A CROSS-LINGUISTIC STUDY OF GRAMMATICAL MORPHOLOGY IN SPANISH- AND ENGLISH-SPEAKING AGRAMMATIC PATIENTS*

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ABSTRACT

To account for cross-linguistic differences in agrammatism, Bates and her colleagues have employed the Competition Model, proposing that the cue validity and cue costs of a grammatical morpheme in a particular language will directly affect how agrammatism is manifested. Using Goodglass et al.’s (1993) Morphosyntax Battery in English and a translated version in Spanish, we analyzed the use of equivalent grammatical structures in production and comprehension by agrammatic speakers of the two languages. Wilcoxon signed-rank tests revealed that the relative order of difficulty in both production and comprehension of various grammatical morphemes was the same for both Spanish- and English-speaking agrammatic patients, with two exceptions: (1) the Spanish-speaking agrammatics were relatively better at producing subject-verb agreement, and (2) the Spanish speakers were significantly worse at comprehending both active and passive voice sentences. The Competition Model can explain the performance differences regarding subject-verb agreement and comprehension of active voice sentences, but it cannot account for the differences seen in comprehending passive voice sentences.

Key words: agrammatism, aphasia, Spanish agrammatism

INTRODUCTION

Spanish is the primary language in over 20 countries, yet few studies have focused on language breakdown in Spanish-speaking aphasic patients. No studies of agrammatism in Spanish speakers have been included in either of the more recent large-scale cross-language studies (Bates, Wulfeck and MacWhinney, 1991; Menn and Obler, 1990). Like Italian, Spanish has a rich system of agreement inflections with flexible word order. Not only is the study of language breakdown in Spanish important for the treatment of thousands of Spanish-speaking aphasic patients, but placed within the framework of comparative aphasiology, it can enhance our scientific knowledge of language processing.

Agrammatism has been defined as a deficit in language production primarily characterized by the omission of grammatical functors and inflections and by a marked reduction in syntactic complexity. Two major issues have been argued regarding such a characterization of agrammatism: (1) whether the language

*This paper was presented in part by J.A. Christiansen at a conference entitled Neurolinguistics in a Multilingual World, Birkbeck College, London, January 4-5, 1996.
deficits demonstrated in agrammatic production are paralleled in comprehension (Goodglass, Christiansen and Gallagher, 1993; Grodzinsky, 1986), and (2) whether omissions of grammatical morphology are really a universal phenomenon of agrammatism or whether they are more related to the particular tasks used to investigate grammatical impairment (Kolk and Heeschen, 1992) and the particular languages investigated (Bates et al., 1991; Grodzinsky, 1984; Menn and Obler, 1990). Kolk and Heeschen (1990, 1992) have shown that agrammatic patients are less likely to omit functionals in spontaneous conversation than when performing restricted experimental tasks. Cross-linguistic studies have indicated that bound morphology is less susceptible to omission than free morphology, so that agrammatic patients speaking more agglutinative languages such as Finnish, Hungarian, and Turkish tend to omit fewer functionals than those speaking more isolating languages such as English (MacWhinney and Osmán-Sági, 1991; Niemi and Laine, 1989; Niemi, Laine, Hänninen et al., 1990; Slobin, 1991). Furthermore, free morphology is less likely to be omitted if it carries more information. For example, free-standing articles in English, marking only definiteness, are usually omitted in agrammatic production; in German, however, articles are marked for definiteness, number, gender, and case, and are much less likely to be omitted by agrammatics (Bates, Frederici and Wulfeck, 1987b). In addition, Goodglass et al. (1993) suggest that verb phrase morphology is particularly affected by agrammatism as opposed to noun phrase morphology.

In recent years, Bates and her colleagues have introduced the Competition Model into comparative aphasiology (Bates et al., 1991; Kilborn, 1991; MacWhinney, Osmán-Sági and Slobin, 1991; Smith and Bates, 1987; Smith and Mimica, 1984; Vaid and Pandit, 1991). The general hypothesis is that variations of the cue validity of certain morphemes across languages, based on the relative availability and reliability of the morphological marker, can account for a large degree for cross-language differences in the manifestation of agrammatism. Additionally, the differences in cue validity must further be weighed against the relative cue costs of similar morphemes across languages, as will be discussed below.

The goal of the current study is to investigate the phenomenon of agrammatism in Spanish-speaking aphasic patients with a particular emphasis on the use of grammatical morphology. Using a Spanish version of Goodglass et al.'s (1993) Morphosyntax Battery, we analyze the use of particular morphological components of Spanish in oral production vs auditory comprehension. We further compare the relative retention and loss of similar grammatical structures in Spanish and English in view of the Competition Model (MacWhinney, 1987; Bates and MacWhinney, 1989). Specifically, we ask if cross-language differences can be accounted for by language-specific differences in the functional cue validity and cue costs of various syntactically similar constructions.

**BACKGROUND**

Since the beginning of the 19th century, grammatical disturbances have been considered a distinguishing characteristic of aphasia, yet the precise mechanisms...
involved in agrammatism and paragrammatism remain unclear (see de Bleser, 1987, for a history of agrammatism research). Kleist (1916) first distinguished between ‘agrammatism’ as characterized by a tendency to omit grammatical morphemes and ‘paragrammatism’ by a tendency to substitute grammatical morphemes; and for better or worse, these two types of grammatical disturbances have remained associated with Broca’s and Wernicke’s aphasia respectively. However, as discussed below, more recent research in the ‘80’s and ‘90’s have attempted to delve more deeply into the underlying mechanisms which may cause the surface manifestations of morphological omissions and substitutions.

Agrammatism as a Central Syntactic Deficit

Agrammatism was viewed solely as a production deficit until 1972, when Zurif, Caramazza and Myerson found evidence that agrammatism was paralleled by ‘asymptactic comprehension’, a deficit preventing the agrammatic patient from using the syntactic information in a sentence to deduce its meaning. Zurif et al.’s finding raised the crucial question as to whether the deficit underlying agrammatism might be a failure in the central syntactic processor. A central syntactic deficit would be manifested by parallel syntactic deficits in the processing of language input and output in both oral and written modalities.

Several subsequent studies have been conducted to test the central syntactic deficit hypothesis, with mixed results (Kolk and van Grunsven, 1985; Miceli, Mazzucchelli, Menn et al., 1983; Schwartz, Saffran and Marin, 1980; Wulfeck, 1988). Based on the fact that at least some patients whose oral production was agrammatic could process syntactic structures in language comprehension (Kolk, Van Grunsven and Keyser, 1985), and make correct grammaticality judgements (Linebarger, Schwartz and Saffran, 1983), the central syntactic deficit hypothesis has been recently rejected (Berndt, 1991). However, the adequacy of the assessment devices used as well as the systematic control of relevant variables by different researchers have been criticized (Berndt and Caramazza, 1980; Caplan, 1995; Goodglass et al., 1993). Goodglass et al. (1993) have pointed out that, although the central syntactic deficit hypothesis is no longer held to account for agrammatic symptoms, a major pitfall in most of this body of research has been that the oral production and auditory comprehension of specific grammatical constructions have not been assessed in the same patients using parallel tasks. In investigating individual patients’ ability to process grammatical and syntactic constructions across modalities, Goodglass et al. found that while agrammatic patients did have difficulty comprehending certain syntactic constructions such as subject/verb agreement and noun possessives, they performed similarly in comprehension to fluent, paragrammatic aphasics and were only distinguishable on production tasks.

Cross-linguistic Studies of Agrammatism

During the last few decades, much of the research on agrammatism has been conducted with English-speaking patients. As a consequence, the agrammatic
symptoms typically described, though primarily exhibited by English-speaking patients, were considered until very recently to be universal. Whenever an agrammatic patient from a different language background was studied, English agrammatism was used as the base reference, and deviations from this pattern were considered exceptions to the universal agrammatic pattern. The use of agrammatic symptoms in English-speakers as a baseline could be one of the reasons why there are so many unanswered questions about the nature of agrammatism (Miceli and Mazzucchi, 1990; Niemi and Laine, 1989). Since the 1980’s, several systematic cross-linguistic studies have called into question some previously accepted definitions of agrammatism, such as the omission of grammatical functors, and have provided greater insight into the possible underlying mechanisms involved in agrammatism (Bates, Friederici and Wulfek, 1987a; Bates et al., 1987b; Bates et al., 1991; Goodglass and Menn, 198a; Grodzinskv, 1984; Lu, 1994; Menn and Obler, 1990; Miceli et al., 1983). It has become apparent that, because grammatical markings (e.g., case markings) in different languages are achieved through different structural patterns (e.g., free-standing articles or noun inflections), the deficit in agrammatism may manifest itself very differently depending on the constraints of the language investigated.

The Competition Model and Its Application to Aphasia

MacWhinney and Bates’ Competition Model was originally designed to reflect normal language processing and to account for normal language acquisition by children. More recently, it has also been used to explain cross-language differences in grammatical processing in aphasia (Bates et al., 1991; Kilborn, 1991; MacWhinney et al., 1991, Smith and Bates, 1987; Smith and Mmica, 1984: Vaid and Pandit, 1991). A primary component of the Competition Model is cue validity (Bates and MacWhinney, 1989; MacWhinney, 1987). In general, cue validity depends on the morpheme’s cue reliability and cue availability. Cue reliability refers to the correlation between a particular morpheme and the grammatical information it provides. A high cue reliability would mean that the presence of a particular morpheme, such as the ‘-s’ in Spanish, would consistently mark only one particular piece of grammatical information, such as the plural. Plural marking with ‘-s’ could be considered to have higher reliability in Spanish than in English, because an ‘-s’ inflection on nouns in Spanish only indicates the plural, while in English it might indicate either the plural or the possessive form. Cue availability, on the other hand, refers to the consistency of a morpheme’s presence as a grammatical marker. For example, the plural marking ‘-s’ in Spanish is very high in availability, as it is always present, regardless of the gender or case of the noun or other modifying words (e.g., adjectives or articles). In contrast, the third person singular verb inflection in English provides reliable information as to the subject of a sentence, but does not appear in conjunction with modals or the past tense, making this inflection low in cue availability.

The force of cue reliability and availability, however, appears to be subjectively tempered by what MacWhinney and Bates call conflict validity.
Conflict validity refers to the influence of a grammatical structure when it directly competes with an opposing cue in the same sentence. For example, when canonical SVO word order competes with subject-verb agreement (i.e., agreement indicates that the subject follows the verb), word order has greater influence on English-speakers whereas agreement wins out in Italian (Bates et al., 1987a; Bates and MacWhinney, 1989).

But cue validity is only half of the argument proposed in the Competition Model. The effects of cue validity are counterbalanced by costs, which include perceivability and assignability. Perceivability, critical in sentence comprehension, simply refers to the perceptual saliency of a structure. Factors such as syllable structure or prosodic stress may raise or lower the perceivability of a grammatical morpheme. Assignability refers to the amount of information which must be held in memory in order to utilize a particular structure. Cues which can be assigned within a single constituent (e.g., unambiguous case markings) are considered to be lower in cue cost than those which must be assigned across sentence constituents (e.g., SV or noun-adjective agreement).

The Competition Model proposes that the strength of form-function mapping of a particular grammatical structure in a language, and therefore the accessibility for its use by native speakers, is directly related to its cue validity minus its cue costs. Furthermore, the cue validity of a grammatical construction is proposed to be equal in both production and comprehension; and cannot account for modality differences in processing. Cue costs, on the other hand, can vary with modality as well as with factors that affect the perceivability of speech (e.g., listening in noise, compressed speech).

It is important to emphasize that the Competition Model was originally designed to reflect normal language processing. When applied to aphasia, the Competition Model alone cannot give a complete account of the retention and loss of grammatical components across languages. Among aphasic patients, cue validity has been shown to interact with a closed-class deficit. When cues compete, for example word order vs. subject-verb agreement, word order tends to win out even when agreement morphology carries a high cue validity in the language investigated (Bates et al., 1987a). However, word order effects are smaller in languages where word order carries a lower cue validity, such as Italian or German, as opposed to those languages in which the cue validity of word order is extremely high, such as English. Furthermore, aphasic patients may be more vulnerable to the effects of cue costs. Therefore, cues marking long-distance relationships, such as agreement, may be selectively more disturbed in aphasia than cues marking locally assignable relationships, such as plural forms.

In the current study, the purpose of comparing grammatical constructions in Spanish and English is to try to distinguish between the effects of the relative cue validity of the constructions and the effects of the cue costs. For example, if we consider a construction such as subject-verb agreement, we would expect Spanish-speaking agrammatic patients to perform better than English-speaking patients, based on the higher cue validity of SV agreement in Spanish. On the other hand, the cue costs of SV agreement are similar in both languages. If agrammatic patients are more affected by the cue costs than by the cue validity
of a construction such as SV agreement, we would expect the performance across the two languages to be similar.

**Grammatical Issues in Spanish**

Four particular grammatical issues in Spanish may provide more insight into the underlying impairments in agrammatism: (1) gender and number marking on articles, (2) possessive constructions, (3) subject/verb agreement and subject dropping, and (4) word order flexibility and alternatives to the passive construction. The use of clitics in Spanish is also of particular interest in the study of agrammatism (see Reznick, Dubrovsky and Maldonado, 1995). We do not include them in the current study, however, as no equivalent of the Spanish clitics exist in English for comparison.

**Articles**

Both definite and indefinite articles in Spanish must agree with the nouns they modify in gender and number, as indicated below:

- Singular masculine - *el/un libro* (the/a book)
- Singular feminine - *la/una casa* (the/a house)
- Plural masculine - *los/unos libros* (the/some books)
- Plural feminine - *las/unas casas* (the/some houses)

As one can see from the examples given, Spanish articles carry not only redundant meaning (e.g., singular vs. plural), but redundant inflectional forms as well, i.e., all plural markings on nouns, articles, and even adjectives are formed with -s (e.g., *la casa blanca* ‘the white houses’). The saliency and redundancy of Spanish number markings on articles may affect the agrammatic patients ability to utilize them in language processing. Unlike previously investigated Romance languages such as French and Italian, agreement markings of gender and number in Spanish can be analyzed separately. Although in French the plural markings of nouns and articles are redundant in written language, the redundancy is not phonologically realized. Italian, on the other hand, marks gender and number agreement saliently and redundantly (e.g., *la ragazza* [the girl]; *le ragazze* [the girls]), however, these two elements are always combined in a single suppletive marker.

**Possessives**

Possessive marking equivalent to the English predicate possessive ‘the book is hers’ can be optionally formed with two different constructions in Spanish, *el libro es de ella* or *el libro es suyo*. In the construction *el libro es de ella*, possession is marked by the preposition *de* and the pronoun *ella* agrees in person, gender, and number with the possessor of the item. In the construction *el libro es suyo*, possession is marked by the possessive adjective which agrees with the owner of an item in person, but is inflected for gender and number agreeing with the object possessed. In this example, *suyo* is marked as masculine
singular agreeing with el libro, even though suyo refers to a female owner. Such a complex system of possessive agreement in Spanish offers the possibility of comparing the ability of the agrammatic patients to match semantic gender as indicated by the de + pronoun construction with their ability to match grammatical gender as indicated by suyo in parallel semantic functions.

Subject-Verb Agreement

The system of verb conjugation in Spanish includes unique inflections for each combined person and number marking:

- yo canto (I sing)
- nosotros cantamos (we sing)
- tú cantas (you-sg. fam. sing)
- vosotros cantáis (you-pl. fam. sing)
- él/ella canta (he/she sings)
- ellos/ellas cantan (they sing)

In addition, none of the inflected verb forms is created with a null inflection which would make the inflected verb equivalent to the verb stem, as in English sing. In fact, Spanish verb stems cannot stand alone in any form, finite or nonfinite. Based on Bates et al.’s (1987b) proposal that inflections in heavily inflected languages tend to be maintained in agrammatism and Grodzinsky’s (1984) finding that agrammatics will not omit inflections if such omissions result in nonwords, one would expect the uniqueness and necessity of verb agreement inflections in Spanish to promote the production of verb inflections by Spanish-speaking agrammatic patients. In addition, Spanish speakers make extensive use of pro-drop forms, forcing the listener to use the verb inflection to decipher the subject of a sentence. As English has only one unique verb agreement inflection (i.e., he/she sings), uses null inflections, and uses pro-drop forms only in informal conversation, one would expect the Spanish-speaking agrammatic patients to be much better at comprehension and production of verb agreement inflections than their English-speaking counterparts.

Word Order

In Spanish, the most frequent word order for active voice sentences is SVO, as illustrated in (a). However, there is considerably more flexibility for word order in Spanish than in English, as shown below.

(a) El perro encuentra a la chica
   “The dog finds the girl.”

The passive voice in Spanish, similar to English, is formed with the auxiliar verb ser and the past participle of the main verb, as shown in sentence (b).

(b) La chica fué encontrada por el perro
   “The girl was found by the dog.”
Although known by every Spanish-speaking individual, the passive form is limited to use in more formal situations (e.g., business letters or public speeches). A frequent alternative to the passive construction in informal speech is the use of active voice with an object-dislocation construction, yielding OVS word order, as in sentence (c) below. In a Spanish version of Caplan and Bub’s (unpublished) test of sentence production, approximately 50% of adult Spanish speakers (n = 1,114) produced object-dislocated constructions when asked to describe a picture by beginning with the semantic theme (Benedet and Caplan, unpublished).

(c) A la chica la encuentra el perro

DO-animate the (fem.) girl she (DO clitic) find (sg. 3p. pres.) the (masc.) dog

“The dog finds the girl./The girl is found by the dog.”

However, OVS word order is complicated by the obligatory use of object clitics. In active voice object-dislocation constructions, clitics agreeing in gender and number with the dislocated object must precede the finite verb. Sentences in the passive voice do not require object clitics; however, the past participle must agree with the subject in gender and number. The study of agrammatism in Spanish offers the opportunity to study the relative abilities of agrammatic patients to use passive forms of verbs as opposed to alternative active voice object-dislocation forms for the same pragmatic purpose.

The Spanish Version of the Morphosyntax Battery

In order to investigate aphasic patients’ ability to process grammatical syntactic constructions across modalities in English, Goodglass et al. (1993) created the Morphosyntax Battery (MSB) to allow for the parallel assessment of morphosyntactic structures in oral production, auditory comprehension, and reading comprehension. The current study focuses on the oral modalities of production and comprehension. In oral production, the English MSB contains three subtests focusing on noun phrase morphology (i.e., plurals and possessives), five subtests for verb phrase morphology (i.e., agreement, tenses, and auxiliary verbs), and two subtests for active and passive word order. In auditory comprehension, the English MSB provides three tests of noun phrase morphology, three tests of verb phrase morphology, and two tests for active and passive word order which parallel the constructions tested in oral production.

For the purposes of this study, the MSB was translated into Spanish and adapted by the first author, M.J. Benedet. The construction of an equivalent Spanish version of the MSB allowed us to test the use of noun phrase and verb phrase morphology as well as active and passive forms by Spanish-speaking agrammatic patients and compare their performance with that of the English speakers. The Spanish version of the MSB presented in this study consisted of 9 oral production tasks and 9 auditory comprehension tasks, described below. Some modifications of the stimuli have been required because of the different syntactic structures of the Spanish language and the slightly different procedures needed to elicit the proper target. Hence, some subtests have been slightly
modified, others have been eliminated, and three new subtests have been created to investigate the particular grammatical structures of Spanish discussed above. Despite the modifications of the Spanish MSB, the two versions of the tests still contained several subtests similar enough to provide a precise means of comparing equivalent syntactic structures used by Spanish- and English-speaking agrammatic patients.

**Materials and Methods**

**Subjects**

The Spanish-speaking subjects used in this study were six agrammatic Broca’s aphasics (3 female, 3 male) drawn from a pool of patients within the metropolitan area of Madrid. All were evaluated and diagnosed as Broca’s aphasics using the Spanish version of the Boston Diagnostic Aphasia Exam (BDAE, Goodglass and Kaplan, 1983). Five of the patients were right-handed, presented with a left hemisphere lesion, demonstrated a prototypical agrammatic speech output, and obtain an auditory comprehension mean score on the BDAE subtest of at least 50%. In addition, one of the selected patients presented with a crossed aphasia. Although she exhibited a classic Broca’s aphasia and was right-handed, her lesion was located in the right hemisphere, in the area homologous to Broca’s area. Her speech was nonfluent and agrammatic, and although her auditory comprehension score was only 47.6%, her low score resulted from massive failure on the Complex Ideational Material subtest only. As her performance on the other comprehension tasks was well above 50%, she was included in the study. Our selected patients ranged in age from 31 to 66 years (mean 45.8), times post onset ranged from 14 months to 17 years (mean 6.7 years), and education ranged from 2 to 17 years (mean 10.3). The performance of the Spanish agrammatic patients was compared to that of the same seven English-speaking Broca’s aphasics used by Goodglass et al. (1993). Table I presents background information for the six Spanish-speaking patients and for the seven English-speaking patients. Representative speech samples for the Spanish-speaking patients are given in Appendix A (see Goodglass et al. [1993] for the English samples).

**Oral Production Subtests**

In the oral production tasks, subjects were asked to either complete a sentence or provide a one-sentence description of a target picture. These production tasks elicited four types of noun phrase morphology (singular/plural, noun possessives (de + NP), de + personal pronoun possessives, and possessive adjectives), three types of verb phrase morphology (subject/verb agreement, verb tense, and low-content verbs such as ser and tener), and word order in active and passive sentences. In each of the oral production subtests of the Spanish MSB, the patients were presented with sets of one to three pictures which embodied a contrast related to the targeted grammatical structure. The examiner then used the pictures (or part of the picture) as a lead-in to the targeted grammatical item. Upon hearing the lead-in sentence, the subjects were asked to complete a sentence describing one of the pictures.

Examples from each oral production task are illustrated in items 1-9 below, along with the criterial grammatical elements tested. The correctness score for each subtest was based solely on the specified criterial elements. Any elaborations beyond the required response, whether correct or not, were not considered in the final score. Lexical substitutions that did not affect the criterial elements were also not considered in the correctness score, so as not to confound the grammaticality scores with a measure of lexical disturbance.
### TABLE I

**Background Information on Subjects**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Age</th>
<th>Edu. (yrs.)</th>
<th>TPO</th>
<th>Etiology</th>
<th>S.R.</th>
<th>A.C.*</th>
<th>Lesion site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spanish speakers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>41</td>
<td>15</td>
<td>17 yrs</td>
<td>Infarct</td>
<td>3</td>
<td>63.2</td>
<td>Left frontotemporal area</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>10</td>
<td>27 mos</td>
<td>Infarct</td>
<td>1</td>
<td>47.6</td>
<td>Right MCA territory (crossed aphasia)</td>
</tr>
<tr>
<td>3</td>
<td>41</td>
<td>8</td>
<td>13 yrs</td>
<td>Aneurysm</td>
<td>2</td>
<td>70.7</td>
<td>Left frontotemporal area</td>
</tr>
<tr>
<td>4</td>
<td>31</td>
<td>20</td>
<td>34 mos</td>
<td>Infarct</td>
<td>3</td>
<td>63.7</td>
<td>Left temporal lobe and subcortical structures</td>
</tr>
<tr>
<td>5</td>
<td>66</td>
<td>2</td>
<td>14 mos</td>
<td>Infarct</td>
<td>4</td>
<td>75.1</td>
<td>Left frontoparietal area</td>
</tr>
<tr>
<td>6</td>
<td>41</td>
<td>10</td>
<td>47 mos</td>
<td>Infarct</td>
<td>3</td>
<td>67.8</td>
<td>Left MCA and putamen; right subcortical lacune</td>
</tr>
<tr>
<td>English speakers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>60</td>
<td>16</td>
<td>5 yrs</td>
<td>Infarct</td>
<td>1</td>
<td>82.5</td>
<td>Broca’s area; parietal area-patchy</td>
</tr>
<tr>
<td>B</td>
<td>64</td>
<td>12</td>
<td>12 yrs</td>
<td>Infarct</td>
<td>2</td>
<td>83.8</td>
<td>Broca’s area, deep extension</td>
</tr>
<tr>
<td>C</td>
<td>74</td>
<td>13</td>
<td>13 yrs</td>
<td>Infarct</td>
<td>2</td>
<td>80.5</td>
<td>Temporal lobe and subcortical structures</td>
</tr>
<tr>
<td>D</td>
<td>62</td>
<td>16</td>
<td>12 yrs</td>
<td>Infarct</td>
<td>3</td>
<td>85.7</td>
<td>Broca’s area, Wernicke’s area, subcortical structures</td>
</tr>
<tr>
<td>E</td>
<td>73</td>
<td>8</td>
<td>14 yrs</td>
<td>Infarct</td>
<td>2</td>
<td>86.0</td>
<td>Posterior parietals lobe with subcortical extension</td>
</tr>
<tr>
<td>F</td>
<td>55</td>
<td>18</td>
<td>30 mos</td>
<td>Infarct</td>
<td>1.5</td>
<td>54.0</td>
<td>Broca’s area, sup. Wernicke’s area, internal capsule</td>
</tr>
<tr>
<td>G</td>
<td>55</td>
<td>20</td>
<td>4 yrs</td>
<td>Infarct</td>
<td>2</td>
<td>66.0</td>
<td>Anterior subcortical area, Wernicke’s area</td>
</tr>
</tbody>
</table>

S.R. = BDAE severity rating; A.C. = BDAE auditory comprehension score.

* Comprehension scores for Spanish are given in percentages correct instead of percentiles as proper norming in Spanish has not yet been completed.

**Noun singular/plural (12 items)**

1. **Aquí hay un reloj, aquí hay varios relojes. En esta imagen, los hombres están arreglando ______ /los relojes.** (Here is a watch and here are some watches. In this picture, the men are fixing ______ /the watches.)

   **Criterial elements:** Correctly inflected noun and article.

   Unlike the original English version, the article was not provided in the Spanish MSB. Given that the Spanish article is inflected for number, it seemed to us to be an important cue for the noun inflection, a cue not present in English. Thus the criterial elements for this task included the correctly inflected article as well as the noun.

**Noun possessive (de + NP) (6 items):**

2. **Este es el capitán y este es su barco. ¿De quién es este barco? _________ /del capitán.** (This is a captain, and this is his ship. Whose is this ship? _________ /the captain’s.)

   **Criterial elements:** Possessive marker de with the noun and its correct article.

   In the original MSB, the subject was given a lead-in to the answer, “it is the...”, however in Spanish, no lead-in was given for two reasons. First, the article was included in the de + NP construction. Second, the absence of the copula made it less likely for the patient to produce the possessive adjective suyo (his) while pointing to the captain.

**Possessives with de + personal pronoun (8 items):**

3. **Este gato es de ellos y este gato es _________ /de ella.** (This cat is theirs and this cat is _________ /hers.)
**Criterial elements**: Possessive marker *de* and the correct personal pronoun.

**Possessive adjectives (12 items):**

4) Aquí hay unos bastones y son de estos hombres; aquí hay una botella y es de estos hombres. Esta botella es suya, y estos bastones _________ /son suyos. (Here are some canes and they are the men’s; here is a bottle and it is the men’s. This bottle is theirs [fem. sg.], and these canes _________ /are theirs [masc. pl.].)

**Criterial elements**: Correctly inflected copula and possessive adjective.

**Subject/verb agreement (6 items):**

5) Las sopranos cantan y las bailarinas bailan. ¿Qué hace una bailarina? Una bailarina _________ /baila. (Sopranos sing and ballerinas dance. What does a ballerina do? A ballerina _________ /dances.)

**Criterial elements**: Correctly inflected verb.

**Verb tenses (12 items):**

6) En esta imagen la niña va a abrir la caja. En esta otra imagen la niña _________ /esta abriendo la caja /la está abriendo. (In this picture, the girl is going to open the box. In this other picture, the girl is opening the box/is opening it.)

**Criterial elements**: Correct tense and correct inflection for subject/verb agreement.

Two points must be made with regard to the tense subtest. First, for completed actions, responses with either the nominal or the pronominal direct object were accepted as long as the correct word order was maintained, i.e., pronominal objects had to precede the finite verb. Second, for the ongoing action, the use of the present progressive (e.g., *está abriendo* ‘is opening) is the best choice for this picture description context, but the simple present tense (e.g., *la niña abre la caja* ‘the girl opens the box’) was also accepted as correct.

**Auxiliary/low content verbs (6 items)**

7) Aquí, algunos peces tienen la boca abierta y algunos peces tienen la boca cerrada. Estos peces tienen la boca abierta y estos la _________ /tienen cerrada. (Here, some fish have their mouths open and some fish have their mouths shut. These fish have their mouths open and these _________ /have (it) shut.)

**Criterial elements**: Correct inflections of the verb and complement.

It should be noted that in Spanish the direct object pronoun (e.g., *la* in item 7) was provided as it precedes the verb. This presentation of the stimuli prevented the subjects from simply responding with *sí* or *no*.

**Active word order (6 items)**

8) Aquí hay un guarda y aquí hay un perro. En esta imagen, el guarda encuentra al niño. En esta imagen, _________ /el perro encuentra al niño. (Here is a ranger and here is a dog. In this picture, the ranger finds the boy. In this picture, _________ /the dog finds the boy.)

**Criterial element**: SVO active voice word order, regardless of morphological errors.

**Passive word order (6 items):**

9) Aquí hay un alpinista y aquí hay un chico. En esta imagen, el alpinista es encontrado por el perro. En esta imagen, _________ /el chico es encontrado por el perro. (Here is a hiker and here is a boy. In this picture, the hiker is found by the dog. In this picture, _________ /the boy is found by the dog.)

**Criterial elements**: theme-verb-agent word order with some grammatical indication of passive voice (e.g., passive verb form or *por* marking the agent).
Auditory Comprehension Subtests

The nine auditory comprehension subtests of the Spanish MSB were designed to match the oral production subtests as closely as possible, with the addition of one task focusing on possessive word order. Five subtests dealt with noun phrase morphology (i.e., singular/plural, noun possessives, de + pronoun possessives, possessive adjectives, and one additional test for possessive word order), three involved verb morphology (subject/verb agreement, verb tense, and low-content verbs), and one test tapped the comprehension of active and passive sentences. The active and passive stimuli were intermixed in the test administration, but were scored separately to be compared with performance on the active and passive production tasks.

For each of the auditory comprehension tasks, the examiner presented two pictures that illustrated the contrasting grammatical structure, then read a sentence corresponding to one of the pictures. The subjects were then asked to point to a picture that best described the given sentence. Both alternative sentences were given in randomized sequence for each of the subtests. Since 50% correct represented chance performance, scores from 26-75% were considered to be within the range of chance. A score of 75% or more was considered better than chance performance, while a score of 25% or below was taken to indicate a systematic reversal in the interpretation of the particular grammatical construction. Examples from each set of stimuli can be found in items 10-18 below.

**Noun singular/plural (12 items):**

(10) Están arreglando los relojes. vs. Están arreglando el reloj. (They are fixing the watches. vs. They are fixing the watch.)

**Noun possessives (de + NP) (12 items):**

(11) El bebé oso vs. El oso del bebé. (The baby bear vs. The bear of the baby.)

**Possessives with de + personal pronoun (8 items):**

(12) Señale el gato de ella vs. Señale el gato de ellos. (Show me the cat of her [= her cat] vs. Show me the cat of them [= their cat].)

**Possessive adjectives (12 items):**

(13) Señale el suyo (libro) vs. Señale los suyos (libros). (Show me his-masc. sg. vs. Show me his-masc. pl.)

**Possessive word order (10 items):**

(14) La madre del gatito vs. El gatito de la madre. (The mother of the kitten vs. The kitten of the mother.)

**Subject/verb agreement (12 items):**

(15) Come hierba vs. Comen hierba. (eat-3rd p. sg. grass vs. eat-3rd p. pl. grass.) Unlike the English MSB, which made use of ambiguous singular/plural subjects (e.g., sheep, fish, deer), the Spanish stimuli incorporated pro-drop forms to avoid marking number on the subject of the sentence.

**Verb tense (14 items):**

(16) La mujer ha vestido al niño vs. La mujer va a vestir al niño. The woman has dressed the baby vs. the woman is going to dress the baby.)
Auxiliary/low content verbs (12 items):

(17) Está nadando vs. Están nadando. ([It] is swimming. vs. [they] are swimming.)

Active and passive voice (20 items):

(18) a. La abuela besa a la niña. (The grandmother kisses the girl.)
   b. La niña besa a la abuela. (The girl kisses the grandmother.)
   c. La abuela es besada por la niña. (The grandmother is kissed by the girl.)
   d. La niña es besada por la abuela. (The girl is kissed by the grandmother.)

 Procedures

The production and comprehension tasks of the MSB were presented in a fixed pseudorandom order as to grammatical construction tested and modality, so that the subjects did not receive two similar tests together. However, each subject received all of the MSB tests in the same order. Subjects received 1-3 practice trials before proceeding with each subtests, and testing did not continue unless it was clear that the patient understood the task. Patients were tested either in their own homes or in the experimenter's office for approximately three one-hour sessions.

 RESULTS

The results of the current investigation are organized as follows. We first present the production scores for the Spanish speakers. These scores are grouped by general category (i.e., noun phrase morphology, verb phrase morphology, and word order) and presented in order of difficulty. The production scores are then compared with the comprehension scores, which are presented in the same order as the production scores to illustrate production/comprehension differences across equivalent tasks. To determine whether the relative difficulty of each task was significant, both the production and comprehension scores were submitted to Wilcoxon signed-rank tests. The relative difficulty of each subtest in Spanish is then compared to the relative difficulties exhibited by the English speakers on each production and comprehension subtest of the MSB.

 Oral Production Subtests

The mean percentages of correct responses for the oral production subtests can be found in Figure 1. For a more detailed representation, see Appendix B, which presents each subject’s percentage of correct responses on both the oral production and auditory comprehension subtests.

 Noun Phrase Morphology

Among those subtests dealing specifically with noun phrase morphology, the relative order of difficulty (from easiest to most difficult) was as follows: (1) noun singular/plural, (2) de + pronoun, (3) possessive adjective, and (4) noun possessive. However, on the Wilcoxon signed-rank test, only the difference between noun singular/plural (the highest) and noun possessive (the lowest) was
significant (p < .05). No significant differences were found among either the highest three subtests or lowest three subtests. In the noun singular/plural task, the primary error was omission of the article; in the noun possessive task, this error pattern was exacerbated by the additional omission of the possessive marker *de*. In the *de* + pronoun and possessive adjective tasks, the primary error involved substitution of the pronoun or adjective inflection.

**Verb Phrase Morphology**

Among the subtests focusing on verb phrase morphology, the relative order of difficulty was: (1) subject/verb agreement, (2) auxiliary/low-content verbs, and (3) verb tense. The patients performed significantly better on the subject/verb agreement subtest than on either of the other two tasks (p < .05, Wilcoxon signed-rank test), but no significant difference was found between low-content verbs and the verb tense subtests. The primary error on the subject/verb agreement task was substitution of the verb inflection. On the auxiliary/low content verbs task, errors consisted almost exclusively of verb omissions. The verb tense task was the most difficult of the entire

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**Fig. 1 – Group means for the Spanish MSB production subtests. Subtests are grouped by noun phrase morphology first, verb phrase morphology second, and finally production of active and passive sentences. S/P = noun, singular/plural; Pro = *de* + personal pronoun; Adj = possessive adjectives; Pos = noun possessives; Agr = subject/verb agreement; L-C = low-content verbs; Ten = tenses; Act = active voice sentences; Pas = passive voice sentences.**
MSB battery, with a mean of only 5.5% correct. Our agrammatic patients appeared virtually unable to produce any composite verb forms (i.e., auxiliary + main verb), in most cases omitting either the auxiliary or the main verb stem, or both.

**Active and Passive Word Order**

The production of active voice SVC sentences was significantly better than passive voice sentences (p < .05, Wilcoxon signed-rank test). Although thematic roles were respected, the passive was converted almost invariably into an active SVO form. Interestingly, the aphasic patients did not take advantage of the pragmatically correct OVS active voice construction in Spanish.

**Comparison of Oral Production with Auditory Comprehension Scores**

The mean scores for the auditory comprehension subtests can be found in Figure 2. As discussed in Goodglass et al. (1993), the scores for the production and comprehension tasks are not completely parallel due to the design factors of the MSB. On the production tasks, patients who were unable to produce the required forms scored zero. On the comprehension tasks, only an individual
score of 75% or more was considered to be significantly above chance, while a score of 25% or less was taken to indicate systematic reversal in the interpretation of the corresponding form. Because of this difference in deriving production and comprehension scores, the most appropriate means of comparison between the two was to compare the relative orders of difficulty among the tasks.

**Noun Phrase Morphology**

If we compare the five noun phrase forms in comprehension, we find that de + pronoun possessive construction was the easiest one for our patients, averaging 93.7% correct, significantly better than performance on any of the other tests (p < .05, Wilcoxon signed-rank test). No further significant differences were found among the possessive pronoun, noun singular/plural, possessive word order, and the noun possessive tasks, in which the mean scores (69.3% to 76.3%) were all at the upper level of chance. It is interesting to note that while plural and singular nouns were the easiest grammatical structures to produce, they were relatively difficult for the Spanish-speaking agrammatic patients to comprehend. This difficulty in comprehending singular and plural nouns was unexpected, considering Goodglass et al.’s (1993) findings that English-speaking agrammatic patients performed well in comprehending singular and plural nouns.

**Verb Phrase Morphology**

In oral production, the verb tense subtest was the most difficult in the MSB battery, and subject/verb agreement was significantly easier. Just the reverse occurred in auditory comprehension. Patients performed significantly better on the verb tense task than on either the low-content verbs or the subject/verb agreement subtests (p < .05, Wilcoxon signed-rank test). No significant differences were found between the low-content verb or subject/verb agreement tasks, both averaging chance level (66.8% and 66.1%, respectively).

**Active and Passive Word Order**

Unlike oral production, in which active sentences were significantly easier to produce than passive sentences, no significant differences were found between the patients’ ability to comprehend active and passive voice sentences. The scores for both SVO active voice sentences (mean 63.4%) and passive voice sentences (mean 51.7%) were only at chance level and were in fact the two most difficult comprehension tasks.

**Performance on the MSB by Spanish- vs. English-speaking Agrammatics**

To answer our question, as to whether or not our agrammatic patients were affected by language-specific requirements in syntactic constructions, we
compared the Spanish- and English-speaking patients in producing and comprehending particular grammatical structures. To do so, we used the production and comprehension scores of the English-speaking Broca’s aphasics cited in Goodglass et al. (1993). Because the various grammatical constructions were not identical in English and Spanish, we could not analyze the data directly, using language group as a variable. Alternatively, we sought to determine whether the English speakers and the Spanish speakers demonstrated the same amount of difficulty with similar grammatical constructions. To compare with the scores of the Spanish speakers, the scores from the English-speaking agrammatics on both the production and comprehension subtests were reanalyzed using a Wilcoxon signed-rank test with a significance value of .05.

Since, in the Spanish version of the MSB, one production task and two comprehension tasks had been devised specifically for the Spanish-speaking patients (i.e., possessive word order and possessive predicate adjectives with suyo), these tasks were not a part of the cross-linguistic analysis. Our comparison of Spanish- and English-speaking agrammatic patients included three of the production and comprehension subtests focusing on noun phrase morphology (i.e., noun singular/plural, noun possessives, and possessive pronouns), as well as all of the tasks involving verb phrase morphology and active/passive word order.

Production of Grammatical Structures

Figure 3 presents the group means for the Spanish and English speakers on each of the eight production subtests. In general, it appears that the relative ease or difficulty of producing equivalent grammatical constructions was similar in both languages, with one exception. Namely, the Spanish speakers were much better at producing subject/verb agreement inflections (63.8% vs. 42%). A comparison of individual patient’s scores in both language groups can be found in Table II. Spanish speakers are represented by numerals and English speakers by letters. Because, unlike English, verb stems in Spanish are not legal words and because verb agreement in Spanish has a much higher cue validity than in English, we predicted that Spanish speakers would perform better on verb inflections than English speakers. However, we expected the Spanish speakers to be better than the English speakers at both production and comprehension of verb agreement markers, which is not the case, as discussed below.

It is important to note that the apparent difference between the Spanish- and English-speaking patients in producing singular and plural nouns (78% vs. 44.5%) is not real.

As described above, the Spanish speakers, unlike the English speakers, were required to produce the correctly inflected article along with the noun, the omission of which was their primary error. If we only consider the production of the plural noun form, ignoring the article, the Spanish speakers scored a mean of 72.3%, the same as the English speakers. Table II displays the individual scores of the Spanish speakers when only the noun inflection is considered.
TABLE II
Individual Production Scores on the Morphosyntax Battery*

<table>
<thead>
<tr>
<th>% Corr</th>
<th>Noun sg/pl**</th>
<th>Poss pro</th>
<th>Noun poss</th>
<th>S/V agr</th>
<th>Tense</th>
<th>L-C verbs</th>
<th>Active order</th>
<th>Passive order</th>
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<td>5,c</td>
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<td></td>
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<td>a</td>
<td></td>
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<tr>
<td>80-89</td>
<td>e, f</td>
<td>a, d</td>
<td>4, 5</td>
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<td></td>
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<td>5, e</td>
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<td>50-59</td>
<td>1, g, d</td>
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<td></td>
<td>a, e, g</td>
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<td></td>
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<td>b, f</td>
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</tr>
</tbody>
</table>

* Numerals represent Spanish speakers; letters represent English Speakers.
** Only noun inflections were considered for both the Spanish and English speakers.

Comprehension of Grammatical Structures

Figure 4 presents the group means for the Spanish and English speakers on the auditory comprehension subtests. Table III displays the corresponding individual scores. Although, in general, the English-speaking agrammatics
TABLE III

Individual Comprehension Scores on the Morphosyntax Battery*

<table>
<thead>
<tr>
<th>% Corr</th>
<th>Noun sg/pl**</th>
<th>Poss pro</th>
<th>Noun poss</th>
<th>S/V agr</th>
<th>Tense</th>
<th>L-C verbs</th>
<th>Active order</th>
<th>Passive order</th>
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<td>a, b, c</td>
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<td>e, g</td>
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<td>3, g</td>
<td>b, g</td>
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<td>1, 6, b, e</td>
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<td>3, 6, f</td>
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</table>

* Numerals represent Spanish speakers; letters represent English Speakers.

seemed to perform better than the Spanish-speaking patients in comprehension, the order of difficulty in comprehending the grammatical structures in both languages remained roughly the same. Two particularly interesting phenomena
emerged from comparison of the individual grammatical constructions: (1) the Spanish speakers, like the English speakers, scored only at chance in comprehending subject/verb agreement inflection, and (2) the Spanish speakers performed only at chance level in comprehending both active and passive sentences, while the English speakers performed well above chance on both tasks. Neither of these results would be expected given the ability of the Spanish speakers to produce these constructions. Nor would they be expected given the markedness of these grammatical structures in Spanish. These results may be more related to the overriding cue costs of these constructions in sentences processing, rather than the language-specific cue validity of structures as discussed below.

**GENERAL DISCUSSION**

In this study, we examined the performance of a group of Spanish-speaking agrammatic Broca’s aphasics on production and comprehension of a number of linguistic structures, presented in a structured morphosyntactic battery. The purpose of this analysis was threefold: (1) to determine which morphosyntactic constructions are particularly impaired in Spanish-speaking agrammatic patients, (2) to determine whether or not there was a parallel between patterns of morphological/syntactic impairment in oral production and auditory comprehension, and (3) to compare the performance of the Spanish-speaking agrammatic patients with that of the English speakers in order to determine whether the compromised language items were similar in the two languages.

In production, the Spanish-speaking Broca’s aphasics were best at singular/plural noun inflections, subject-verb agreement, and active SVO word order. They were particularly impaired on noun possessives (de + NP), low-content verbs, verb tenses, and passive voice sentences. In auditory comprehension, a very different pattern emerged. The Spanish speakers were best at comprehending possessive constructions with de + personal pronoun, possessive adjectives (suyo), and tenses. The noun possessive as well as active and passive constructions were the most difficult.

**Cue Costs in Production and Comprehension of Syntax and Morphology**

It would appear from our Spanish results that both production and comprehension of morphological and syntactic features are disturbed in Spanish-speaking agrammatic Broca’s aphasics. However, these disturbances are not parallel with respect to the production and comprehension of individual structures. As cue validity is part of core grammatical representations in a given language, it alone cannot account for these modality-based differences. When the cue costs of each grammatical item are considered together with its cue validity, however, clear patterns related to comprehension and production costs begin to emerge. Most discussions of cue costs have related to comprehension. In production, we must consider additional issues in cue cost, as discussed below, which have not been previously mentioned in the aphasia literature.
As presented in the Competition Model, cue costs are based on perceivability and assignability. Perceivability, referring to the perceptual saliency of a structure, is solely a factor in comprehension. Assignability, referring to the amount of information which must be held in working memory in order to utilize a particular structure, is involved in both comprehension and production, although the processing costs for a particular structure may not be equivalent in both modalities. For example, case marking, such as the Spanish *a* for accusative case in active voice sentences, is considered low in cue cost because it can be assigned immediately within a single constituent. However, case marking is only low in cue cost with respect to comprehension, as the listener knows immediately that the constituent marked with *a* is the direct object. In production, on the other hand, the speaker must hold the entire propositional message in working memory to assign case. Case marking in production could therefore be considered very high in assignability costs. As cue costs have been most clearly defined for comprehension, we will discuss the performance of our Spanish speakers on the comprehension tasks of the MSB first.

In comprehension, grammatical structures were better retained if the cue validity was higher than the cue costs in general AND perceivability costs were low. Personal pronouns, possessive adjectives, and tense markings in Spanish are all very high in cue reliability and availability. In addition, they are all easily perceivable. Although personal pronouns and possessive adjectives are relatively high in assignability costs, tense could be considered low in assignability costs in comprehension. Once the listener hears the verb, the tense can be assigned (in a main clause) without considering the other constituents, making it locally assignable. The high cue validity coupled with the low comprehension costs may account for the relative preservation of tense comprehension. Structures such as noun singular/plural marking and verb inflection were marked with a single phoneme, making them very difficult to perceive. Despite the very high cue validity of these structures, the high cue costs in perceivability resulted in poor performance in auditory comprehension. The prepositional markers, *de*, *a* and *por*, as used respectively in the noun possessive, active and passive constructions, are all low in cue reliability, as each preposition has many different meanings in Spanish. In addition, the perceivability costs of these items is relatively high, as they are all single unstressed syllables in a sentence context. Furthermore, *a* and *por* interact with word order in active and passive sentences, which in Spanish is very low in cue validity. The interaction of these weak cues in comprehending active and passive sentences is discussed in more detail below, when we compare the performance of the Spanish speakers with that of the English speakers.

In oral production, the cue validity of a grammatical construction is the same as in comprehension. In terms of cue costs, assignability applies to production as well as to comprehension. Those constructions which are assignable within a single constituent would be considered lower in assignability costs than those involving dependencies across two or more constituents. An additional factor in production costs, which has not been considered in the Competition Model but which we find critical, is the origin of a grammatical construction within the production process. Referring to Levelt’s (1989) model of language production,
certain grammatical markers carrying independent semantic meaning (e.g., quantification, possession, tense, aspect, and topicalization) must be indicated at the message level, forming part of the preverbal message which feeds into the grammatical formatter. In some cases, grammatical markers (e.g., possession) originate as complex semantic propositions. Other grammatical constructions, based on subcategorization rules and grammatical conventions in the language (e.g., grammatical gender, agreement marking, and word order rules) originate in the grammatical formatter. Grammatical constructions originating at the message level, especially those stemming from complex semantic propositions, require additional working memory to embed the semantic information in the generated message. We would therefore expect constructions reflecting information at the message level to be higher in cue costs than rule-based, subcategorized constructions.

The grammatical constructions which were easiest for our Spanish-speaking aphasic patients to produce were subject-verb agreement, active SVO word order, and singular/plural noun inflections, while the most difficult were noun possessives, tense markings, and passive voice constructions. Subject-verb agreement and SVO word order originate in the grammatical formatter and do not arise directly from semantic information found in the message. Even though SVO word order is low in cue validity in normal speakers of Spanish, it can be considered a default order assigned by the grammatical formatter, when no topicalization is indicated at the message level. Singular/plural noun inflections originate at the message level; however, they are still relatively low in cue costs, as they do not arise from an independent semantic proposition. Furthermore, they are very low in assignability costs, as they only involve a single constituent. Grammatical constructions which originate from propositional information at the message level (e.g., noun possessives and tense) were almost impossible for our agrammatic patients to produce. Passive voice constructions result from topicalization at the message level, and additionally required very high cue costs in assignability. Failure to topicalize would also explain why the patients did not revert to the common OVS active voice alternative to the passive voice. To summarize, production of a grammatical construction, regardless of its inherent cue validity, was directly related to its cue costs, particularly those costs arising from message level generation of the semantic marking underlying the construction.

Language-specific Effects in Agrammatism

In comparing the performance of the Spanish-speaking agrammatic patients with that of the English speakers, the relative order of difficulty in the production and comprehension of grammatical structures was similar with two exceptions: (1) the Spanish-speaking agrammatic patients were relatively better at producing subject/verb agreement, and (2) they were significantly worse at comprehending both active and passive voice sentences. These two differences between the language groups can be explained, at least in part, by the relative cue validity and cue costs of these syntactic features in each language.

As stated above, Spanish subject/verb agreement inflections are uniquely
differentiated as to person and number and no null forms exist. In addition, they are extremely high cue reliability and availability. In contrast, English has a distinct agreement marker only for the third person singular and all other present tense forms are equivalent to the verb stem, resulting in low cue reliability, and agreement marking at all only occurs in the present tense, resulting in low cue availability. The cue costs for subject-verb agreement are equivalent in both languages; agreement originates in the grammatical formulator and must be assigned across constituents. The high cue validity of verb inflections in Spanish probably accounts for the better preservation of subject/verb agreement inflection in production by Spanish-speaking agrammatic patients. When the verb inflection was substituted, the infinitive form was used, not a form indicating the wrong person or number agreement. In other words, failure to mark the proper agreement stemmed from a failure to mark finiteness altogether. These findings agree with those in other languages such as Dutch, German, and Italian, in which patients tend to substitute a nonconjugated, infinitive form for a conjugated, finite verb (Heeschen, 1985; Kolk et al., 1985; Miceli and Mazzucchi, 1990).

In comprehension, the Spanish and English speakers did not differ in their performance. As discussed above, perceivability is critical in auditory comprehension. The high perceivability costs in both languages (both depend on a single phoneme) could offset the differences in cue validity found at the representational level. Logically, if subjects cannot perceive a grammatical morpheme, they cannot comprehend it.

Regarding the comprehension of active and passive sentences, English has only SVO word order for active voice sentences, except in certain pragmatic conditions where OSV word order can be used (e.g., the money, Philip lost). OSV word order in English, however, is only used for strong contrastive emphasis and would not be used in isolated sentences like those in the MSB. In most cases, the passive voice would be used when the semantic theme is topicalized in the sentence. In Spanish, direct objects may be topicalized using OVS word order with active voice sentences, instead of using a passive voice construction. In fact the passive voice in conversational Castillian Spanish occurs much less frequently than in English and is usually associated with a formal educated sociolect. We would propose that the lack of relationship between word order and thematic role assignment in Spanish is the main reason why the agrammatic patients fail to comprehend reversible sentences in either the active or passive voice. In Italian, which has a similar word order flexibility to that seen in Spanish, Bates et al. (1987a) found that both normal control subjects and Broca’s aphasics were much less likely to assign active SVO structure to NVN sentences than the English-speaking subjects. In English, both normal control subjects and Broca’s aphasics assigned the agent role almost exclusively to the first noun (averaging 89% for both groups). In Italian, however, the subjects were barely above chance in assigning the agent theme to the first noun (averaging 64% for both groups). In comprehension of reversible SVO active sentences, our English speakers averaged 94% correct in assigning the agent role to the first noun, while our Spanish speakers averaged only 63.4% correct, exactly in line with performance of the Italian speakers in Bates et al.’s study.
If we account for the language differences in comprehending active sentences by claiming that word order has much greater cue validity in English than in Spanish, this then raises a number of questions as to how the agrammatic patients in English and Spanish use available morphology for comprehension. Unlike Italian, Spanish uses the preposition *a* to mark animate direct objects. In active voice sentences, the Spanish speakers did not use the preposition *a* to determine the thematic roles in the sentence. Although carrying very weak cue validity, as it has both low reliability (the preposition *a* can have several different meanings) and low availability (*a* is used only with animate direct objects; inanimate objects are unmarked), *a* has an extremely high contrast validity. Among normal speakers, in fact, it is the most overriding cue in determining semantic role (Kail, 1989). For the aphasic speakers, however, even the converging cues of word order and direct object marking did not aid in assigning thematic roles.

The relative cue validity of word order, furthermore, cannot explain the performance differences found between our two language groups in the comprehension of passive voice sentences. The fixed SV word order in English is not a direct marker of thematic role, but only of syntactic subject. Nouns indicating semantic agents, themes, goals, and even roles such as instrumentals (e.g., the hammer hit the nail) may serve as syntactic subjects in English. The English-speaking aphasic patients had to be able to use either the verb morphology, the agent marker ‘by’, or the convergence of both cues to comprehend the passive voice sentences, and they were well above chance in doing so, even though they were relatively worse at comprehending passives compared with actives (p = .06, Wilcoxon signed-rank test). Why then should the Spanish speakers have so much more difficulty in comprehending passives, when the grammatical morphology of passives in Spanish is so similar to that in English? We cannot say that the Spanish speakers are generally worse than the English speakers in comprehending grammatical morphology, as the relative difficulty of comprehending other grammatical structures was identical to that in English. The comprehension of active and passive sentences in Spanish deviates from the overall performance pattern displayed by the two groups. We have at this time no clear answer to that question. It is possible that the performance differences we found are related to the differences of the relative frequency of passive voice in Spanish and English.

**CONCLUSION**

In this study, we have presented an overall analysis of agrammatism in Spanish. When considering performance within a particular language, we found that the ability to comprehend a grammatical construction was strongly related to its perceivability costs plus its cue validity. The production of a grammatical construction was directly related to its cue costs regardless of its cue validity. Moreover, we more clearly defined the differences in cue costs with regard to comprehension and production.

When comparing the Spanish-speaking agrammatic patients to their English-speaking counterparts, we found that the relative difficulties of various
grammatical constructions in both production and comprehension were strikingly similar, with two exceptions: (1) the Spanish speakers were better at producing subject/verb agreement, and (2) they were much worse at comprehending both active and passive sentences. The better production of subject/verb agreement can be accounted for by the higher cue validity of agreement in Spanish. The difficulty in comprehending active sentences is explained, in part, by the lower cue validity of word order in Spanish. The great disparity between the two language groups in comprehending the passive voice may be related to the lower frequency of the passive voice in Spanish, but the good performance by the English speakers would not be predicted and cannot be accounted for by the Competition Model.

This study raises a number of questions which must be further explored. We need to look further at the relative performances of fluent and nonfluent patients. We also need to investigate the possible interactions of word order strategies with morphological cues. Future cross-language studies such as this one using a battery of production and comprehension tests across two or more languages should prove fruitful, particularly when the languages compared have several structures in common and differ in only a few grammatical structures which vary in relative cue validity or cue costs. In this way, we can better see how the cue validity and cue costs of grammatical structures in a language may affect its relative loss or retention in agrammatism.

Acknowledgements. This work was supported in part by a Spanish DCICYT PB90-0236 research grant to Maria J. Benedet. We would like to extend our special thanks to Elizabeth Bates for her many insightful comments on a previous draft of the manuscript.

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(Received 17 July 1997; accepted 25 September 1997)
Appendix A

Descriptions of the BDAE Cookie Theft Picture by Spanish-speaking Patients

Patient 1 - Interior... ese galletas... ese... niñas... ese... m... padre... no sé... cocina... ese... gato(1) eh... no sé... agua... ese no... ese... bien... no sé... no... ese agua... suelo ese... contino, pero no, no sé... ese tazas ese... lleta ese... comer, niña ese comer anqueta ese... sí, no, ese... cuidado ese eh?... romper... sí, no pero bien, sí... gato... ese... ese sí...

Patient 2 - Galletas... taburete... gato... taburete... niños, galletas... mamá... mamá... cae, caer, fregadero, fregadero... agua... cómo se llama [points to the dish]... fregar fregar... gato... galletas... taza... cómo se llama... éstas éstas [points to the cupboard]... cocina, cocina bandeau bandeau... puertas puertas... vusillos vusillos... la luna, no... la luna... puerta, no, no, no... lazo, lazo, calcetines, calcetines... zapatos, zapatos... cola, cola... bu... bu... bugotes... cortina... mandil... cortos, cortos...

Patient 3 - Pum, pum, pum, pum agua, agua [Ex: Anything else?] agua, niña... m... m... eh... eh... niño eh... niño eh... comer ca... ca... ca... ca... ca... ca... no, hoy no... ca... g... g... ca-xe-tas... yo... agua... ca-xe-tas... y eh... eh... eh... sixón, no eh?... sí... sixa... pum, pum, más? eh... jato... eh... niña... eh... mamá... eh... cocina... eh... pum, pum, agua... comer... no, eh... no, eh... no, ay! no... no... eh... eh... pum, pum, ventana... exo pum, eh... eh... hoy no hablar, no... hoy menos, eh?

Patient 4 - Una señora, un mujer, hombre, gato, galletas, el grifo, un comedor, una mujer, el grifo abierto... cerrado, agua la pila bu... bu... un hombre se cae en la puerta-silla.

Patient 5 - Éste... sube por un banco... ésta tiene una... veja... una mesa... éste lleva una posca... y está mando una bolleta el o... je... un baco [points to the cat]... esto dos tazas... [points to the water running over, but cannot say anything] unas cortinas... están corrida y yo ya no sa... sa...

Patient 6 - Hala!... agua, bueno... je... grifo... bueno, por favor, no sé... galleta... Javier todos días, Juan todos días, todos días, Silvia no, pero Juan sí... galletas... ah... ay favor!... ah... cuchillo... no, no... banqueta, pero... banqueta y caer, caer, bueno... pequeño, pequeña [points to the girl]... ah reir, reir no? bien?... gatos, gatos, perros, gatos, gatos, sí... está tum...

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(1) The Spanish version shows a cat sleeping on the floor.
APENDIX B

Individual Scores for the Spanish-speaking Patients

### Percentage Scores for the Production Subtests

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