single, left-hemisphere stroke, and they were all monolingual speakers

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[2]Because English does not allow omission of nouns or verbs, the cue validity of verbs does not seem relevant to the English speakers with aphasia.

of their native languages. We recruited Korean-speaking individuals with aphasia at a speech clinic in a rehabilitation hospital in Seoul, where we administered the Korean version of the Western Aphasia Battery (H. Kim & Na, 2001). On the basis of the Korean version of the Western Aphasia Battery, we classified seven Korean-speaking individuals with Broca's aphasia and seven with anomic aphasia. The aphasia quotient ranged from 28.6 to 61.4 for Broca's aphasia and from 69.7 to 91.8 for anomic aphasia.

We obtained data for English-speaking individuals with aphasia from the Aphasia Bank project (MacWhinney, Fromm, Forbes, & Holland, 2011), matching the type and severity of aphasia to Korean speakers with aphasia. No significant differences emerged in aphasia quotient scores between 14 English ($M = 67.65$, $SD = 19.15$) and 14 Korean ($M = 67.61$, $SD = 21.86$) speakers with aphasia, $F(1, 26) = 0.00$, $p = .996$. The mean ages of English and Korean participants were 61.03 years ($SD = 20.08$) and 54.50 years ($SD = 15.26$), respectively. Mean age was not significantly different between language groups, $F(1, 26) = 0.937$, $p = .342$. Years of education of English and Korean speakers with aphasia were 15.14 ($SD = 2.48$) and 12.27 ($SD = 3.10$), respectively. Significant differences emerged between the groups, $F(1, 26) = 0.937$, $p < .05$. Descriptive information is provided in Table 1.

Korean-speaking controls were monolingual Korean speakers, recruited in Seoul. They took the Korean Mini-Mental State Examination (Kang, Jahng, & Na, 2012), and scored above the 17th percentile on the basis of age, gender, and education-adjusted criteria of the Korean Mini-Mental State Examination. We obtained data for English-speaking controls from the Aphasia Bank project (MacWhinney et al., 2011). The control groups were matched for age (Korean speakers mean age = 63.80 years, $SD = 13.52$; English speakers mean age = 67.57 years, $SD = 4.98$), $F(1, 18) = 0.684$, $p = .419$, and education (Korean speakers mean age = 63.80 years, $SD = 13.52$; English speakers mean age = 67.57 years, $SD = 4.98$), $F(1, 26) = 2.074$, $p = .167$.

We matched the control groups to the aphasic groups for age and education, separately for each language. No significant differences emerged for age, $F(1, 22) = 1.006$, $p = .327$ and education, $F(1, 22) = 3.143$, $p = .09$ between English-speaking individuals with aphasia and their controls. No significant differences emerged for age, $F(1, 22) = 2.376$, $p = .137$ and education, $F(1, 22) = 0.187$, $p = .669$ between Korean-speaking individuals with aphasia and their controls.

Experimental Materials

We used the picture–description task to obtain connected speech samples using a *cat rescue* picture (Nicholas & Brookshire, 1993) following the Aphasia Bank Protocol (MacWhinney et al., 2011). Participants were told, "Here is a picture. Look at everything that's happening and then tell me a story about what you see. Tell me the story with a beginning, a middle, and an end." If participants presented no response for 10 s, we provided prompts following the Aphasia Bank Protocol. For Korean participants, we translated instructions into Korean on the basis of the Aphasia Bank Protocol.

Linguistic Analyses

Linguistic outcome measures included a total of 11 variables such as number of utterances, number of Nouns-Token, number of Nouns-Type, Noun-Type Token Ratio (TTR), number of Verbs-Token, number of Verbs-Type, Verb-TTR, number of nouns per utterance, number of verbs per utterance, Noun-to-Verb Ratio (NVR) Token, and NVR Type.

Number of Utterances

The criteria for utterances of English data followed the Aphasia Bank protocol (MacWhinney et al., 2011), in which all linguistic samples were transcribed using a transcription program in CHAT format (MacWhinney, 2000). The criteria for utterances for Korean was based on previous studies on linguistic analyses of spontaneous speech in Korea (H. Kim et al., 1998; Y. Lee & Kim, 2001).

Noun-Related Variables

Noun-related variables included number of Noun-Token, number of Noun-Type, and Noun-TTR. Nouns included common nouns, proper nouns, and pronouns. Pronouns were counted as nouns because speakers tended to use pronouns while pointing to the picture. In the picture–description task, demonstrative pronouns (*this* or *that*) and personal pronouns (*he* or *she*) were not used as anaphoric function words that referred to linguistic antecedents from the context. Rather, pronouns were used as nouns that referred to the specific contents of the picture.

Verb-Related Variables

Verb-related variables included number of Verb-Token, number of Verb-Type, and Verb-TTR. For English, auxiliary verbs did not count as verbs, whereas Korean auxiliary verbs did. We applied different criteria to Korean and English speakers for the following reasons: English auxiliary verbs such as *don't* or *can't* are realized as negative adverbs (*mos*) in Korean. An example from Sohn (2013b, p. 251) is illustrated as below. We used a Yale system (Martin, 1992) for Korean transliteration. In these cases, neither the English auxiliary verb nor the Korean negative adverb was included in the verb count.

Example: (He) cannot go to school.
Hakkyo-ey mos ka-n-ta
School-to cannot go-ind-dec

Korean auxiliary verbs are realized in a sentence as a separate verb with semantic weights. For example, a Korean auxiliary verb (*pota,* meaning "try") can be attached to a main verb (*mekta,* meaning "eat") such as *mek-e pota* "try eating" (Sohn, 2013a, p. 221). In this case, for English coding, the number of verbs was counted as two. However, if we count only the main verb for Korean, this example would yield only one count for a Korean verb. Thus, we counted

Table 1. Descriptive information on aphasia severity of Korean and English speakers with aphasia.

Language group	Aphasia bank ID	Aphasia type	Aphasia quotient	Fluency (10)	Repetition (10)	Naming (10)	Comprehension (10)	Months post onset
Korean	Sung01a	Anomic	89.2	8	10	8.5	10	10
Korean	Sung02a	Anomic	85.6	6	9.8	9	10	1
Korean	Sung03a	Anomic	84.2	6	8	9.1	10	8
Korean	Sung04a	Anomic	81	5	9	8.8	10	3
Korean	Sung05a	Anomic	94.3	9	8.6	9.7	10	14
Korean	Sung06a	Anomic	91.8	9	9.6	9.3	10	23
Korean	Sung07a	Anomic	85.8	7	9.4	8.7	9.8	24
Korean	Sung01b	Broca	48.6	4	3.8	4.2	4	4
Korean	Sung02b	Broca	61.4	4	6.5	7	10	7
Korean	Sung03b	Broca	46.2	4	1.2	2.3	4	6
Korean	Sung04b	Broca	47.4	3	3	6.1	5.6	60
Korean	Sung05b	Broca	48.6	4	3.8	4.2	6.3	45
Korean	Sung06b	Broca	53.8	4	6.4	6.8	5.7	54
Korean	Sung07b	Broca	28.6	2	4.6	1.6	4.1	Not available
Korean-speaking average			67.61	5.36	6.69	6.88	7.82	19.92
SD			21.86	2.21	2.94	2.80	2.66	20.32
English	thompson14a	Anomic	90.1	8	10	9.2	9.85	18
English	kurland03a	Anomic	83.6	6	9	9	9.8	78
English	elman13a	Anomic	78.3	6	7.6	7.9	9.65	34
English	whiteside09a	Anomic	78.7	5	7.4	9	9.95	70
English	fridriksson09a	Anomic	90.2	9	8.8	9.3	10	99
English	elman10a	Anomic	93.2	9	9.4	8.2	10	178
English	adler20a	Anomic	79.1	7	8.8	7.7	9.05	24
English	tucson02a	Broca	38.8	2	4.1	4.1	4.2	94
English	elman06a	Broca	45.5	4	2.9	2	7.85	23
English	whiteside04a	Broca	50	4	2.6	5.4	8	272
English	ACWT01a	Broca	63.9	2	6.4	6.9	9.65	142
English	whiteside12a	Broca	54.3	3	7.4	4.6	7.15	68
English	TAP13a	Broca	44.4	4	3	3.5	4.7	56
English	scale15b	Broca	57	4	4.4	6	7.1	58
English-speaking average			67.65	5.21	6.56	6.63	8.35	
SD			19.15	2.36	2.64	2.38	1.96	

an auxiliary verb for Korean, but not for English, as the number of verb categories is a reasonable way to equate coding verbs for English–Korean cross-linguistic analyses.

Be-copular verbs counted as a verb for both English and Korean. When be-verbs were used as auxiliary verbs in English (such as "is eating"), only the main verbs ("eat") were included in the verb category. The Korean expression for the present progressive form is often realized as a morphological inflection with a present progressive tense form ("nun"; *mek-nun-ta* for "is eating") added to the main verb (*mek-ta* for "eat"). Constructions such as the present progressive form were also counted as one verb in Korean.

Normalization by Utterance for Nouns and Verbs

We normalized the numbers of nouns and verbs by numbers of utterances to minimize the influence of the total numbers of utterances on critical linguistic units such as nouns and verbs in the current analyses.

NVR

NVR served as one of the critical linguistic measures in the current analyses. NVR variables included NVR Token and NVR Type.

Results

We conducted Mann–Whitney U tests as a non-parametric analysis to examine the differences between the two language groups and between the two aphasia types for 11 linguistic variables. Alpha was corrected as .005 level to control the type I error induced by multiple comparisons.

Analysis 1: Comparisons Between English and Korean Speakers Without Brain Damage

We first examined whether there are significant group differences between healthy English and Korean speakers. Descriptive information of mean and standard deviation appears in Table 2 for each linguistic variable in both groups.

English speakers generated significantly more numbers of utterances than Korean speakers, $Z = -2.742$, $p = .005$. There were significant differences between the two language groups in numbers of nouns-token, $Z = -3.784$, $p < .0001$, and numbers of nouns-type, $Z = -3.68$, $p < .0001$, with English speakers generating significantly more nouns than Korean speakers in general. In contrast, no significant differences emerged between the language groups in the numbers

Table 2. Descriptive information of mean and standard deviation on linguistic measures for healthy control group.

Linguistic variables	English		Korean	
	Mean	**SD**	**Mean**	**SD**
# of Utterances	11.50	4.65	6.10	1.14
# of Nouns-Token	39.10	13.14	13.40	4.32
# of Nouns-Type	22.20	4.10	10.10	3.11
Noun-Type Token Ratio	0.59	0.08	0.76	0.08
# of Verbs-Token	19.40	5.80	15.70	3.90
# of Verbs-Type	13.10	3.70	11.70	3.10
Verb-Type Token Ratio	0.68	0.09	0.76	0.13
# of Nouns per Utterance	2.74	0.66	2.20	0.55
# of Verbs per Utterance	1.81	0.48	2.57	0.38
Noun-to-Verb Ratio Token	2.02	0.30	0.87	0.21
Noun-to-Verb Ratio Type	1.74	0.28	0.87	0.19

of verbs-token, $Z = -1.411$, $p = .165$, the numbers of verbs-type, $Z = .379$, $p = .393$, and verb-TTR, $Z = .211$, $p = .218$.

When the numbers of nouns and verbs were normalized by the number of utterances, English speakers produced marginally more nouns per utterance than Korean speakers, $Z = -1.893$, $p = .063$. In contrast, Korean speakers generated significantly more verbs per utterance than English speakers, $Z = -2.875$, $p < .005$. These patterns led to significant differences between the language groups in NVR for token, $Z = -3.78$, $p < .0001$, and type, $Z = -3.78$, $p < .0001$, with English speakers exhibiting greater NVR than Korean speakers.

Analysis 2: Comparisons Between English and Korean Speakers With Aphasia Across the Types of Aphasia

Significant differences emerged between the two language groups in number of verbs per utterance, $Z = -2.854$, $p < .005$, with Korean speakers with aphasia presenting more verbs per utterance than English speakers with aphasia. There were significant language-group differences in NVR-type, $Z = -3.476$, $p < .0001$, with English speakers with aphasia exhibiting higher NVR than Korean speakers with aphasia. No other linguistic measures elicited significant language-group differences.

Table 3 provides descriptive information of means and standard deviation for each linguistic measure for both language groups.

Analysis 3: Comparisons Between Broca and Anomic Aphasia Types for Each Language Group

We conducted separate analyses for each language group of individuals with aphasia to examine the group differences depending on the type of aphasia. In English speakers with aphasia, none of the variables elicited significant differences between the types of aphasia. In contrast, Korean speakers with aphasia presented significant group differences between Broca and anomic types of aphasia in two linguistic measures associated with verbs. Korean speakers with anomic aphasia produced significantly more

Table 3. Descriptive analysis of mean and standard deviation on linguistic measures in both types of aphasia from each language group.

Linguistic variables	English	Korean	Z	p
# of Utterances	11.71 (5.03)	8.36 (3.71)	−1.816	.077
# of Noun-Token	12.86 (6.15)	12.71 (11.17)	−.852	.401
# of Noun-Type	8.50 (3.72)	8.21 (6.27)	−.877	.401
Noun-Type Token Ratio	0.68 (0.18)	0.70 (0.15)	−.506	.635
# of Verb-Token	9.14 (5.78)	13.71 (10.22)	−1.152	.265
# of Verb-Type	5.64 (2.92)	9.21 (5.31)	−1.823	.069
Verb-Type Token Ratio	0.70 (0.22)	0.73 (0.17)	−.392	.701
# of Nouns per Utterances	1.12 (0.53)	1.47 (0.86)	−.921	.376
# of Verbs per Utterances	0.83 (0.45)	1.67 (0.82)	−2.854	.004
Noun-to-Verb Ratio Token	2.32 (2.42)	0.97 (0.55)	−2.390	.016
Noun-to-Verb Ratio Type	2.13 (2.07)	0.84 (0.23)	−3.476	.000

types of verbs, $Z = -2.704$, $p < .005$, and more verbs per utterances, $Z = -2.875$, $p < .005$, than Korean speakers with Broca's aphasia.

We provided descriptive information of means and standard deviation for each linguistic measure in both types of aphasia for English and Korean speakers in Table 4 and Table 5, respectively.

Discussion

The current study examined whether there are cross-linguistic differences in verb and noun production across language and aphasia groups. Korean speakers with aphasia

Table 4. Descriptive information of mean and standard deviation for each linguistic measures in both types of aphasia for English speakers.

Linguistic variables	English speakers			
	Anomic	**Broca**	**Z**	**p**
# of Utterances	13.29 (4.75)	10.14 (5.15)	−1.223	.259
# of Noun-Token	12.00 (4.90)	13.71 (7.50)	−.322	.805
# of Noun-Type	8.14 (2.61)	8.86 (4.78)	−.257	.805
Noun-Type Token Ratio	0.74 (0.24)	0.62 (0.10)	−.704	.535
# of Verb-Token	7.29 (4.89)	11.00 (6.35)	−1.282	.209
# of Verb-Type	4.43 (2.94)	6.86 (2.54)	−1.360	.209
Verb-Type Token Ratio	0.60 (0.26)	0.72 (0.19)	−.322	.805
# of Nouns per Utterances	0.86 (0.35)	1.39 (0.57)	−1.668	.097
# of Verbs per Utterances	0.58 (0.34)	1.08 (0.41)	−2.315	.017
Noun-to-Verb Ratio Token	2.90 (3.23)	1.75 (1.22)	−.512	.620
Noun-to-Verb Ratio Type	2.83 (2.78)	1.42 (0.67)	−1.279	.209

Table 5. Descriptive information of mean and standard deviation for each linguistic measures in both types of aphasia for Korean speakers.

Linguistic variables	Korean speakers			
	Anomic	Broca	Z	p
# of Utterances	8.29 (5.09)	8.43 (1.99)	−1.065	.318
# of Noun-Token	17.57 (13.75)	7.85 (5.11)	−1.727	.097
# of Noun-Type	11.43 (7.32)	5.00 (2.71)	−2.187	.026
Noun-Type Token Ratio	0.70 (0.11)	0.70 (0.18)	−.128	.902
# of Verb-Token	18.57 (12.49)	8.87 (3.89)	−2.248	.026
# of Verb-Type	12.57 (5.50)	5.86 (2.12)	−2.704	.004
Verb-Type Token Ratio	0.75 (0.15)	0.71 (0.19)	−.576	.62
# of Nouns per Utterances	2.02 (0.77)	0.92 (0.54)	−2.558	.007
# of Verbs per Utterances	2.25 (0.65)	1.08 (0.45)	−2.875	.002
Noun-to-Verb Ratio Token	0.92 (0.27)	1.01 (0.76)	−.448	.71
Noun-to-Verb Ratio Type	0.85 (0.20)	0.83 (0.27)	−.259	.805

tended to produce more verbs than English speakers with aphasia, whereas English speakers with aphasia produced more different types of nouns than Korean speakers with aphasia. This tendency might account for the significant differences in the NVR between the two language groups, indicating that Korean speakers with aphasia showed lower NVR than English speakers with aphasia. These results were consistent with the prediction that Korean speakers with aphasia are less likely to omit verbs and more likely to drop noun phrases than English speakers, given that Korean is a verb-salient language (cf. Bates et al., 1991).

The results were consistent with competition model's prediction that speech production would be influenced by language-specific cue validity (Bates et al., 1991). Cue validity is higher in Korean for verbs than in English because Korean is a verb-salient language. The verb-saliency hypothesis is well supported by the control data from the current study. Korean controls produced significantly more verbs than English speakers, whereas English speakers produced more nouns than Korean speakers. The difference in verb salience was associated with higher rates of verb production in Korean speakers with aphasia compared with English speakers with aphasia. These results are consistent with previous studies of cue validity. Bates et al. (1988) examined the article omission rates from three different languages (German, Italian, and English). German has the largest number of articles, which are marked for gender, number, and case, followed by Italian and then English (Bates et al., 1988, 1991). Consistent with the cue validity prediction, Bates et al. (1988) found that German-speaking individuals with aphasia presented the smallest rate of article omission (15%) followed by Italian (25%) and English (70%) speakers. The study suggested that linguistic features with higher cue validity were less vulnerable to linguistic

deficits after brain damage. In other words, highly informative linguistic features are likely to be less impaired in individuals with aphasia.

The current results are inconsistent with Hyun et al. (2003), who reported the standard noun–verb dissociation in Korean speakers with Broca's aphasia. The authors reported that individuals with Broca's aphasia showed better naming performance on nouns than verbs, whereas the noun–verb dissociation was not present in individuals with Wernicke's aphasia. One explanation for why the present results differ from Hyun et al. (2003) relates to task differences. In confrontation naming, participants are *required* to produce both nouns and verbs. In addition, verbs and nouns in confrontation naming tasks can be matched for some lexical variables such as frequency and imageability. In contrast, spontaneous speech does not control for these sorts of lexical variables. The task differences account is flawed for at least one reason. If both Korean and English speakers with aphasia experienced difficulty producing verbs, we might expect the groups to produce similar numbers of verbs per utterance. Instead, Korean speakers with aphasia produced more verbs than their English-speaking counterparts. The two language groups did not differ significantly with respect to number of nouns produced. These data suggest that the spontaneous speech samples do not significantly underestimate Korean speakers' noun production. Thus, it does not seem that confrontation naming provides the more accurate measures of the noun–verb dissociation.

An alternative, and more appealing, account is that the Hyun et al. (2003) results are an artifact of the error-coding schema. Confrontation-naming tasks require a target response (a noun or a verb). However, Korean speakers often use the verb "do" with a noun (do + noun) in verb-confrontation-naming tasks (Sung, 2015). To use an English example, this would be akin to saying "does the dishes" instead of "washes" in response to a picture of a person washing dishes. In English, this problem can be largely avoided through judicious stimulus selection. For example, "does the car" is not an acceptable response if the picture shows a person washing a car. In Korean, most verbs can be expressed using this construction (e.g., "does the car" or "does the broom"). Sung (2015) suggested that participants may be predisposed to do + noun responses in confrontation-naming tasks because the verb stimuli are presented with noun-related arguments. This account is difficult to evaluate because Hyun et al. (2003) did not explicitly describe how they coded errors. However, it is likely that do + noun responses would be coded as errors because the target verb was not produced. This issue would disproportionately affect verb naming, and so could lead to the apparent noun–verb dissociation for individuals with Broca's aphasia. The lack of noun–verb dissociation in the Hyun et al. (2003) individuals with Wernicke's aphasia likely reflected overall higher error rates, rather than more successful verb naming.

If it is the case that the Hyun et al. (2003) data reflected the error-coding schema, then their confrontation-naming data may underestimate Korean speakers' verb production. Thus, spontaneous speech samples in the present study

provide a more accurate representation of the underlying noun–verb dissociation in Korean speakers than confrontation-naming tasks. This interpretation supports the idea that standard noun–verb dissociation is reversed for Korean speakers with aphasia.

The idea that spontaneous speech samples provide a more accurate reflection of noun–verb dissociation than confrontation naming is appealing. First, generating a story about a picture is arguably more natural than producing single nouns and verbs in response to a picture. Also, as Druks (2002) noted, it is quite hard to match all the critical psycholinguistic variables on confrontation-naming tasks (e.g., age of acquisition, familiarity, or imageability) while also achieving high levels of naming agreement. Kambanaros (2010) has also argued that connected speech samples provide a more accurate measure of word retrieval ability than confrontation-naming tasks. She showed that Greek-English bilinguals with anomic aphasia produced similar numbers of nouns and verbs in confrontation naming but more verbs than nouns in spontaneous speech. For these reasons, it seems likely that spontaneous speech samples—in this study, but also across languages (cf., Kambanaros, 2010)—provide the more accurate measure of word retrieval deficits. The spontaneous speech sampling procedures in the present study may have elicited verb-salient features of Korean more clearly than the picture confrontation-naming task.

The spontaneous speech samples in the present study provide evidence that language-specific characteristics can affect the noun–verb dissociation, such that verbs are produced more frequently than nouns. However, further research is needed to disentangle the relative contributions of task and coding schema to the noun–verb dissociation in Korean speakers. First, the noun–verb dissociation might be compared in the same individuals' spontaneous speech and confrontation naming. The noun–verb dissociation might also be examined in other types of spontaneous speech samples (e.g., personal narratives), in which researchers provide no picture to establish discourse referents. A related idea would be to develop a naming task for Korean speakers that did not elicit do + noun constructions, which would permit better control over possible confounding variables (e.g., word frequency). In addition, Druks (2002) suggested that individuals with verb-naming deficits in a confrontation-naming task might demonstrate unimpaired usage of "light verbs" in their spontaneous speech (p. 313). It would be interesting to analyze the proportion of semantically "heavy" versus "light" verbs in spontaneous speech samples for Korean speakers with aphasia (cf. Barde et al., 2006).

The present results are also relevant to determining the underlying cause of the noun–verb dissociation. If language-specific characteristics can reverse the noun–verb dissociation, then differences in noun and verb retrieval cannot be fully accounted for by the neural substrates of nouns and verbs (cf. the semantic-conceptual hypothesis; Bates et al., 1991). As Bates et al. noted, the semantic-conceptual hypothesis would predict similar findings on noun–verb dissociations for individuals with aphasia across

languages. The present results are consistent with the idea that word frequency contributes to the noun–verb dissociation, on the assumption that noun omission in Korean increases the relative frequency of verbs (cf. Luzzatti & Chierchia, 2002). More important, the results align with the hypothesis that linguistic features of the premorbid language affect specific manifestations of deficits in aphasia more than type of aphasia. The present results do not rule out the idea that verb retrieval impairments reflect the semantic and syntactic features of verbs. Instead, it could be that the relatively high cue validity of verbs in Korean makes this word class more resistant to impairments.

We did not find that individuals with Broca's and anomic aphasia showed qualitatively different noun–verb ratios. For English speakers, there were no significant differences between individuals with the two aphasia types. Korean speakers with anomic aphasia produced more verb types and more verbs per utterance than Korean speakers with Broca's aphasia. The differences in verb production is likely associated with the Korean speakers with Broca's aphasia being more severely impaired than those with anomic aphasia. In addition, the groups showed similar noun–verb ratios. The similar noun–verb ratios are probably because Korean speakers with anomic aphasia also produced more nouns and nouns per utterance than those with Broca's aphasia. However, differences in noun production did not reach significance for these groups. The two groups produced a similar number of utterances, meaning that the Korean speakers with anomia produced longer, and possibly more complex, utterances than those with Broca's aphasia.

We used TTR as a measure of lexical diversity. However, TTR is flawed in that it positively correlates with sample length (Malvern & Richards, 1997; McKee, Malvern, & Richards, 2000). We reported TTR instead of other indices of lexical diversity (e.g., Malvern & Richards, 1997) because the other measures of which we are aware rely on the computerized language analysis system (MacWhinney, 2000). Computerized language analysis is not available for analysis of Korean-language data. In the present study, this issue affects only one result, which is that English-speaking controls had a higher TTR for nouns than Korean-speaking controls. The possible implication is that our analysis underestimated lexical diversity in Korean speakers because their spontaneous speech samples tended to be shorter than the English speakers' speech samples. Given that our focus was on the ratio of nouns and verbs produced by Korean and English speakers, and on the number of nouns and verbs per utterance, this was not a significant limitation to the present study.

Another potential issue is that we were not able to match education levels across all four groups. One reason is that the compulsory minimal education level for Korean individuals in this age group was only 6 years. This limitation could affect measures of lexical diversity if participants with lower levels of education produced fewer different word forms. Again, that was not the focus of the present study. Instead, we were interested in the relative number of nouns

and verbs produced by speakers in each group. We had no reason to expect that these variables would be influenced by education level. Nonetheless, future studies might control for education level to rule out any possible contribution of this factor. In addition, given the relatively small sample size, it is important that these results be replicated in the future.

Conclusion

To summarize, in the current study we found that Korean speakers with aphasia produced significantly more verbs per utterance and lower NVR than English speakers with aphasia. However, no significant differences emerged between Broca's and anomic aphasia groups in either language group. The results suggest that the linguistic characteristics of an individual's language influence aphasia symptoms more strongly than the type of aphasia. The results are consistent with the idea that language differences play an important role in determining aphasic symptoms (e.g., Bates et al., 1991). It is theoretically and clinically important that the current cross-linguistic study provides different perspectives, in that noun–verb deficits may vary, depending on linguistic features. Aphasia classification on the basis of linguistic symptoms may need to be refined to reflect linguistic characteristics of different languages to better understand the nature of linguistic deficits in aphasia.

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