

TENSE-MOOD-ASPECT FREQUENCY, VERB-FORM REGULARITY AND
CONTEXT-GOVERNED CHOICE IN AGRAMMATISM: EVIDENCE FROM
SPANISH *SER* AND *ESTAR*

by

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Abstract

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Barbara O'Connor Wells

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ABSTRACT

This dissertation study examined the effects of tense-mood-aspect frequency (TMA Frequency), verb-form regularity (VF Regularity) and the semantics of context-governed choice (CGC) on verb production in agrammatism- an acquired language disorder resulting from brain damage (e.g., stroke), in which speech output is produced in a slow and labored fashion and utterances are short in length and missing crucial syntactic and morphological features of the language. Although numerous factors have been proposed to contribute to agrammatism and its cross-linguistic manifestation, none have been able to fully explain this disorder. We chose the Spanish language, and its dual-copula system, to test these three factors that have been nominated as important and likely candidates to explain the disorder of agrammatism. The Spanish language is a useful resource to examine these factors, in that it possesses two copula verbs: *ser* and *estar* (*be* in English), which differ semantically (depending on the context of the sentence), as well as in frequency and form regularity.

Eighteen Spanish-speaking individuals (six participants with agrammatism, twelve control participants) participated in a sentence-completion task to examine the influence of the three previously-mentioned factors on verb production in agrammatism. The results indicated that the factors of TMA Frequency and VF Regularity facilitated copula verb production in Spanish agrammatism, whereas CGC did not.

For our participants with agrammatism, the results revealed the following: 1) they produced the present tense of the copula verbs more correctly than the imperfect past tense, 2) they were more accurate on the more regular copula verb (i.e., *estar*) than the more irregular one (i.e., *ser*), 3) they produced rule-governed uses of the copula verbs more accurately than CGC uses and 4) when allowed a copula choice, three of them strongly preferred *estar*, while the remaining three preferred *ser*.

The error analysis showed further that both groups were heterogenous in their overall error patterns. A feature-distance analysis revealed that both the control group and the agrammatic group typically produced errors that were off by one feature during the task. However, they diverged in their pattern of errors (i.e., the most common error pattern was “*ser* for *estar*” errors for the control group, with the opposite pattern (“*estar* for *ser*” errors) for the agrammatic group).

This study furthers our understanding of copula verb production in agrammatism, since cross-language studies have demonstrated its vulnerability to aphasia in languages where only one copula verb exists (Menn & Obler, 1990) and adds to the growing body of literature on how the factors of TMA Frequency and VF Regularity, but not CGC, contribute to verb production in agrammatism.

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Chapter 1: Introduction

The purpose of this dissertation study was to examine how the factors of tense-mood¹-aspect² frequency (hereafter, “TMA Frequency”), verb-form regularity (hereafter, “VF Regularity”) and context-governed choice (hereafter, “CGC”) contribute to verb production in agrammatic aphasia. In this study, we choose the Spanish language, and its dual-copula system, to compare and test these factors as they relate to the disorder of agrammatism. Spanish is a useful language to examine these factors, in that it possesses two main copula verbs: *ser* and *estar* (both of which translate to *to be* in English), which differ semantically (depending on the context of the sentence), as well as in overall frequency and in form regularity. By comparing errors on *ser* to those on *estar*, the Spanish language allows us to answer the research questions motivating this dissertation study, which will be introduced at the conclusion of this chapter.

The goal of the following sections is to motivate this study by highlighting the conceptual basis underlying this investigation of verb production in agrammatism. I first begin by defining the disorder of agrammatism. Following this, I outline the characteristics of agrammatism in English, since much of the research on agrammatism has been conducted on English-speaking populations, and this language has been used as the basis for describing the manifestation of agrammatism in other languages. I then define the term “copula” as it is used throughout this study, before turning to a discussion of the copula verb system in Spanish and English. I move from there to what cross-dialect and cross-language agrammatism research has revealed about copula verbs, and

¹ “Mood” in this study is always indicative.

² By “aspect,” we mean “the grammatical category associated with verbs that expresses a temporal view of the event or state expressed by the verb.”

<http://www.sil.org/linguistics/GlossaryOfLinguisticTerms/WhatIsAspect.htm>, retrieved 2-15-10)

then to what we know thus far about the manifestation of agrammatism in Spanish. I conclude the discussion of agrammatism by describing the factors crucial to this study of agrammatism: TMA Frequency, VF Regularity and CGC.

In the chapters that follow, I explain the methodology for this study and present the results, discussion and conclusions.

1.1 Agrammatism Defined

Agrammatism can be broadly defined as a disorder of speech-language production, usually concomitant with Broca's aphasia, in which the grammatical features of the language are impaired or inaccessible to the speaker. More specifically, this disorder is characterized by "slow, halting speech, by short and/or fragmentary sentences, and by limited use of the syntactic and morphological resources of language" (Menn & Obler, 1990a, p. 3). Goodglass (1993) suggested that for the disorder of agrammatism, there is a "prototypical form," in which there are overt omissions of grammatical functors, with sentence structures broken into groupings "that rarely exceed three or four syntactically-related words" (Goodglass, 1993, p. 106). In the most severe form of this disorder, agrammatic speakers produce sentences composed only of nouns strung together; in milder forms of the disorder, functors (i.e., free grammatical morphemes, such as articles, auxiliary verbs, etc., and inflectional affixes) are omitted or substituted for (O'Connor, Anema, Datta, Signorelli & Obler, 2005). Cross-language studies of languages where only one copula verb exists have found that copula verbs are vulnerable to omission in the "telegraphic" style of speech produced by agrammatic speakers (see Menn & Obler, 1990).

Patient variability with respect to the grammatical features that are spared in agrammatism or vulnerable to it makes the task of creating a universal definition of agrammatism challenging. Although commonalities of some agrammatic features are noted among speakers of different languages diagnosed with agrammatism (e.g., Menn & Opler, 1990 found cross-linguistic evidence of more omissions of low-content verbs, such as *have* and *be*, than of lexical main verbs) the overall manifestation of this disorder differs from language to language (e.g., Benedet, Christiansen & Goodglass, 1998 found more difficulty with comprehension of active and passive sentences in Spanish speakers with agrammatism compared to their English-speaking counterparts). Therefore, it is essential to describe the features of agrammatism within the context of the language(s) in question (Goodglass, 1993). However, we must expect some similarities and some specific differences in the cross-language profiles of agrammatism (Ardila, 2001).

In the following section, I discuss the features of agrammatism in English: the language typically used to compare how agrammatism manifests in other languages.

1.2 Agrammatism in English

Agrammatism in English is manifested predominantly as the omission of, or substitution for, functors. Standard American English (SAE) contains numerous free-standing functor words, including the verb *be*. While agrammatic speakers of English usually preserve word order: i.e., the canonical word order of subject-verb-object (SVO), they omit free and bound morphemes (including functors, like “is”) and inflections, like “-ing” and “-ed” that mark tense. Thus, agrammatic speakers are able to communicate their intended message in short, sparse, telegraphic utterances (e.g., “He eat” for “He is

eating”) that lack key grammatical information. Benedet et al. (1998) proposed that this reliance on English as a research comparison for the manifestation of agrammatism in other languages is the main reason why so many unanswered questions about the cross-language effects of agrammatism still remain.

In the next section, I define the term “copula,” for the purposes of this dissertation, since we will be examining if the copula verb difficulties that English speakers with agrammatism demonstrate are mirrored in Spanish-speakers with the same disorder.

1.3 Copula Defined

From Aristotle’s time to the present, the functions of the copula have been studied and debated. As described by Moro (1997), the term “copula” originated from the Latin word *copulare*, meaning “to link.” This link occurs between the subject and the predicate of a sentence (e.g, “John *is* a man”- “Juan *es* un hombre”). The copula helps associate the subject of the sentence with the predicate (i.e., the state of being “a man” is attributed to John). When this copula is a verb or a verb-like part of speech (e.g., *be* in English; *ser/estar* in Spanish), it is called a “linking verb.”

The copula verb in English and other Indo-European languages is irregular and contains various forms. For example, in English there are eight forms that the copula verb may take (“be,” “am,” “is,” “are,” “being,” “was,” “were,” & “been”), while there are 105 forms of the Spanish copula verbs *ser* and *estar* combined that express the same range of functions that these eight English copula verb forms do

(<http://www.answers.com/topic/copula-1>, retrieved 9/29/08). A sentence, therefore, is

considered a copular sentence “when the main verb is *be* or its equivalent in languages other than English” (Moro, 1997, p. 23).

While the term “copula” is typically associated with the main copula verb of a given language (e.g., *be* in English; *ser/estar* in Spanish), it can also be used to refer to certain other light verbs in the language (e.g., “seem” - “The girls seem tall today;” “feel” - “The boys feel sick this morning” in English). However, in our study, we use the term “copula” specifically to refer to the primary copula system in Spanish: *ser* and *estar*.

In the following section, the dual copula system in Spanish is contrasted to the copula verb *be* in English, for the purpose of exposition for the English-speaking reader and to explain the semantic distinction between *ser* and *estar* in Spanish.

1.4 The Copula Verb System in Spanish and English

Spanish is a morphologically-rich language that relies much more on inflection for meaning and uses more inflectional categories than English (e.g., Fantini, 1985; Merino 1992). This is particularly evident in its verb system, where verbs are marked for tense, aspect, person, number and mood. One area of particular distinction between Spanish and English verb morphology lies in the forms and uses of the copula verb(s).

In the English language, a single copula verb (i.e., *be* and its derivatives) exists as a means of connecting the subject of a sentence with a description (Anderson, 1995). Research has shown that the verb *be* and its derivatives are the second most common word class in the English language (Sera, 1992), while others have shown that *be* is the most common verb in the English language (Bull, 1965). According to the theory of copula support (Dik, 1980) the copula verb (e.g., *be* in English) is generally considered to

be a “semantically-void,” supportive device, which can often be deleted in a language like English without modifying the semantic value of an utterance.

Such is not the case with the Spanish language. In Spanish, mastery of the copula requires comprehension and production of two semantically distinct, yet overlapping *be* verbs: *ser* and *estar* (Anderson, 1995; de Mello, 1980; Garcia, 1983; Roldán, 1974; Sera, 1992; Sole & Sole, 1977). Linguists have studied and debated the uses of these two Spanish copula verbs for many years, due to their high frequency of usage and the numerous meanings and purposes they serve (Sera, 1992). Differential frequency of usage has been suggested; although *estar* is highly frequent, *ser* is reported to be used four times more frequently than *estar* (Campbell, 1940). *Ser* is proposed to be acquired earlier, while *estar* is gradually acquired over time (Guntermann, 1992).

The linguistic debate over the Spanish *ser* vs. *estar* distinction has resulted in the proposal of behavioral, structural and semantic views regarding the uses of these two copula verbs (Roldán, 1974). The behavioral view suggests that Spanish speakers use these two verbs to distinguish entities as having undergone a change (*estar*) vs. no change (*ser*). Proponents of the structural view postulate that the two verbs are essentially variations of one verb and that their contrast is distributional, not semantic. In other words, there are structural environments where *ser* is used, but not *estar* and vice versa (e.g., a temporal adverb can follow *ser* in a sentence but not *estar*, Stevenson, 1970, p. 170). By contrast, the semantic view proposes that the distinction between these two verbs is of a semantic nature, which Roldán proposed is not overtly different from the behavioral view mentioned above, except that the latter view “ascribes semantic responsibility to the copula” (p. 69). One of the goals of this dissertation study was to

explore this semantic view of the Spanish copula verbs, in order to determine if semantics, with respect to CGC, contributes to verb production in agrammatism.

Research on the Spanish language has revealed that these two Spanish copulas and their respective forms are typically not interchangeable, since they have distinct semantic and syntactic functions. With respect to semantics, the main distinction between *ser* and *estar* lies in the underlying meaning each verb conveys. According to de Mello (1980), the major semantic contrasts that have been proposed for these two verbs are the following: permanent (*ser*) vs. transient (*estar*), quality/nature (*ser*) vs. state (*estar*) and inherent (*ser*), vs. accidental (*estar*). Serrano and Serrano (1992) postulated the dichotomy of whatness (*ser*) vs. howness (*estar*). Chung Cheng (2002) proposed that *ser* is used when the subject of the sentence is being compared to others, while *estar* is used when the subject is being compared to him/herself under varying conditions. Bull (1942) suggested that *ser* is used when the speaker is making a first impression or describing a normal concept, while *estar* is used when there has been a change from the average or norm.

A detailed description of the functions and uses of these two verbs is provided in Sole and Sole (1977, pp. 266-268) and remains applicable today. See Tables 1 and 2 for examples of the major contrasts of these verbs in their function as copulas, as proposed by Sole and Sole (1977).

Table 1: *Ser-* Copula Uses (adapted from Sole & Sole, 1977)

1. Used with nouns or as part of a noun phrase. <ul style="list-style-type: none">• “El vestido <i>es</i> para Elena.”- “The dress is for Elena.”
2. Used with adverbs of place to express origin or occurrence of an event. <ul style="list-style-type: none">• “Ella <i>es</i> en Irlanda.” - “She is from Ireland.”
3. Used with adverbs of time to express temporal relationships. <ul style="list-style-type: none">• “<i>Son</i> las tres.” – “It is three.”
4. Used with adjectives to express the existence of a quality. <ul style="list-style-type: none">• “Ella <i>es</i> bonita.” - “She is pretty.”

Table 2: *Estar-* Copula Uses (adapted from Sole & Sole, 1977)

1. Not used with nouns, except in the instance of idiomatic phrases.
2. Used with adverbs of place to indicate location. <ul style="list-style-type: none">• “Ella <i>está</i> en Irlanda.” – “She is in Ireland.”
3. Used with adverbs of manner to describe a condition. <ul style="list-style-type: none">• “Ella <i>está</i> triste.” – “She is sad.” (At this moment)
4. Used with adjectives to describe a state of being. <ul style="list-style-type: none">• “Ella <i>está</i> bonita.” – “She is pretty.”(At this moment/these days)

Due to their distinct semantic values, the Spanish copula verbs cannot be considered “semantically empty,” and do not adhere to the theory of copula support (Dik, 1980). These verbs cannot be as readily deleted from a sentence as the English copula verb. If deleted, they would likely result in a changing of the underlying meaning being conveyed in the sentence. Silva-Corvalán (1986) proposed that the notion of a *ser* vs. *estar* dichotomy implies that these verbs carry “semantic load” (p. 595). Sera (1992) found that their semantic values are particularly evident in their use with adjectives, as

well as their use with locatives.

Although *ser* and *estar* are semantically distinct and rarely interchangeable, there are some structural environments and predicate adjectives that these copula verbs share, requiring the Spanish speaker to make a careful, contextually-based decision as to which one to use (e.g., Chung Cheng, 2002). Sera (1992) postulated that the use of *ser* with an attribute in the form of an adjective or adjectival phrase implies that that attribute is a defining feature of the subject of the sentence, while the use of *estar* with attributes has a limited effect on the participant's reliance on that attribute as a defining feature of the subject. Her study investigated Spanish copula verb use by adults and children in four separate experiments: spontaneous speech, use of the copulas with terms of dimension (e.g., shape, size, color) in a "wug" task (e.g., "Esto *es* un wug, *es* redondo, y *está* rojo"- "This is a wug; it's round and it's red," p. 416), with locatives to describe object and event locations (e.g., "El carro *está* en el parque"- "The car is in the park," p. 420) and with adjectives to mark attributes of objects (e.g., "verde"- "green" with *ser*; "enfermo"- "sick" with *estar*). Her study confirmed the existence of a semantic contrast between the Spanish copulas and provided evidence of a semantic basis for a distinction between the Spanish copulas, which was stronger in the adult population she studied than in the child one.

With respect to adjective forms, which are considered to be one of the most challenging contexts for *ser/estar* distinction for learners of Spanish, some have postulated that the norm is to use *ser*, with *estar* being used only in exceptional cases where a particular meaning is being placed at a particular point in time (Ciot, 1931). Some have postulated that there are a large number of adjectives that only occur with *ser*

(e.g., “feliz”- “happy”) and another set that only occur with *estar* (e.g., “contento”- “content”). However, Stevenson (1970) argued that this notion is false and misleading, since there is only a very small set of adjectives in Spanish that, due to their inherent meaning, cannot be used with **both** *ser* and *estar*.

Furthermore there is inconsistency in the literature with respect to whether or not these two verbs hold parallel semantic value. According to Roldán (1974), *ser* holds less semantic weight than *estar*, and could be more freely deleted from a sentence than *estar* without a change to the sentence’s underlying meaning. De Mello (1980) suggested that *ser* is the true copula or linking verb, while *estar* is the “copula-plus,” because it does much more than just link two items in a “classificatory relationship,” in that it suggests the notion of duration (p. 370). Lema, (1995) supported this assertion by suggesting that *ser* is the true copula, while *estar* carries aspectual information and functions more like an aspectual auxiliary than a copula. In contrast, others have postulated that the two verbs have “equal communicative value” (i.e., they hold equal importance “for understanding the proposition(s) contained in an utterance,” VanPatten, 1985, p. 404).

As the reader sees, the *ser* vs. *estar* distinction continues to be a much-debated topic in the field of Spanish linguistics, with some researchers proposing that *ser* carries less semantic weight than *estar*, and others ascribing equal semantic status to the Spanish copulas.

In the next two sections, I compare the copula verb system in English and Spanish and transition into what cross-dialect and cross-language agrammatism research has revealed about the copula verbs studied here.

1.5 Cross-Dialect Agrammatism Research and Copula Verbs

According to the theory of copula support (Dik, 1980), the copula verb (e.g., *be* in English) is generally considered to be a semantically-void, supportive device, which can often be deleted in a language like English without modifying the semantic value of an utterance. However, we see that *be* can carry semantic weight in non-standard dialects of English. Jones (2002) examined the manifestation of agrammatism in a bidialectal speaker of African-American Vernacular English (AAVE) and Standard American English (SAE). Her innovative case study examined a variety of AAVE dialect features using narrative discourse (Experiment 1), oral reading (Experiments 2-5) and sentence completion (Experiment 6). Her participant was a 61-year old African-American male with moderate expressive aphasia and agrammatism. He grew up and resided in an AAVE-speaking community, where he used his AAVE dialect. Prior to his CVA (i.e., stroke), he worked as a bank manager, where he routinely used his SAE dialect.

The methodology Jones (2002) employed included a variety of tasks to distinguish agrammatism from appropriate AAVE dialect structure. The tasks consisted of spontaneous conversation, picture description, and individual experiments to examine habitual *be*, double and multiple negation, plural /z/ marker and past tense /d/ marker. For the purposes of our study, the findings of Experiment 2 (habitual *be*) were particularly interesting. This experiment consisted of 20 naturalistic sentences containing habitual *be* as the copula or auxiliary of the sentence (e.g., “*They be bad and get in trouble*”). The task was a reading-aloud paradigm. The research question for this experiment asked whether habitual *be* would be susceptible to error in a bidialectal AAVE-SAE speaker.

The results of this experiment were particularly unexpected. The participant demonstrated remarkable preservation of the habitual *be*, both in its function as copula and auxiliary. However, errors were noted in the surrounding text:

“He be saying stuff that don’t be true.” (target)

“He be saying stop that do be true.” (response)

With respect to the AAVE dialect, the habitual *be* bears important semantic information in that it suggests an inherent or usual state and makes an aspectual distinction. Consider the following contrast:

John *be* early. (Habitual *be*)

John early. (Zero morph)

The first sentence above suggests a “habitual” state of the subject. In essence, this sentence suggests that John is a person who is typically early. In contrast, the second sentence above suggests that John is early for this particular event (e.g., a party, an appointment, class, etc.), but this is not a typical state for him. In other words, this “earliness” is specific to this situation. The speaker is required to make a conscious decision as to whether the context of the spoken sentence requires the habitual *be* or not.

The finding of this experiment was unexpected because cross-language agrammatism studies have revealed difficulty (more specifically, a high percentage of omissions) with forms of the verb *be* in agrammatism (Menn & Obler, 1990b, p. 1377). Jones postulated that this finding may be due to the “semantic weight” and “invariability” of habitual *be* compared to SAE *be* (p. 91).

1.6 Cross-Language Agrammatism Research and Copula Verbs

In their cross-language study of agrammatism, Menn and Opler (1990b) found that the general category of functors was vulnerable to omission across the 14 languages studied. More specific to this dissertation study, cross-language comparisons revealed that “empty” main verb (e.g., “*have*”/“*be*”) and auxiliary verb omissions were predominant across the languages studied. Of the 16 participants for whom performance information was included, the range of main verb (“*have*”/“*be*”) omissions was 4-100% ($X = 39\%$) and auxiliary verb omissions was 0-100% ($X = 33\%$). In comparison, the range and mean for lexical main verb omissions was much lower (range= 0-39%; $X = 11\%$). According to Menn and Opler, this confirmed previous cross-linguistic research findings of more omission of low-content main verbs (i.e., “*have*,” “*be*”) than of lexical main verbs. In addition to their “low-content” status, the authors postulated that the irregularity of these “empty” main verbs may also have contributed to this pattern of omission, and made these verbs less available for production by agrammatic speakers.

In the next section, I turn to what the research on agrammatism in Spanish has revealed about the manifestation of the disorder in this language.

1.7 Agrammatism in Spanish- What Is Known Thus Far

There is a paucity of studies in the aphasiology literature concerning how agrammatism manifests among Spanish speakers. In addition to this, a Spanish-speaking cohort of agrammatic speakers has not been included in the larger scale cross-language agrammatism studies, and only a few published studies we know of have addressed agrammatism in speakers of this language. From these few studies, however, a profile of

agrammatism in Spanish has been created (Ardila, 2001)

The grammatical structures in Spanish that are of particular importance with respect to agrammatism were highlighted by Benedet, Christiansen and Goodglass (1998) as the following: gender and number marking on articles, passive sentence constructions, subject-verb agreement and word order flexibility. The authors conducted a cross-language agrammatism study, comparing the group of English-speakers with agrammatism from Goodglass, Christiansen and Gallagher (1993) with their group of Spanish-speakers with agrammatism on a translated version of *The Morphosyntax Battery* (Goodglass et al., 1993). They found a similar profile of deficits in the production and comprehension of grammatical morphemes between the two language groups, with the following two areas of contrast: 1) production of subject-verb agreement was better in the Spanish-speaking group than the English-speaking one, which was postulated to be due to the “high cue reliability and availability” (p. 331) of subject/verb agreement inflections in Spanish compared to English, and 2) comprehension of active and passive sentences was worse in Spanish than in English. Reduced comprehension of active sentences was postulated to be due to the higher cue validity (i.e., a combination of “cue reliability” -how tightly linked a morpheme is to the grammatical function it serves and “cue availability” -how consistent a morpheme is in its function as a grammatical marker) of word order in English compared to Spanish, while the reduced comprehension of passive sentences was postulated to be due to the fact that passive sentence constructions are much more frequent in English compared to Spanish, thus making them more resistant to aphasia in English than in Spanish.

Of particular interest to our study was Benedet et al.’s (1998) examination of verb

phrase morphology, which included a subtest assessing production and comprehension of the “auxiliary/low-content” verbs, including *ser* and *estar*. With respect to these “auxiliary/low content” verbs, the group performance was poorer on the oral production subtest (24%) than on the comprehension subtest (67%) examining these verbs. The primary production error made by the Spanish speakers with agrammatism on these “auxiliary/low content” verbs was verb omission. (Note, the authors do not describe the comprehension errors made by the participants). This finding supports Menn and Obler’s (1990b) finding of omission of copula/auxiliary verbs in cross-language agrammatism studies. However, Benedet et al. (1998) did not tease apart performance on *ser* and *estar*, thus making it impossible to know the relative impairment or sparing of each of them.

In their case study of a Spanish speaker with agrammatism, Reznik, Dubrovsky and Maldonado (1995) found the following features of agrammatism in Spanish: 1) restricted word order, where sentences were either limited to the canonical form or word order was altered (e.g., “encontré no a una hermana mía”- “find no a sister my” for “no encontré a mi hermana”- “I didn’t find my sister”), 2) clitic pronoun omission (e.g. “ella dice”- “she tells” for “ella me dice”- “she tells me”) and 3) overuse of the strong pronoun in the subject position: Spanish is a pro-drop language where the subject pronoun does not need to be produced (e.g., “Yo soy tu hermana” instead of “Soy tu hermana”- “I’m your sister”). They concluded that the above-noted deficits, which they observed during spontaneous speech, are suggestive of “a selective deficit in syntactic production” (p. 355) in Spanish agrammatism.

By contrast, Ostrosky-Solis, Marcos-Ortega, Ardila, Rosselli and Palacios (1999) found the following morpho-syntactic structures to be resistant to agrammatism in their

study of 10 Spanish speakers with Broca's aphasia: 1) use of the preposition "a" to distinguish the animate object of a sentence from the subject (e.g., "Golpeó un tigre a un león"- "A lion hit a tiger"). The authors proposed that this was due to the critical role that the preposition "a" serves in thematic role assignment in Spanish and 2) definite and indefinite articles (e.g., "La mujer;"- "the woman;" "Una mujer"- "a woman"). Their participants were engaged in an untimed, forced-choice comprehension task, in which they heard reversible sentences and had to select the corresponding picture from among a choice of four that correctly depicted the target sentence. The authors concluded that their participants were relying on morpho-syntactic markers of high cue validity in Spanish and that such markers (as mentioned above) were resistant to agrammatism.

Others studies have examined verb use patterns and verb production by Spanish speakers with agrammatism. Centeno and Obler (2001) focused in particular on the frequency of verb forms in Spanish during spontaneous and elicited speech. The authors compared Spanish verb form use by healthy control speakers (via randomly-selected written and spoken discourse from newspaper articles and soap opera dialogues) and Spanish speakers with agrammatism (via spoken discourse and sentence repetition).

They found that the present and preterite past tenses were the most frequently used verb TMA forms by both the normal language speakers and the agrammatic participants. All other verb TMA forms (e.g., imperfect past tense, conditional, future) were minimally produced by the control group, and were minimally-to-never produced by the agrammatic participants. The authors concluded that daily verb use and verb TMA Frequency facilitated verb production by Spanish speakers with agrammatism. This finding was confirmed in a reexamination of the sentence repetition data originally

from Centeno (1996) conducted by Centeno and Cairns (2010).

In sum, these limited studies of agrammatism in Spanish have reported the following grammatical structures of this language as vulnerable to this disorder:

- 1) Word order (i.e., word order is a) limited to canonical form and/or b) the canonical form is altered)
- 2) Clitic pronouns (i.e., they are frequently omitted)
- 3) Subject pronouns (i.e., they are frequently overused)
- 4) Complex and less-commonly used verb TMA forms, such as the imperfect past tense (i.e., they are infrequently, if not rarely used)

In contrast, these studies have reported the following grammatical structures of Spanish as resistant to agrammatism:

- 1) Subject-verb agreement
- 2) The preposition “a” to mark direct objects
- 3) Definite/indefinite articles

The results found in these studies do not complement each other, because of the differing methodologies used (e.g., different selection criteria, different number of participants, different tasks, different modality of communication examined (e.g., comprehension vs. production); however, they help develop a profile for the manifestation of agrammatism in Spanish. However, this profile does not yet include a description of the copula verb system in Spanish, and whether it is resistant or vulnerable to agrammatism. In this dissertation, we explore this topic to answer this question, to add

to the limited research on the manifestation of agrammatism in Spanish.

In the section that follows, I will conclude my discussion of agrammatism by turning to the specific factors proposed to explain agrammatism that are relevant to this dissertation study.

1.8 Factors Explaining Agrammatism

The factors that have been proposed to explain agrammatism are as varied as the symptom complexes of patients with this communicative disorder. However, no one factor has been able to fully explain this disorder. Some of the more popular factors that have been nominated to explain agrammatism have included verb status (i.e., copula, auxiliary, light verbs), frequency (i.e., word frequency, affix frequency), word and syllabic length, and phonological complexity. I will return to these above factors in Chapter 4: Discussion. My focus, in the following sections, however, is a detailed description of the three factors crucial to this study of agrammatism: **TMA Frequency**, **VF Regularity** and semantics with respect to **CGC**. We chose these three factors because they are strong candidates to explain the disorder of agrammatism, based on the literature, and, in addition, the dual-copula system in Spanish offers us the unique opportunity to compare and contrast the contribution of these three factors to agrammatism, given that the two copula verbs in Spanish: *ser* and *estar* differ in frequency, form regularity and semantics (with respect to the context of the sentence).

1.8.1 Agrammatism and Frequency

Frequency is a factor that has been proposed to be influential in lexical access in

aphasia generally, and in agrammatism specifically, with research suggesting that high frequency words, inflectional endings and/or TMA forms are more easily and more accurately accessed from the mental lexicon than their low frequency counterparts by agrammatic speakers (see Centeno, 1996; Centeno & Obler, 2001; Faroqi-Shah & Thompson, 2004). Centeno (1996), Centeno (2007), Centeno and Obler (2001) and Centeno and Cairns (2010) suggested that frequency of occurrence in daily use is another important factor in agrammatism, because high frequency and low frequency lexical items show differential resistance to agrammatic impairment (i.e., high frequency items are more resistant; low frequency ones are less resistant).

Agrammatic speakers of English have been observed to overuse simple verb forms, such as the infinitive, and the present progressive “-ing” forms, in the place of more complex verb forms and inflectional markings (Goodglass, 1976). With respect to verb morphology, agrammatic speakers are known to substitute more frequent forms of the verb (i.e., more frequent TMA forms) for less frequent forms. For example, Centeno (1996), Centeno and Obler (2001) and Centeno and Cairns (2010) found that Spanish speakers with agrammatism most frequently and most accurately produced verbs in the present tense, both during narrative discourse and sentence repetition. This was followed by the preterite past tense, which was produced with 50% accuracy during sentence repetition, but not produced at all during narrative discourse. These agrammatic speakers produced all other TMA forms (e.g., imperfect past tense, future, conditional) minimally or not at all during spoken discourse; these same TMA forms were produced with low accuracy during sentence repetition. The authors concluded that this pattern of verb use by the agrammatic participants mirrors the frequency of these verb TMA forms in daily

verb use among non brain-damaged individuals; thus, daily use appears to facilitate verb production by agrammatic speakers. Centeno and Cairns (2010) confirmed this conclusion, in their reexamination of a subset of the data from Centeno (1996).

Other researchers have postulated that high accuracy on the present tense is not due to its frequency, but because the present tense is the default tense for agrammatic speakers; that is, it is the unmarked verb tense, assigned automatically to a verb unless conjugation into another tense occurs. Stavrakaki and Koukova (2003) proposed that the present tense is the default tense for Greek agrammatic speakers, with significantly more errors made in the past tense during spontaneous speech by the two participants in their study. These errors in particular were substitution of the present tense for its corresponding past tense form, particularly as syntactic complexity increased (e.g., in negation + clitic contexts). The authors concluded that their participants were resorting to the present tense when the “load of syntactic complexity” (p. 135) increased and that the tense deficit was due to markedness (present= unmarked, past= marked in Greek). Additionally, Menn and Obler (1990, p.1373) found overuse of the present tense in the Romance and Germanic languages, and in the more severely agrammatic Hindi and Hebrew speakers included in their cross-language agrammatism study.

In contrast, Clahsen and Ali (2009) found that the nine agrammatic English speakers included in their study were more impaired overall in tense compared to agreement and mood, but that this tense deficit was not specific to past or present tense. In other words, past and present tense were equally impaired, for both comprehension (via grammaticality judgment) and expression (via sentence-completion) tasks, irrespective of verb type (i.e., the verb *be* and regularly-inflected main verbs were equally

impaired for tense). The errors their participants made were “true tense substitutions” (p. 443) where the present tense was used for the past tense and vice versa, with neither appearing to be the default option. Their findings were supported by Burchert, Swoboda-Moll and De Bleser (2005) in their study of verb tense and agreement in eight German-speaking agrammatics (via a sentence-completion) and Wenzlaff and Clahsen (2004) in their investigation of tense and agreement in seven German-speaking agrammatics (via sentence-completion and grammaticality judgment). Both of these studies also found no difference between production of the present tense and past tense in German speakers with agrammatism and proposed that neither the present nor the past tense appears to be the default option in German agrammatism.

In recent studies, others have proposed that the errors agrammatic speakers make in producing verbs in the past are not due to a specific deficit in tense marking, but to a more global deficit in making time reference to past events. Bastiaanse (2008) found that time reference to the past was more difficult than time reference to the present for Dutch agrammatic speakers. Her study included ten Dutch speakers with agrammatism, who were engaged in a sentence-completion task accompanied by pictures (i.e., participants were presented with a picture with an incomplete sentence underneath; the sentence was missing the target verb and they had to supply the correct verb to describe the picture). During this task, the participants not only made more errors on past tense compared to present tense, but they also made more errors on past participles than its counterpart in the present (i.e., infinitive). Bastiaanse concluded that the “notion of past” (i.e., the understanding or conceptualization of past events) is more difficult than the “notion of tense” (i.e., the understanding or conceptualization of tense marking) for agrammatic

speakers and that discussing events in the past is more semantically complex than in the present (p. 115).

Yarbay Duman and Bastiaanse (2009) partially confirmed Bastiaanse's (2008) finding. In a study of Turkish agrammatic speakers, they found that their participants made errors in referencing events in the past four times more often than in the future. They proposed that their finding, as well as the finding of Bastiaanse (2008), point to an overall deficit not in tense per se, but in time reference to the past, since "time reference on participles that lack tense inflection is as difficult as verbs with tense inflection, even when they are identical in form" (p. 35). They hypothesized that these findings suggest that remote forms (i.e., past) are more difficult to produce for agrammatic speakers than non-remote forms (i.e., present & future).

Abuom, Obler and Bastiaanse (submitted) found a selective deficit in production of English past tense in two bilingual Swahili-English speakers with agrammatism. Their participants performed at or near ceiling on the future tense in both languages and at ceiling on past tense in Swahili. The authors proposed that this selective deficit in English past tense might have two possible explanations: 1) there are multiple-form inflections used to mark past tense in English (i.e., /d/, /t/, /Id/) compared to Swahili, where past is marked by a single and "invariable" syllable, and/or 2) reference to a time-frame in the past via tense is indirect in English, while it is direct in Swahili. The authors argued that in English, information to clue the reader into a time-frame "is rather limited" (p. 27), and often involves a "periphrastic verb form" to provide morphological and syntactical information about what time-frame is being referenced. By contrast, in Swahili, "the finite verb itself includes a direct reference to a time-frame" (p. 27), and

there is a “one-to-one relation” (p. 21) between the verb tense and the time-frame it refers to, thereby making such time referencing relatively easy in Swahili. They concluded that reference to the past requires “discourse linking,” which is proposed to be impaired in agrammatism, and that other verb tenses, such as present and future, do not require such linking.

In sum, TMA Frequency may be a crucial factor for verb production in agrammatism. We include it here in our study, via comparison of production of the present tense and imperfect past tense forms of the copula verbs *ser* and *estar*, in order to answer our first research question and add to the growing body of literature on the contribution of TMA Frequency to verb production in agrammatism. In line with the arguments of Bastiaanse (2008), Centeno (1996), Centeno and Obler (2001), Centeno and Cairns (2010), Menn and Obler (1990b), O’Connor, Obler and Goral (2007), Stavrakaki and Koukova (2003) and Yarbay Duman and Bastiaanse (2009), we predicted that our Spanish-speaking participants with agrammatism will produce more correct present tense forms of the copula verbs *ser* and *estar* compared to imperfect past tense forms.

1.8.2 Agrammatism and Verb-Form Regularity (VF Regularity)

VF Regularity, in particular with respect to past-tense verb morphology, is an additional factor that has been investigated in agrammatism, yielding conflicting results. A dissociation between regular and irregular verb morphology has been suggested in the literature and posited to be due to distinct brain processing mechanisms for these two classes of verbs (see Faroqi-Shah, 2007; Jaeger, Lockwood, Kemmerer, Van Valin, Murphy, & Khalak, 1996). Regular verb inflections are believed to involve retrieval of

the inflection and affixing the inflection to the verb stem, while irregular forms are believed to be retrieved from the mental lexicon as whole words. In this model, frontal lobe areas, including Broca's area, are involved in the processing and production of morphologically-regular words, while temporal/parietal areas, including Wernicke's area, are involved in the retrieval of morphologically-irregular words as whole units from the mental lexicon. Research on highly-inflected languages, such as Greek, provides clear evidence to support this dissociation with respect to regular/irregular verb morphology. For example, Tsapkini, Jarema and Kehayia (2002) conducted a case study of a Greek speaker with agrammatism. Their participant was engaged in a variety of production and comprehension tasks to examine inflectional morphology. He exhibited a dissociation between regular and irregular verbs in that he displayed impaired production of irregular verbs, while regular verbs were relatively spared.

With respect to the effect of regularity on verb production in agrammatism, a subset of the research literature supports Tsapkini, Jarema and Kehayia's (2002) finding of lower accuracy in production of irregular verbs compared to regular verbs by both normal (Jaeger et al., 1996- English) and agrammatic speakers (de Diego Balaguer, Costa, Sebastián-Galles, Juncadella, & Caramazza, 2004- Spanish-Catalan bilinguals; Kok, van Doorn & Kolk, 2007- Dutch and Miozzo, 2003- English). Jaeger et al. (1996) reported higher error rates and longer reaction times for irregular than for regular verb forms by a group of neurologically-healthy speakers of English. Miozzo (2003) conducted a single subject study of a native English speaker with anomia and problems with phonological access, but intact ability to access the meaning of words during speech production, and found a dissociation between production of regular and irregular verb

forms, with the participant performing significantly less accurately with irregular verb forms (e.g., “buy-bought”) than regular verb forms (e.g., “walk-walked”) in the past tense. A particularly interesting finding was that the errors on the irregular verbs were found even on “ultra-high frequency” irregular verbs, (e.g., “go- went”). This study, thus, lends more support to the notion of independent mechanisms for regular vs. irregular verb inflection.

Similar results have been found among monolingual and bilingual agrammatic speakers of languages other than English. De Diego Balaguer et al. (2004) found lower accuracy in producing irregular than regular verb morphological transformations by two bilingual Spanish-Catalan speakers with agrammatic aphasia. In the morphological task included in their study, the participants were asked to complete orally-presented sentences that contained temporal markers (e.g., yesterday, today, etc.) to indicate if the target verb missing in the sentence was to be in the present or past tense. The finding of more errors on irregular than regular verbs (more specifically, the most common errors were “no response” and “morphological errors”) was equivalent in both languages and the authors concluded that their findings support an underlying morphosyntactic processing deficit in agrammatism. Kok, van Doorn and Kolk (2007) found comparable results for nine Dutch-speaking agrammatics. Their study engaged participants in a series of three tests (i.e., *Reading Aloud Test*, *Inflection Test and Order* and *Inflection Test*). Although the overall error patterns (i.e., agreement and tense errors) for irregular and regular past tense verbs were similar, more overall errors were noted for irregular past tense verb inflections than for regular ones. In addition, Menn and Obler (1990) proposed that the irregularity of “empty main verbs,” such as the copula *be* may have

contributed to their cross-language difficulty and “lessened availability” (p. 1378).

Others, however, have instead reported the opposite pattern among agrammatic speakers. Ullman, Corkin, Coppola, Hickok, Growdon, Koroshetz, and Pinker (1997), for example, found lower accuracy of production for regular than irregular verbs in English-speaking patients with anterior aphasia. By contrast, Faroqi-Shah and Thompson (2003) reported no difference in production accuracy of regular and irregular verbs by English-speaking patients with agrammatic Broca’s aphasia (i.e., the morphological category of past tense marking was impaired equally for regular and irregular verbs). They postulated that Ullman et al.’s (1997) finding was due to more phonological complexity of regular verbs compared to irregular verbs in English. Similarly, Bastiaanse, Sikkema and van Zonneveld (2004) found no difference in accuracy between regular and irregular past tense for Dutch agrammatic speakers. Finally, Clahsen and Ali (2009) found that the tense deficit in agrammatism equally affected both regular and irregular verb forms.

Unmentioned in all this literature, however, is the fact that the term “verb irregularity” can have multiple meanings: stems and/or inflections can be irregular. The Spanish verb *ser* allows us to clearly illustrate this notion of irregularity in both stems and inflections. If we examine the conjugation of the first person singular of the verb, for example, across the present indicative, preterite past tense, imperfect past tense and future tense, we see marked irregularity in both the stem of the verb and the inflectional paradigm. Only when *ser* is conjugated into the future tense do we see it follow the regular conjugation of “-er” verbs in Spanish:

Yo soy- (I am- present indicative)

Yo *fui*- (I was- past preterite)

Yo *era*- (I was- past imperfect)

Yo *seré*- (I will be- future)

In sum, the cross-language and bilingual aphasia literature presents conflicting results regarding whether regular or irregular verbs are better spared in agrammatism. One aim of our study was to clarify the contribution of VF Regularity to agrammatism by selecting two verbs that contrast in terms of regular vs. irregular stem and inflections. Based on the findings of de Diego Balaguer et al. (2004), Jaeger et al. (1996), Kok, van Doorn and Kolk (2007), Menn and Obler (1990b), Miozzo (2003) and our pilot study (i.e., O'Connor, Obler and Goral, 2007), we predicted that our Spanish-speaking participants with agrammatism would produce *estar* and its corresponding forms with greater accuracy compared to *ser* and its corresponding forms, since *estar* is more highly regular than *ser*, both in stem and inflectional paradigm.

1.8.3 Agrammatism and Stress/Saliency (with a Focus on Semantics and Context-Governed Choice- CGC)

It has been postulated that “saliency,” which can be defined as “a combined effect of semantic significance and word stress” (Goodglass, Fodor & Schulhoff, 1967, as cited in Goodglass, 1993, p. 114) is associated with production in agrammatism. Therefore, functors would be vulnerable to agrammatism in a language such as English, because of their low saliency (i.e., they are unstressed lexical items that are “semantically-empty,” Goodglass, 1993).

However, as discussed above, this is not the case in Spanish: the Spanish copulas

ser and *estar* have distinct semantic values (Roldán, 1974). As a result, these verbs are not considered “semantically-empty” and their vulnerability or sparing in the face of agrammatism cannot be explained by this theory of “stress-saliency.” One could argue that the Spanish copulas *ser* and *estar* cannot be as readily deleted from a sentence as the English copula verb. Doing so would generally result in a semantic change or ambiguity with respect to the meaning of the target message (greater for *estar* than for *ser*, as previously discussed in Section 1.4). In addition, there are certain adjectives in Spanish for which the speaker has to make a context-governed choice (CGC) regarding the copulas, in order to appropriately convey the meaning of the adjective that follows it in the sentence (e.g., *ser* with “listo” to mean “clever/intelligent” vs. *estar* with “listo” to mean “ready”). Research on aphasia has demonstrated that context facilitates sentence and narrative comprehension (e.g., Hough, Pierce & Cannito, 1989; Pierce & Beekman, 1985). Therefore, based on this factor of CGC, we made a two-fold prediction: 1) participants with agrammatism would perform with higher accuracy on sentences we labeled “high CGC” (i.e., sentences where copula verb selection results in substantial semantic consequences to the adjective that follows it in a sentence) than on non-CGC sentences (i.e., rule-governed uses of the copula verbs) and 2) participants with agrammatism would prefer *estar* over *ser* when allowed a copula choice, since *estar* is semantically “heavier” than *ser*, and we found in the pilot phase of this study that participants with agrammatism preferred *estar* when given a choice between these two copulas.

In sum, although a variety of factors have been proposed as contributing to the patterns of verb use in agrammatism, none have been able to fully explain the patterns we

see in the speech of agrammatic individuals. In this dissertation study, we chose the Spanish language and its dual-copula system to compare and tease apart the relative contribution of our three factors: TMA Frequency, VF Regularity and CGC on verb production by agrammatic speakers, precisely because the two Spanish copula verbs differ in their form regularity and semantics.

In studying the Spanish language, one must consider the variation across dialects of Spanish. In the next section, then, I discuss dialectal variation as it relates to *ser* and *estar* uses.

1.9 Dialect Differences in *Ser* and *Estar* Use

Before turning to the study proper, it is important to discuss dialectal differences in the use of *ser* and *estar*, since we did not want any potential differences in *ser/estar* use to undermine the findings of this study. The dialectal variation in the use of *ser* and *estar* that has been most discussed in the field of Spanish linguistics is the extension of *estar* to contexts where *ser* is traditionally the norm, referred to as the “innovation” or “extension” of *estar*. Language-internal changes over time, caused by such external factors as bilingualism and language contact, have resulted in more generalized meaning and increased usage of *estar*, which has caused a distributional change in the *ser/estar* dichotomy, with the diachronic shift favoring *estar*. Sociolinguistic research has examined copula use for evidence of this phenomenon in Spanish speakers in the United States (Silva-Corvalán, 1986; 1990; 1994 in Los Angeles; Kirschner & Stephens, 1988 in New York); in Michoacán, Mexico (Gutiérrez, 1992; 2003); in Caracas, Venezuela and Mexico City (de Jonge, 1993) and in Galicia, Spain (Guijarro-Fuentes & Geeslin, 2006).

Silva-Corvalán (1986; 1990; 1994) was the first to describe this phenomenon as

the “extension” of *estar*. This extension of *estar* specifically impacts how the two copulas are used in predicate adjective constructions, with the diachronic shift toward using *estar* with predicate adjectives. She noted that this distribution of *estar* and *ser* in predicate adjective constructions is featured prominently in the field of Spanish linguistics and remains a much-debated issue. This is in part due to the loss of the original Latin meaning of *estar* (“to stand”) over the course of time since the 12th century, resulting in its more generalized meaning and ability to be used with an increasing number of adjectives (Silva-Corvalán, 1994). In addition, she postulated that there has been an acceleration of this change noted among Mexican-American bilingual speakers in Los Angeles, due to a linguistic contact situation (i.e., exposure to English as an L2, in Silva-Corvalán, 1986). The result of this has been increased contexts for the use of *estar* “to the detriment of those [contexts] of *ser*” (p. 95). Silva-Corvalán (1990) noted that this extension is evident in all varieties of Spanish, but that it is featured most prominently in Mexican Spanish compared to other Spanish dialects. She pointed to the findings of Gutiérrez (1989, in Silva-Corvalán, 1990) as evidence that this extension is also happening among monolingual Mexican Spanish speakers, albeit to a lesser degree. Thus, this extension of *estar* is not unique to bilingual Spanish-speakers exposed to English in a ‘language-in-contact’ situation. Her study of 33 Los Angeles bilingual speakers revealed extension of *estar* was 34%, compared to 16% extension among monolingual Mexican Spanish speakers observed by Gutiérrez (1989). Similar to Gutiérrez (1989), she observed that this innovation featured most prominently among younger speakers, and that generational differences in *estar* innovation exist, even within a single family.

In her 1994 study, Silva-Corvalán examined the language samples from 33 Mexican-American bilinguals across three generations; in particular, examining the extension of the meaning and usage of *estar* by these bilingual speakers living in Los Angeles. She postulated that “susceptibility” vs. “nonsusceptibility” to change (i.e., the relationship between referent and attribute is susceptible/nonsusceptible to change) and “class” vs. “individual frame of reference” were the factors that best explained the choice between *ser* and *estar* and the innovation in use of *estar* among these speakers. She proposed that the shift towards use of *estar* in more contexts is suggestive of a semantic change (i.e., meaning differences) in what motivates copula choice.

One of the factors she proposed as influential to innovative use of *estar* is the type of adjective used in the copula + predicate adjective construction. In her data, the types of adjectives that invited the most innovation in the use of *estar*, similar to the pattern found among monolinguals by Gutiérrez (1992), were the following:

- A) Age: 78% (e.g., “viejo”- ‘old’)
- B) Size: 53% (e.g., “alto”- ‘tall’)
- C) Sensory characteristics: 47% (e.g., “caliente”- ‘hot’)
- D) Physical appearance (animate): 31% (e.g., “bonito”- ‘beautiful’)
- E. Description (referring to inanimate objects): 25%, (“liso”- ‘smooth’)

She concluded by proposing that the “stable and prolonged situation of bilingualism” (p. 119) greatly contributed to the diffusion of innovative *estar* use among these Mexican-American bilinguals studied.

By contrast, Kirschner and Stephens (1998) found no evidence to suggest a shift in the norms for copula choice by 37 bilingual Puerto Rican Spanish-English speakers in

New York. In their study, they examined how the single copula system in English would impact the use of the dual copula system in Spanish. They hypothesized that use of the copulas by these speakers would “conform to standard patterns of usage” (p. 128) of *ser* and *estar*, and that the semantic functions of the two verbs would be maintained. The participants in their study were all university students in the New York metropolitan area. Of these, 20 were English dominant, while the remainder were either Spanish dominant or balanced bilinguals. Participants completed two questionnaires related to copula choice. Task A was a production task, while Task B was a grammaticality judgment task, both involving the *ser/estar* dichotomy. The authors found high overall conformity to the standard uses of *ser* and *estar* for Task A. The authors pointed out that the one participant who made a few errors on this task was English dominant. They do not specify the Spanish dialects of the participants. For Task B, despite high overall accuracy, more errors were committed by the participants on this task than on Task A. The authors, however, do not elaborate on what exactly the errors were on the task, though it can be inferred from the study that the errors were *ser* for *estar* or *estar* for *ser* substitution errors. They concluded that although the overall errors on the two tasks were ‘inconsequential,’ the social factors that influenced responses on Task B and resulted in more errors on this task compared to Task A were age of arrival to the English-speaking society and age of exposure to English. Therefore, the earlier a participant arrived to an L1 English-speaking community and the earlier they were exposed to English, the more errors they committed on the two tasks in this study.

Others have noted innovative use of *estar* among monolingual speakers of Spanish in Latin-American countries. Gutiérrez (1992) studied the innovative extension

of *estar* by monolingual Spanish speakers in Morelia, Mexico. In this study, the examiner met each participant for two one-hour sessions, where spontaneous language samples were elicited and copula verb use was observed. Participants also completed a questionnaire regarding the *ser/estar* opposition. The variables of the social context that were taken into account were gender, age and educational level. Copula use was coded as *estar* innovative- (*estar* used in a context previously requiring *ser*) or *estar* prescriptive- (*estar* used in a traditional context) vs. *ser* prescriptive- (*ser* use in a traditional context). The adjective type that followed the verb was coded as one of the following: age, size, physical appearance, description, moral characteristic, class, perception, color, social status, evaluation or other. Of the total uses of *estar* (32.8%), 12.5% were labeled innovative, or, in other words, “encroaching on the territory of *ser* whose use has decreased in this context” (p. 121). The linguistic shift that this creates is a shift from describing the subject of the sentence from an individual (comparing the subject to him/herself) to a class frame of reference (comparing the subject to other members of the same class).

In his study, Gutiérrez (1992) found that the types of adjectives with the greatest use of the innovative *estar* were ones that refer to age (43%), size (34%) and physical appearance (33%), similar to the later findings of Silva-Corvalán (1994). Educational status was an important variable in innovative *estar* use, with higher levels of formal education resulting in more prescriptive and less innovative use of *estar*. Age of the participant was another important factor, with younger groups displaying the most innovation compared to the other older groups. Within the younger group, those with less education had the highest uses of innovative *estar*. In terms of gender, women

produced more innovative *estar* than men, especially women with incomplete education. The results of the study suggested that there is a change in progress in this monolingual community, similar to other varieties of Spanish previously studied where this change was hypothesized to be accelerated by contact with English.

The phenomena of the *ser/estar* opposition and the innovation of *estar* in the Spanish of Mexican speakers living in Michoacán, Mexico were again examined by Gutiérrez (2003). The results revealed that within this monolingual community, the process of change in the *ser/estar* opposition was taking place, similar to what had been found previously in other varieties of Spanish spoken by bilingual speakers, in which the speakers were in a contact situation with English. He postulated that for this monolingual community, there are factors that contribute to innovation of *estar*, such as age (younger participants used it more than older ones), and factors that support the *ser/estar* distinction, such as experience with reading Spanish and formal learning of Spanish. He found a 16% innovative use of *estar*, with conservative uses of *estar* still a very powerful linguistic force among these speakers. The most common types of adjectives used with the innovative *estar* were the following: descriptive (44%), age (43%), size (34%) and physical appearance (33%). Gutiérrez suggested that the process of innovation can originate in monolingual environments, but accelerates when that environment becomes a bilingual community. He pointed to Silva-Corvalán's findings of innovation among Los Angeles bilingual speakers to support this claim, and summarized the findings of his study by suggesting that this process of innovation is a form of "linguistic simplification," in which the speaker overextends *estar* and its respective forms to contexts previously occupied by *ser* as a way to minimize the cognitive load by limiting

the need to make a lexical choice between *ser* vs. *estar*.

Other studies have compared copula use in monolingual Spanish speakers from two different geographic regions in Latin America. De Jonge (1993) studied copula verb use with adjectives of age in monolingual Spanish speaking university students in Caracas, Venezuela and Mexico City. They found that in general the two geographic groups of speakers were at different stages in the process of language change, and more specifically, were at different stages in *estar* innovation with expressions of age (e.g, “viejo”- ‘old’; “joven”- ‘young’), with the Venezuelan speakers ahead by one stage. However, the authors postulated that the process of language change in these two Latin-American countries with respect to the innovation of *estar* with adjectives of age was not a gradual, but a discontinuous process that had remained relatively unchanged since the original data were collected in the 1960’s and 1970’s. The authors concluded that for both geographic groups, *estar* was becoming increasingly more common with expressions of age.

Other studies have examined copula verb production and innovation of *estar* in bilingual Spanish speakers in contact with languages other than English. Sanz and González (1995) examined the evolution of the copula verbs in the context of locative predicates and predicate adjectives in bilingual Spanish-Catalan speakers. This was the first study of the uses of *ser/estar* and their equivalents in two Romance languages with dual copula systems.

The authors hypothesized that Catalan is at an earlier stage in the process of *estar* innovation, and that as a language, Catalan is more conservative with respect to copula choice. Additionally, Spanish was the higher prestige language among bilingual speakers

of these two Romance languages.

The participants in this study were nine Catalan-Spanish bilinguals, ranging in age from 5-61 years. All of the participants had Catalan as their first language and had varying levels of proficiency in Spanish. The tasks consisted of spontaneous speech, elicited speech and grammaticality judgment task all directed at the copula verbs *ser/estar* and their equivalent in Catalan. The authors found that innovation of *estar* in the context of locative predicates was also evident in Catalan, and that it was also the dominant copula with adjectives to describe physical attributes, inanimate objects and animate subject references, though not unanimously used in all sentence contexts. A generational difference was noted, with younger speakers showing a “clear preference” for *estar*. The authors concluded that the innovation of *estar* seen in two Romance languages such as Spanish and Catalan was “internal to the language system and not particular to the language contact situation.” (p. 18). They also concluded that an underlying “universal explanation” for this phenomenon may be due to the influence of “regular paradigms,” in that *estar* is a regular verb (p. 18). However, we must acknowledge that the overuse of *estar* may be the result of an interaction between the regularity of this verb and its semantic weight. As I discuss in the Results chapter (i.e., Chapter. 3), in this study, participants with agrammatism performed with higher accuracy on “high CGC” *estar* than the “high CGC” *ser*.

Finally, Guijarro-Fuentes and Geeslin (2006) conducted a study of copula verb production and innovation of *estar* in bilingual Spanish-Galician speakers living in Galicia, Spain. The study consisted of 37 participants, recruited from a university setting. The experimental tasks in this study consisted of a background questionnaire and a

contextualized preference task involving paragraph-length scenarios where participants had to make a copula choice. These bilinguals selected *ser* as the preferred copula 49% of the time, *estar* 48.3% of the time and both 2.7% of the time. The authors compared the findings of this study to the findings of an earlier study they conducted with monolingual Spanish speakers in Granada, Spain. They noted that the Galician bilinguals chose *estar* slightly more frequently than the Granadan monolinguals (48.3% vs. 43.8% respectively). They also found that the linguistic variables that predicted *estar* innovation were the same for both groups, but the factors of predicate type and susceptibility to change were more influential for the Galician bilinguals. They concluded that the bilinguals in their study behaved differently with respect to copula choice from Silva-Corvalán's (1986) participants (i.e., the predictor variables for copula choice in Silva-Corvalán (1986) varied based on degree of bilingualism, whereas in Guijarro-Fuentes and Geeslin (2006), these predictor variables did not differ between the bilinguals and monolinguals).

In sum, the most predominant dialectal difference in *ser/estar* use appears to be a diachronic shift in favor of use of *estar* in contexts previously subscribed to *ser*. This shift is found in different geographic groups and across different groups of speakers (i.e., monolinguals and bilinguals). As noted in the studies presented above, this innovative use of *estar* is found among both monolingual and bilingual speakers of Spanish, and appears to be influenced by a variety of social factors, such as gender, age and education and linguistic factors, such as predicate type and susceptibility to change. In the pilot phase of this dissertation, speakers from various dialects of Spanish were included, and comparisons were made in *ser/estar* use between and within dialect groups. No dialect

differences in *ser/estar* use emerged from the data. In the current study, we addressed some of the issues raised in this section in a two-fold manner: 1) we included both male and female participants from a variety of Spanish-speaking dialects in the control and agrammatic groups who were similar in age range, SES status and L1 Spanish status (participant demographics will be discussed in detail in Section 2.2.1) and 2) we included adjectives, such as “viejo” (“old”) and “bonita” (“beautiful”) in the “low CGC” sentences to test for estarcization, which have proposed to invite the most *estar* innovation (see Silva-Corvalán, 1986; 1990; 1994 and Gutiérrez, 1992; 2003).

In the next section, I remind the reader why the Spanish copula verb system will allow us to study the factors of TMA Frequency, VF Regularity and CGC as they relate to agrammatism. In the chapters to follow, I move to the methodology for the study and conclude with the results and discussion and conclusions.

1.10 Using the Spanish Copula System to Examine the Effects of a) TMA Frequency, b) VF Regularity and CGC in Agrammatism

As argued above, Spanish is a particularly useful language to compare and test the contributions of TMA Frequency, VF Regularity and CGC to verb production in agrammatism, due to its substantial inflectional paradigm and prominent set of verb forms that are irregular in stem and/or inflection.

Of the two copula verbs, *estar* is the markedly more regular, both in its stem forms across tenses and in its inflectional paradigm, while *ser* is the markedly more frequent. As mentioned above, *ser* is actually the most frequent verb of the Spanish language. The high irregularity of *ser*, with its tense-related stem and inflectional

alternations, and the relative regularity of *estar*, can be seen in Appendix A.

In addition to VF Regularity, the semantic distinction between these two Spanish copulas allows us to examine the factor of semantics as it relates to verb production and copula choice based on the context of the target sentence, labeled in this study, “CGC.” In particular, we were interested in examining the factor of semantics in sentences where copula verb choice results in substantial semantic consequences to the adjective that follows it (e.g., “El niño *es* listo” - “The boy is clever” vs. “El niño *está* listo” - “The boy is ready”) and in sentences where either of the copula verbs can be used without semantic (just aspectual) consequences to the adjective that follows it (e.g., “Nuestro gato *es/está* gordo” - “Our cat is fat”).

If the participants’ responses to such sentences were predominantly a form of *ser*, we would conclude that either the higher word frequency and/or the higher irregularity of this verb facilitated its production. On the other hand, if the participants’ responses comprised mainly a form of *estar*, we would conclude that the higher regularity of this verb facilitated its production. In O’Connor, Obler and Goral (2007), the responses of participants with agrammatic aphasia to low CGC sentences (i.e., sentences where either *ser* or *estar* in the 3rd person singular present tense form can be used without semantic (just aspectual) change to the adjective that follows the verb) were overwhelmingly in the direction of *estar*: the more regular verb. It was anticipated that the findings of the current study would support O’Connor, Obler and Goral’s (2007) findings.

1.11 Research Questions and Hypotheses

The broad research question motivating this study was the following:

How do the factors of TMA Frequency, VF Regularity or CGC contribute to an agrammatic individual's verb production abilities?

The more specific empirical questions under investigation were the following:

In our Spanish-speakers with agrammatic aphasia:

- 1) *Is the more frequent present tense of the copula verbs, “ser” and “estar” better spared than the less frequent imperfect past tense?*
- 2) *Is the more regular copula verb, “estar,” better spared than the more irregular copula verb, “ser,” in the present and imperfect past tenses?*
- 3) *Are more semantically-weighted uses of the copula verbs (i.e., instances where copula choice is governed by the context of the sentence and results in substantial semantic consequences to the adjective that follows it) better spared than less semantically-weighted uses (i.e., rule-governed uses) of the copula verbs?*

The hypotheses for this study are:

- 1) If more frequent verb TMA forms are better spared than less frequent ones, then more errors will be observed on the imperfect past tense than on the present tense and its respective forms. This finding would support the arguments of Bastiaanse (2008), Centeno (1996), Centeno and Obler (2001), Centeno and Cairns (2010), Menn and Obler (1990b), O'Connor, Obler and Goral (2007), O'Connor Wells, Obler and Goral (2009),

Stavrakaki and Kouvoiva (2003) and Yarbay Duman and Bastiaanse (2009).

2) If more regular verbs are better spared than more irregular ones, then more errors will be observed on *ser* than *estar*, since *ser* is more irregular than *estar*, both in its stem and inflectional paradigm. This finding would support the arguments of de Diego Balaguer et al. (2004), Jaeger et al. (1996), Kok, van Doorn and Kolk (2007), Miozzo (2003), O'Connor, Obler and Goral (2007), O'Connor Wells, Obler and Goral (2009) and Tsapkini, Jarema and Kehayia (2002). However, if the opposite pattern occurs: i.e., if irregular verbs are better spared than regular ones, then more errors will be observed on *estar* than *ser*, since *estar* is more regular than *ser*. This finding would support the argument of Ullman et al. (1997).

3) If verbs selection results in substantial semantic consequences to the adjective that follows it (e.g., “El niño *es* listo...” - “The boy is clever”... vs. “El niño *está* listo...” - “The boy is ready”...), then *ser* and *estar* will be produced with high accuracy in high CGC sentences relative to non-CGC ones (i.e., rule-governed uses of the copula verbs). This would support the arguments of Goodglass (1993) and Goodglass, Fodor and Schulhoff (1967) that “semantically empty words” (p. 115), which are low in saliency are less accessible for output by agrammatic speakers than words high in saliency.

In addition, in this dissertation study, we included a category of sentences (Category 7) which we called “low CGC” sentences, because these sentences can examine copula choice without semantic (just aspectual) change to the adjective that follows the verb in the sentence.

e.g., “Nuestro gato *es/está* gordo.” – “Our cat is fat.”

In the pilot phase of this study (O'Connor, Obler & Goral, 2007), we found that

when participants were allowed to choose a copula (i.e., they could select *ser*, *estar* or both copula verbs in the 3rd person singular present tense to complete the target sentence), the five control participants showed a clear preference for *ser*, while the two participants with agrammatism preferred *estar*. We were interested to see if this pilot finding with respect to semantics would be replicated in the study proper.

Chapter 2: Methods

2.1 Methodology for the Study

2.1.1 Participants

A total of 18 Spanish speakers were recruited within the New York metropolitan area to participate in this study. The six participants with agrammatism were all L1 Spanish speakers with varying degrees of English proficiency. The 12 control participants were all Spanish-dominant (L1 Spanish) bilingual speakers of Spanish and English. All participants gave both verbal and written consent to participate. Written consent forms, which provided general information, outlined the experimental procedure, highlighted the benefits of volunteering and how records were to be kept confidential, were signed by each participant. These consent forms were made available in both Spanish and English, and participants were allowed to choose which language they preferred the form in (4/6 or 67% of the agrammatic group preferred the form in Spanish, while 10/12 or 83% of the control group did). When family members were present, the study was also explained to them, along with the participant.

Additionally, all participants or their spouses/family members filled out a detailed language proficiency and language history questionnaire, which was also made available in both Spanish and English.

All participants were paid \$20 per visit for their participation. None of the participants withdrew from the study.

Participants with Agrammatism

Six post-stroke participants with agrammatic aphasia were recruited via referral

by their speech-language pathologist from outpatient rehabilitation hospitals in the metropolitan New York area. All participants with agrammatic aphasia had this diagnosis confirmed by at least two speech-language pathologists and via administration of the Spanish version of the *Multilingual Aphasia Examination-3* (as suggested by A. Ardila, personal communication, July 6, 2006), a spontaneous language sample and clinical records. On these measures, participants were considered agrammatic if their speech output was characterized by “slow, halting speech, short and/or fragmentary sentences, and limited use of the syntactic and morphological resources of language” (Menn & Obler, 1990a, p. 3). All participants had suffered a single left frontal or left MCA infarct and had no prior history of neurological, psychiatric, learning, hearing and/or unaided visual impairment. Four of the participants with agrammatic aphasia were speakers of the same dialect of Spanish (Puerto Rican Spanish) with the remaining two participants were Dominican Spanish speakers. Although all six participants with agrammatism were L1 Spanish speakers, three of the six reported being balanced bilingual speakers of Spanish (L1) and English (L2) prior to their stroke, while the remaining three participants reported being relative monolingual speakers of Spanish with minimal to no knowledge of English prior to their stroke. Two of the participants (Ag1 & Ag4) were also participants in the most crucial of the pilot studies conducted prior to this experiment (see O’Connor, Obler & Goral, 2007). See Table 3 on page 46 for the relevant demographic information of our agrammatic group.

Control Participants

Twelve normal participants, matched for language history, age and educational attainment, served as the control group. In addition to language and age, all control

participants were matched to the participants with agrammatic aphasia for relative socioeconomic status (SES) (determined by their self-report of their SES as “upper,” “middle,” or “working” class; of note, none of the 18 participants reported their SES as “upper class”), educational attainment and length of time in years living in mainland United States. Six of the control participants were speakers of Spanish from Puerto Rico, while the remaining control participants were speakers of other dialects of Spanish (i.e., 1 Peruvian, 1 Argentinean, 4 Colombians). These participants had no history of neurological, psychiatric, learning, hearing and/or unaided visual impairment. Spouses and/or family and friends of the post-stroke participants were invited to serve as control participants, and one did. See Table 4 on page 46 for the relevant demographic information of our control group.

Table 3- Agrammatic Group (Ag) Demographics

Participant	Gender	Age	Birthplace	SES	Years in US	L1	Language Status	Dialect	Age of L2	Education	Etiology of Agrammatism	Time Post-Onset
Ag1	Male	51	New York	Working Class	51	Spanish	Bilingual	Puerto Rican	4	High School	Left Frontal CVA	5 years
Ag2	Female	60	Puerto Rico	Working Class	45	Spanish	Bilingual	Puerto Rican	25	Com. College	Left Frontal CVA	2 years
Ag3	Female	57	Puerto Rico	Middle Class	40	Spanish	Bilingual	Puerto Rican	8	High School	Left MCA CVA	3 years
Ag4	Male	72	Puerto Rico	Middle Class	55	Spanish	Monolingual	Puerto Rican	20	Grade School	Left Frontal CVA	4.5 years
Ag5	Female	68	Dom. Rep.	Middle Class	7	Spanish	Monolingual	Dominican	N/A	Grade School	Left MCA CVA	4 years
Ag6	Female	53	Dom. Rep.	Working Class	32	Spanish	Monolingual	Dominican	25	Grade School	Left MCA CVA	2 years
Range		51-72			7-55 years				0-25 years			2-5 years
Mean		60			38				14			3.4 years

Table 4- Control Group (C) Demographics

Participant	Gender	Age	Birthplace	SES	Years in US	L1	Language Status	Dialect	Age of L2	Education
C1	Female	69	Peru	Middle Class	48	Spanish	Bilingual	Peruvian	20	College
C2	Female	69	Puerto Rico	Working Class	65	Spanish	Bilingual	Puerto Rican	5	1 Year College
C3	Female	53	New York, USA	Middle Class	53	Spanish	Bilingual	Puerto Rican	6	1 Year College
C4	Female	61	Colombia	Middle Class	42	Spanish	Bilingual	Colombian	5	College
C5	Female	61	Colombia	Middle Class	45	Spanish	Bilingual	Colombian	16	Grade School
C6	Female	60	Colombia	Middle Class	41	Spanish	Bilingual	Colombian	15	College
C7	Female	71	Puerto Rico	Middle Class	51	Spanish	Bilingual	Puerto Rican	15	High School
C8	Female	71	New York, USA	Middle Class	71	Spanish	Bilingual	Puerto Rican	4	College
C9	Female	66	Colombia	Working Class	45	Spanish	Bilingual	Colombian	21	1 Year College
C10	Female	66	Puerto Rico	Middle Class	62	Spanish	Bilingual	Puerto Rican	35	Grade School
C11	Female	69	Puerto Rico	Middle Class	54	Spanish	Bilingual	Puerto Rican	16	Grade School
C12	Male	65	Argentina	Middle Class	44	Spanish	Bilingual	Argentinean	22	1 Year College
Range		53-71			41-71				4-35 years	
Mean		65			52				15	

2.1.2 Stimuli and Procedures

All participants were engaged in casual conversation with the experimenter, in order to establish rapport and obtain a spontaneous language sample. A picture description was elicited via presentation of the *Boston Diagnostic Aphasia Examination* “Cookie Theft” picture. Additionally, participants were asked to describe their family and birthplace using a lot of detail and adjectives (e.g., people, music, food, beaches) in order to observe spontaneous use of the target copula verbs in this and the aforementioned tasks. This approach was employed by Silva-Corvalán in her research examining spontaneous use of the copula verbs in healthy Spanish speakers: “I tried to elicit examples with *ser* and *estar* in the flow of conversation by leading the speakers toward describing people and places unknown to me” (Silva-Corvalán, 1994, p. 98).

The experimental protocol was a sentence-completion paradigm. The study included instructions, which were repeated twice (once at the beginning of the study and once before the practice items), a set of examples and a set of practice items to train participants in the task. The experiment consisted of a total of 130 sentences (selected from a master list of 270 sentences, based on $\geq 90\%$ agreement on the correct copula verb form to complete the sentence by controls on multiple pilot studies). Fifty-five of these sentences required forms of the verb *ser*, while the other 55 required forms of *estar*. The remaining 20 were sentences where either forms of *ser* or forms of *estar* can be used to complete the target sentence. During the experiment, participant responses were both audio recorded and transcribed to a Microsoft Excel spreadsheet. Participants were advised that they could take as long as they wanted to respond, as the task would not be timed, and that the final response given would be the one saved and used for cross-comparison with the other participants. Furthermore, to prevent fatigue, participants with

agrammatism completed the task over multiple sessions (i.e., 2-4 sessions, depending on the participant).

The experimental sentences were simultaneously presented both auditorily and visually via a Microsoft PowerPoint presentation and the participant only had to say what the missing copula verb form was, not repeat or read the entire sentence, in order to ensure that memory load was not a confounding factor.

The stimuli were recorded by a Spanish-speaking male speech-language pathologist of Puerto Rican descent producing the target stimuli sentences. This speaker was chosen for numerous reasons: 1) he is from the same language background as the agrammatic participants that were anticipated for this study, 2) he is a speech-language pathologist who works extensively with the target population and thus has extensive experience in the most effective auditory presentation style for individuals with aphasia (appropriate volume, intonation, rate, use of equal pacing and pausing to indicate where the verb needs to be filled in, etc.) and 3) although he was born and raised in New York, he is a compound bilingual speaker of both Spanish and English and can pass as a native Puerto Rican Spanish speaker.

Prior to the experimental study, all sentence stimuli (examples, practice items and experimental items) had been recorded in a soundproof booth, with a specified pause of three seconds within the sentence to indicate where the missing verb was in the sentence. Following this, all sentences were edited and their loudness normalized in Sound Forge.

All stimuli were comprised of high-frequency lexical items. All categories of sentences contained sentences of similar length range (6-10 word sentences). Only four verb TMA forms were sampled:

<i>Es</i>	Third person singular of <i>ser</i> - present tense (él- “he”/ella- “she”)
<i>Está</i>	Third person singular of <i>estar</i> - present tense (él- “he”/ella- “she”)
<i>Era</i>	Third person singular of <i>ser</i> -imperfect past tense (él- “he”/ella- “she”)
<i>Estaba</i>	Third person singular of <i>estar</i> -imperfect past tense (él- “he”/ella- “she”)

Of note, there is a syllabic difference between *ser* and *estar* (one syllable for *ser* vs. two syllables for *estar* in the present tense and two syllables for *ser* vs. three syllables for *estar* in the imperfect past tense).

Stimulus sentences were created to compare the factors of TMA Frequency, VF Regularity and CGC within seven categories. Each of these categories included 20 sentences (except Categories 5 and 6, which contained 15 sentences each for a total of 30 sentences), and the sentences were pseudo-randomized prior to recording.

The seven sentence categories for the experimental protocol were the following:

- 1) *Category 1: High TMA Frequency/Low VF Regularity (Ser in the present tense)*
 (“La camisa *es* de seda.” - “The shirt is made of silk.”)
- 2) *Category 2: High TMA Frequency/High VF Regularity (Estar in the present tense)*
 (“La niña *está* en el parque.” - “The girl is at the park.”)
- 3) *Category 3: Low TMA Frequency/Low VF Regularity (Ser in the imperfect past tense)*
 (“Cuando niño, su pelo *era* rubio.” - “As a little boy, his hair was blonde.”)
- 4) *Category 4: Low TMA Frequency/High VF Regularity (Estar in the imperfect past tense)*
 (“Antes del cierre, la escuela *estaba* llena de estudiantes.” - “Before closing, the school was filled with students.”)

5) *Categories 5 and 6: High TMA Frequency/High CGC* (Sentences required either *ser* or *estar* in the 3rd person singular present tense (él- “he”/ella- “she”); verb choice would result in a semantic change to the adjective that follows the verb in the sentence). These categories contained 15 sentences each that required forms of *ser* (Category 5) or *estar* (Category 6) for a total of 30 sentences

Category 5. (“Ese actor de Hollywood *es* muy orgulloso.”- “That Hollywood actor is very haughty/arrogant.”)

Category 6. (“El abuelo *está* orgulloso de su nieto.”- “The grandfather is proud of his grandson.”)

6) *Category 7: High TMA Frequency/Low CGC* (Either *ser* or *estar* in the 3rd person singular present tense (él- “he”/ella- “she”) can be used without semantic (just aspectual) change to the adjective that follows the verb).

(“Nuestro gato *es/está* gordo.” -“Our cat is fat.”)

The effect of TMA Frequency was examined by comparing production of the copula verbs in the present tense (high frequency) and the imperfect past tense (lower frequency in daily use compared to the present tense). For the contribution of VF Regularity, we compared *ser* (highly irregular) and *estar* (highly regular) in the present tense and imperfect past tense. Our examination of CGC involved comparing a subset of the sentences of “high CGC,” (i.e., Categories 5 and 6 where only one copula verb form can be used to complete the sentence; in these sentences, verb choice results in a semantic change to the adjective that follows the verb in the sentence), to non-CGC sentences: i.e., rule-governed uses of these copula verbs (i.e., Categories 1 and 2). In addition, a tally of copula verb choice was taken for Category 7 sentences, where forms of either verb can be used to complete the sentence and verb choice results in an aspectual (not a semantic)

change to the adjective that follows the verb.

2.1.3 Data Coding, Statistical Analyses, Error Analyses, Feature-Distance Analysis and Intrarater Reliability

Data for the practice items and for all 130 experimental sentences from all participants were compiled and arranged on Microsoft Excel spreadsheets. During the study, when participants produced their final response, the experimenter immediately logged the response to the participants' Microsoft Excel spreadsheet (i.e., the Microsoft PowerPoint program for the experiment was linked to Microsoft Excel so that participants' responses could be recorded on-line during the experiment). In addition, the testing session(s) were audio-recorded. A cross-comparison of participant responses to each of the 130 experimental sentences was made, and any responses where an error in *ser* or *estar* production was made were highlighted. Another Microsoft Excel spreadsheet was created for an error analysis of all participant errors.

A participant's response was coded as an error within the following general error types:

- 1) Verb Choice (i.e., "Estar for Ser" or "Ser for Estar") Error:
 - a) A form of the verb *estar* was used in place of a form of the verb *ser* in those sentences from Categories 1, 3 and 5.
 - b) A form of the verb *ser* was used in place of a form of the verb *estar* in those sentences from Categories 2, 4 and 6.
- 2) Agreement/Tense Error:
 - a) A person/number error occurred. All experimental sentences were developed to require only the 3rd person singular forms of the verbs in either

the present or imperfect past tense.

b) A *clear* tense error occurred. The present tense sentences were developed to elicit the present tense of the verb (e.g., “Hoy *es* jueves, cinco de marzo.”- “Today is Thursday, the 5th of March”). Similarly, the imperfect past tense sentences were developed to require only the ‘habitual’ imperfect past tense form (“Antes de su muerte, el hombre *era* muy sano.”- “Before his death, the man was very healthy”). However, there were some present tense sentences for which a participant’s response was considered correct non-target copula.

A participant’s response was considered “correct non-target” in the following circumstance:

Present tense forms were produced as the preterite past tense or future tense (e.g., *fue* or *será* for *es*) if the target sentence did not contain a specific present tense indicator (e.g., “ahora”- “now;” “hoy”- “today”). Of note, 76 of the 90 present tense sentences did not have a specific present tense marker. This was done to avoid having the experimental sentences sound highly repetitive and keep the sentences within a specified length.

3) Verb Choice Error- Other:

A non-target verb substitution or an omission error occurred.

With respect to Category 7- where either *ser* or *estar* in the 3rd person singular present tense could be used to complete the sentence, a tally was created comparing the number of *ser* vs. the number of *estar* instances produced by the control participants and

participants with agrammatism. If overall word frequency alone matters, then we expected to see excess use of *ser* responses to these sentences; if regularity alone matters, then we expected to observe excess use of *estar* responses to these sentences, similar to our findings in O'Connor, Obler and Goral (2007).

When a participant produced multiple responses to a given sentence, the last response produced was the one coded for cross-comparison with the other participants.

Overall percent correct was calculated for the following parameters:

- a) Within and between group comparisons of overall percent correct.
- b) Within and between group comparisons of overall percent correct for individual Categories 1 through 7.

To answer the research questions, the following comparisons were performed:

For research question #1 (TMA Frequency), percent correct for present vs. imperfect past tense, collapsing across *ser* and *estar*, was compared a) between groups and b) within groups.

For research question #2 (VF Regularity), percent correct for *estar* (more regular) vs. *ser* (more irregular), collapsing across tense, was compared a) between groups and b) within groups.

For research question #3 (CGC), two different comparisons were performed:

a) Comparison of percent correct for *ser* and *estar* in Category 1 (rule-governed *ser*) vs. Category 5 (high CGC *ser*) and Category 2 (rule-governed *estar*) vs. Category 6 (high CGC *estar*) a) between groups and b) within groups.

b) Proportion of use (copula choice) of *estar* vs. *ser* in Category 7 (low CGC) was

compared a) between groups and b) within groups.

A Mixed-Effects Logistic Regression was used to analyze the data from the between category comparisons. This statistical approach was preferred over ANOVA because this method better takes into account the ceiling and floor effects in comparing two groups with differing performance ranges (for our study, healthy controls and agrammatic speakers, J. Verkuilen, personal communication, December 10, 2009). Group membership (control vs. agrammatic) served as the between subjects factor. Number correct served as the dependent variable. Verb type (*ser* or *estar*) and Category (1-7) served as independent measures.

A Mann-Whitney U Test was used to analyze the data from the within category comparisons for the two groups. A Wilcoxon Signed-Rank Test was used to make within category comparisons of the agrammatic group data for our three factors. Finally, A Kruskal-Wallis Test was used to make between group comparisons of *ser* and *estar* preference in Category 7 (the copula choice category).

Error Analyses

For the error analyses, we first examined the number and percent error by all error types and by all categories of sentences made by the two groups. Following this, we took a more direct look at the three most common error types for both groups and the three most common categories where errors were committed by both groups and did further analyses to look for patterns within these errors.

Feature-Distance Analysis

A feature-distance analysis was also conducted, via classifying errors as one or two-feature errors. To do this, I reviewed all the errors committed by the two groups (i.e., total of 308 errors for the agrammatic group, 56 for the control group). When a participant's error differed from the target copula verb form by only one feature (e.g, *estar* for *ser* error, *ser* for *estar* error, tense error only, number error only), the error was scored as one. When a participant's error differed by two features (e.g., *estar* for *ser* + tense error), the error was scored as two. Subsequently, a tally and percentage of one feature and two-feature errors for each participant and for both groups was calculated.

Intrarater Reliability

Recall that the selection criterion for participants in the agrammatic group was that they had no concomitant dysarthria and/or apraxia of speech. Since participants only had to say what the missing copula verb in the sentence was, their responses, along with the control group's responses, were easy to score. Intrarater reliability was conducted, to further assure that errors did not occur in the coding and/or scoring of the data. The experimenter listened to each participant's audiotape recording of the experimental session(s) on a separate occasion, and blindly created a second Microsoft Excel spreadsheet for each of the 18 participants from both groups. Overall agreement between the original coding/scoring and the second one was >95% accuracy. As a result of our high intrarater reliability, we judged that there was no need for interrater reliability.

Chapter 3: Results

The results chapter is structured in the following manner: First, I discuss the overall performance of the control participants and the participants with agrammatism, to provide a general understanding of the data and how the two groups differ on this task. Following this, I compare the performance of the agrammatic group on the factors crucial to this study: TMA Frequency, VF Regularity and CGC, in addition to detailing copula choice for both groups of participants as it relates to semantics. A summary of the overall results is provided, before moving into the within category data. The results chapter concludes with error analyses for both groups of participants and a summary of the results.

3.1 Overall Comparison of Control Participants and Participants with Agrammatism

A mixed-effects logistic regression was conducted to address the primary research questions. It showed that the agrammatic group performed significantly worse than the control group ($\beta = -3.13$, $z = -11.04$, $p < .001$). As expected, the control participants performed at or close to ceiling on this task, achieving a mean overall accuracy of 96%, while the participants with agrammatism performed with significantly lower overall accuracy on this task, achieving a mean overall accuracy of 60%. See Figures 1 and 2 for this comparison.

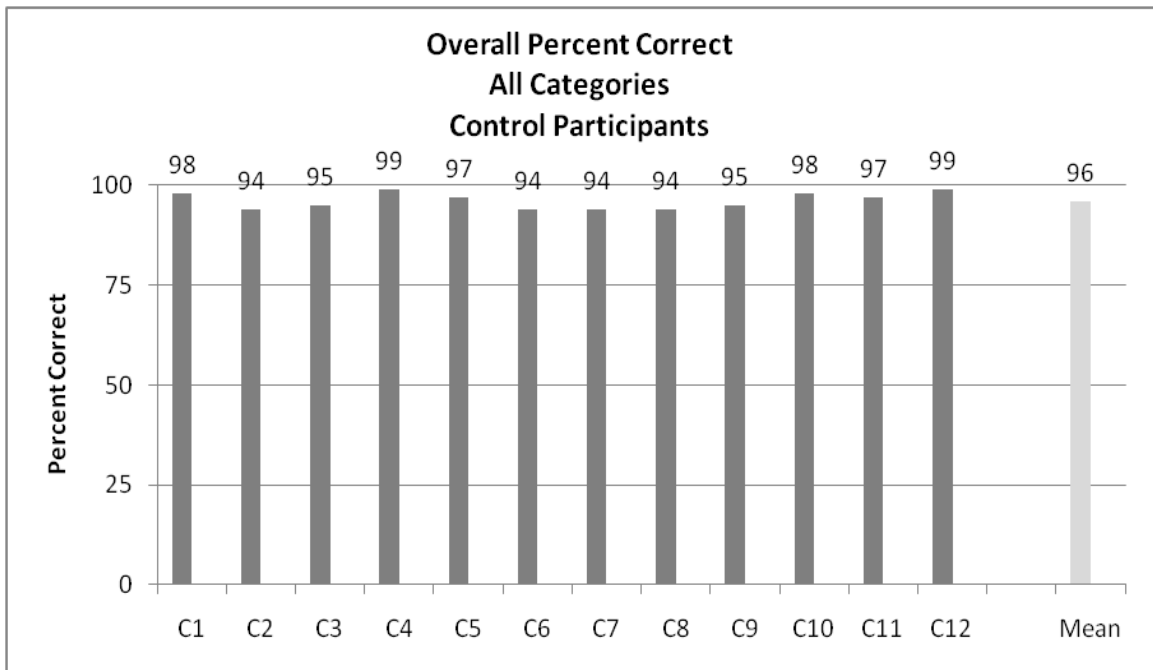


Figure 1

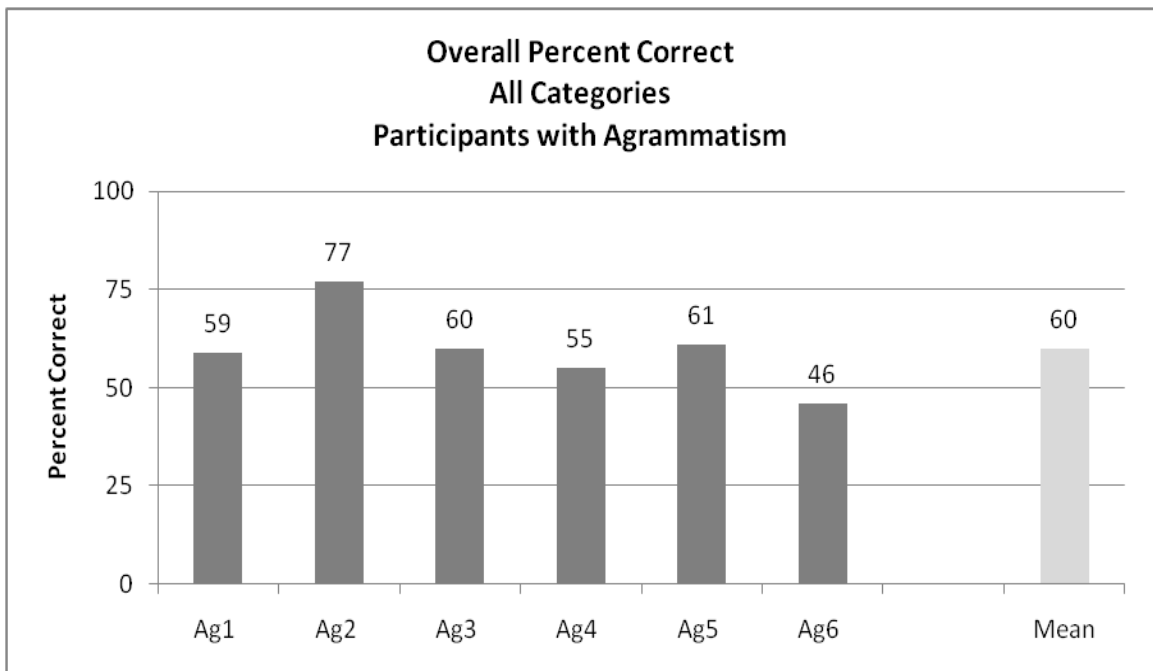


Figure 2

3.2 Tense-Mood-Aspect Frequency (TMA Frequency)

In examining the contribution of TMA Frequency to copula verb production, for

the participants with agrammatism, the regression confirmed that the performance on the imperfect past tense was significantly worse than the performance on the present tense ($X = 49\%$ vs. 65% respectively, $\beta = -.717$, $z = -3.05$, $p = .002$). See Figure 3 for a summary of the data.

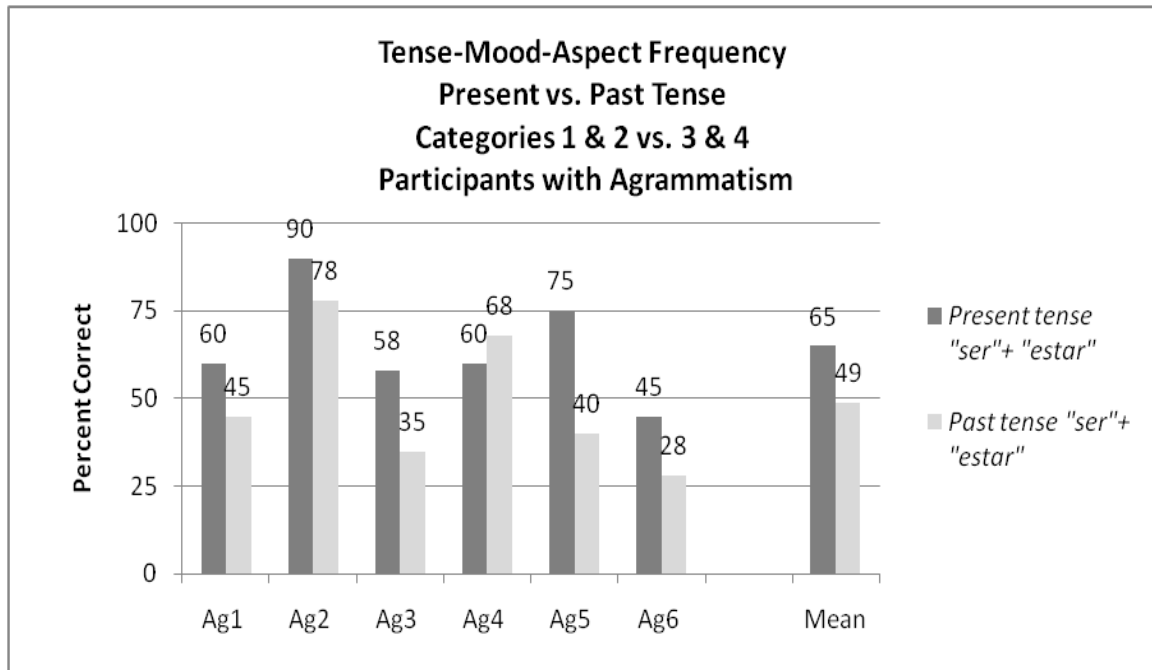


Figure 3

Therefore, our hypothesis #1 is confirmed: **the more frequent present tense forms of the copula verbs were better spared compared to the less frequent imperfect past tense forms in these Spanish speakers with agrammatism.**

3.3 Verb-Form Regularity (VF Regularity)

With respect to how VF Regularity contributes to copula verb production, the regression confirmed that the performance on irregular verb-forms was significantly worse than the performance on regular verb-forms for our participants with

agrammatism, ($X = 44\%$ vs. 70% respectively ($\beta = -.440, z = -2.38, p = .017$). See Figure 4 for a summary of the data.

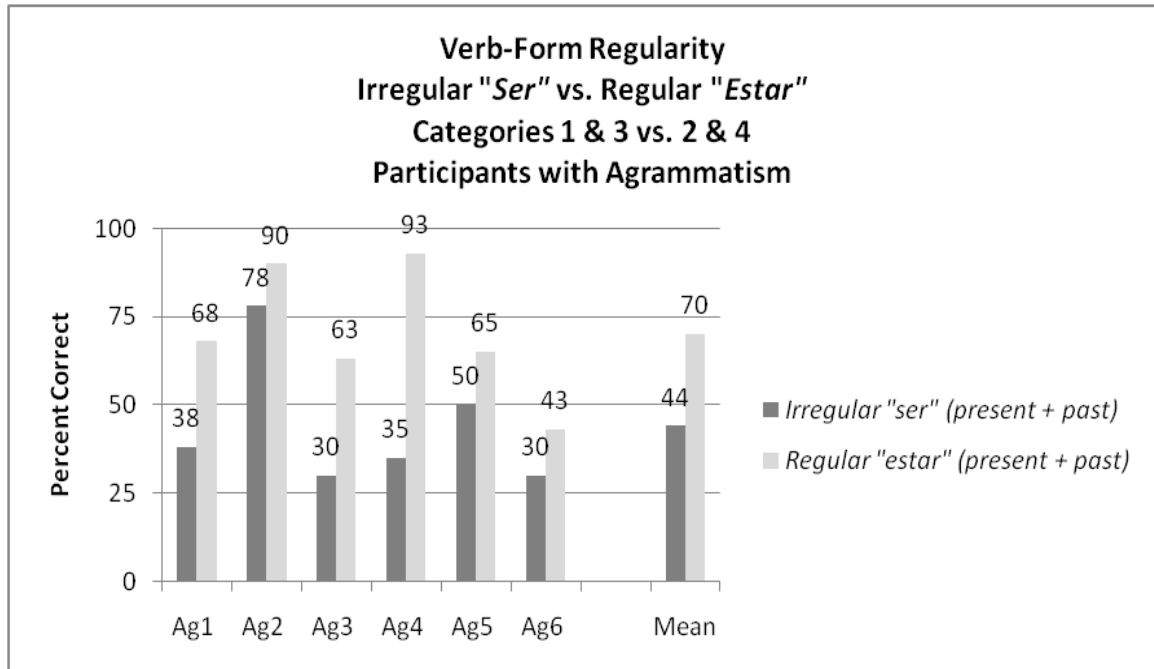


Figure 4

We conclude, then, that our hypothesis #2 is also confirmed: **the more regular copula verb, *estar*, was better spared than the more irregular copula verb, *ser*, in these Spanish speakers with agrammatism.**

3.4 Context-Governed Choice (CGC)

For the factor of CGC and its contribution to copula verb production, the regression demonstrated that for the participants with agrammatism, rule-governed uses of *ser* and *estar* were more accurate than CGC uses ($X = 65\%$ vs. 50% respectively, $\beta = -.873, z = -4.71, p < .001$). See Figure 5 for a summary of the data.

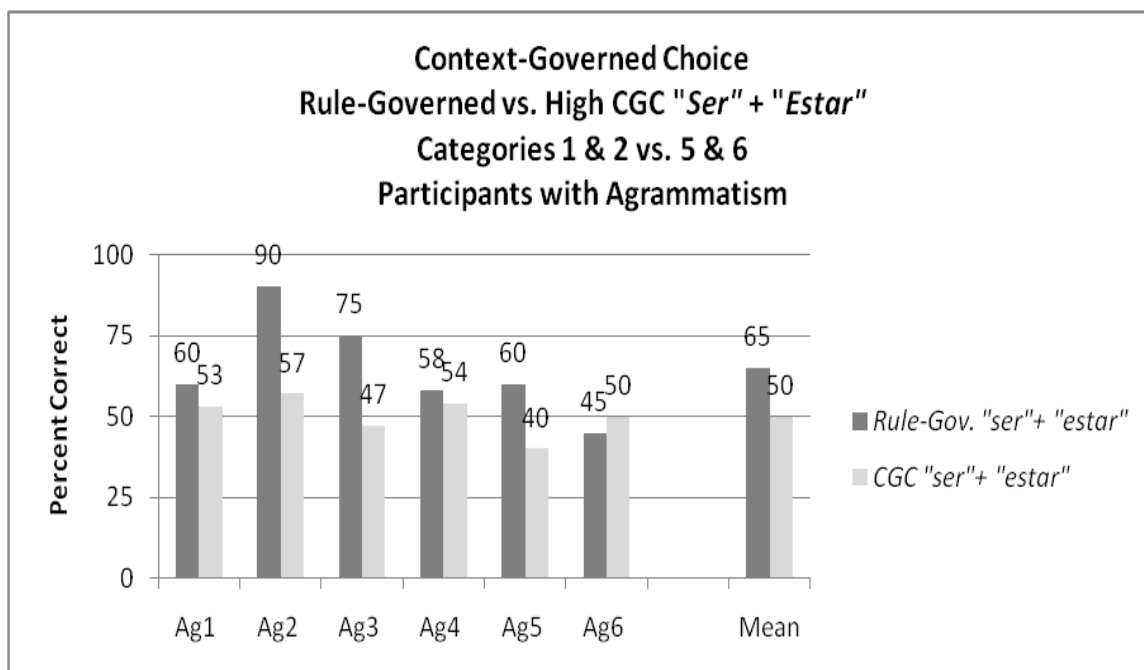


Figure 5

Therefore, our hypothesis #3 was not supported: **CGC did not facilitate performance.**

3.5 Summary of Overall Results

Research Question and Hypothesis	Factor	Result
1	TMA Frequency	Supported
2	VF Regularity	Supported
3	CGC	Unsupported

3.6 Semantics and Copula Choice

When the sentences allowed a choice between the two copulas in Category 7, the controls performed quite differently from each other and rarely selected “both copulas.” Selection of *estar* ranged from 5-70%, while the range for *ser* was 25-90%; in other

words, the majority of the control participants preferred the *ser* verb (8 of 12) while the remaining four either preferred *estar* or both.

The participants with agrammatism also did not demonstrate uniformity in copula choice. They never chose “both copulas” in these low CGC sentences. Three of the participants (Ag2, Ag4 and Ag5) showed a strong preference for *estar*, while the remaining three (Ag1, Ag3 and Ag6) showed a preference for *ser*. Overall, the range of use of *estar* was higher (35-80%) than the range of *ser* (20-65%). The three participants who preferred *estar* (i.e., Ag2, Ag4 and Ag5) also demonstrated better performance on *estar* than the other three participants (i.e., Ag1, Ag 3 and Ag6) in Category 2 (rule-governed *estar*). See Figures 6 and 7 for a summary of these data.

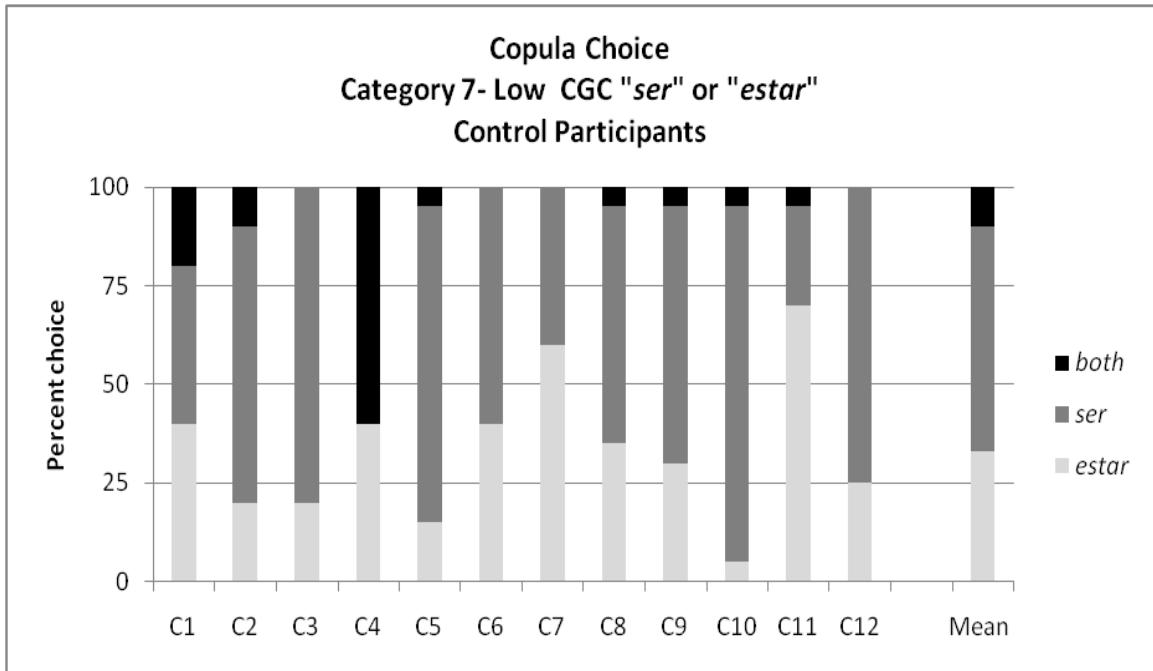


Figure 6

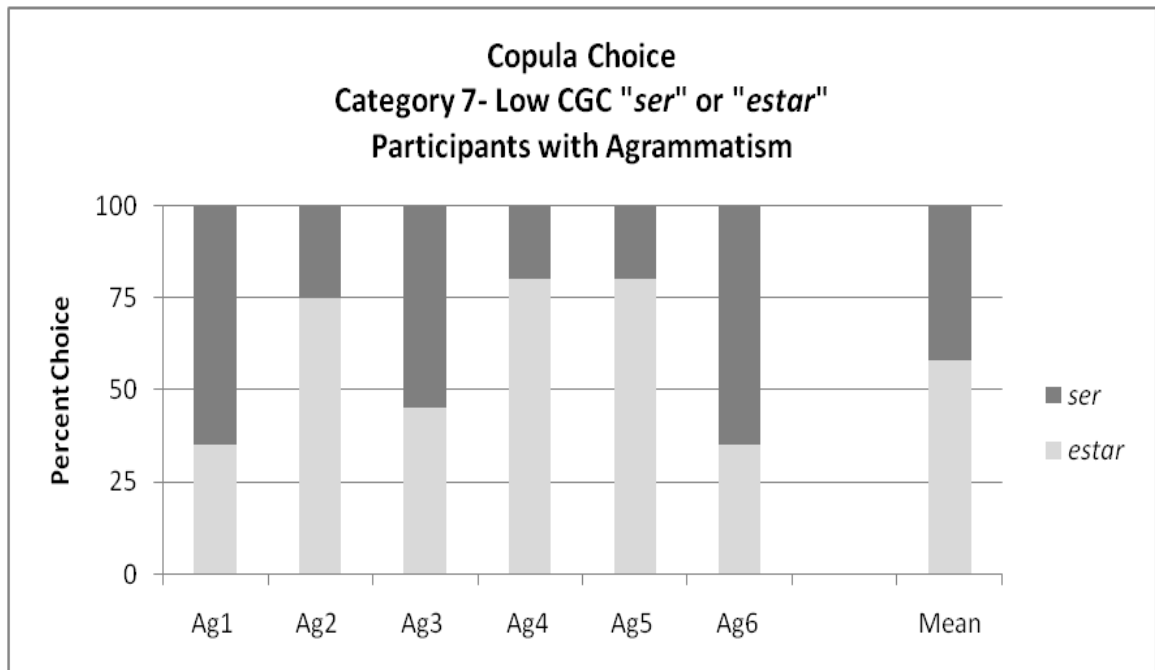


Figure 7

A Kruskal-Wallis Test revealed that the proportion of *estar* preference was significantly different between the two groups, with this proportion higher for the agrammatic group than the control group ($H = 4.68, p = .030$), while the proportion of *ser* preference did not differ significantly between the two groups ($H = 2.12, p = .145$).

3.7 Interaction Effects

The regression revealed a trend toward an interaction between TMA Frequency and VF Regularity; i.e., the irregular verb in the imperfect past tense (i.e., *era*) yielded the lowest overall accuracy among participants with agrammatism ($\beta = -.555, z = -1.90, p = .057$). A three-way interaction between TMA Frequency, VF Regularity and CGC could not be analyzed because Categories 5 and 6 only contained 15 items each, whereas all other categories contained 20 items each. See Table 5 for a summary of the data from the mixed-effects logistic regression.

Table 5- Mixed-Effects Logistic Regression: Percent Correct Comparison for Agrammatic Group vs. Control Group:

Correct	Coefficient/ β	Standard Error	Z	P	95% Conf. Inter.
Agrammatic	-3.13	.283	-11.04	0.000	[-3.68, -2.57]
Past Tense	-.717	.235	-3.05	0.002	[-1.17, -.255]
Irregular Verb	-.439	.184	-2.38	0.017	[-.801, -.077]
Semantic	-.873	.185	-4.71	0.000	[-1.23, -.509]
Past x Irregular	-.555	.292	-1.90	0.057	[-1.12, .017]
Constant/Controls	4.17	.260	16.03	0.000	[3.66, 4.68]

3.8 Within Category Comparisons

The experimental protocol for this study included only 130 items because piloting of up to 270 sentences revealed that participants with agrammatism fatigued when the task included more than approximately 130 sentences. As a result, nonparametric statistics were used for within category comparisons. For the between groups comparisons, (i.e., comparing the control and agrammatic groups within each category), a Mann-Whitney U Test was employed because this test allows comparisons of independent samples (i.e., controls vs. agrammatics). A Wilcoxon Signed-Rank Test was used for within agrammatic group comparisons between *ser* and *estar* categories, because this test allows for comparison of related samples (i.e., comparisons within a given group of participants). In the following sections, I discuss these between and within group comparisons.

3.8.1 Between Group Comparisons

The between group comparisons using Mann-Whitney U Tests for our categories, showed not only that the agrammatic group performed worse on the task overall

compared to the control group, but they also performed worse on all categories. See the summary of the Mann-Whitney U Test results for each category below, and refer to Table 6 for more detailed information on the data from these between group, within category comparisons.

Category 1: $U = .00, z = -4.02, p < .001$

Category 2: $U = 13.0, z = -2.73, p = .006$

Category 3: $U = .50, z = -3.49, p < .001$

Category 4: $U = 10.5, z = -2.44, p = .015$

Category 5: $U = .000, z = -3.44, p = .001$

Category 6: $U = .000, z = -3.43, p = .001$

Table 6- Mann-Whitney U Test: Summary Table of Within Category Comparisons:

Test Statistics^b

	Category1	Category2	Category3	Category4	Category5	Category6
Mann-Whitney U	.000	13.000	.500	10.500	.000	.000
Wilcoxon W	21.000	34.000	21.500	31.500	21.000	21.000
Z	-4.016	-2.726	-3.487	-2.442	-3.444	-3.434
Asymp. Sig. (2-tailed)	.000	.006	.000	.015	.001	.001
Exact Sig. [2*(1-tailed Sig.)]	.000 ^a	.032 ^a	.000 ^a	.013 ^a	.000 ^a	.000 ^a

a. Not corrected for ties.

b. Grouping Variable: Group

In the following paragraphs, I provide more specific information on the performance of the two groups on each of the categories of this experimental study.

Category 1- (ser in the 3rd person singular present tense- “es”):

As expected, for Category 1, the control participants performed at ceiling ($X =$

100%, $SD = 0$). The participants with agrammatism, also as expected, performed with lower accuracy on this category ($X = 61\%$, $SD = 24.98$) than the control participants. See Figures 8 and 9 for a comparison the control and agrammatic group's data on this category.

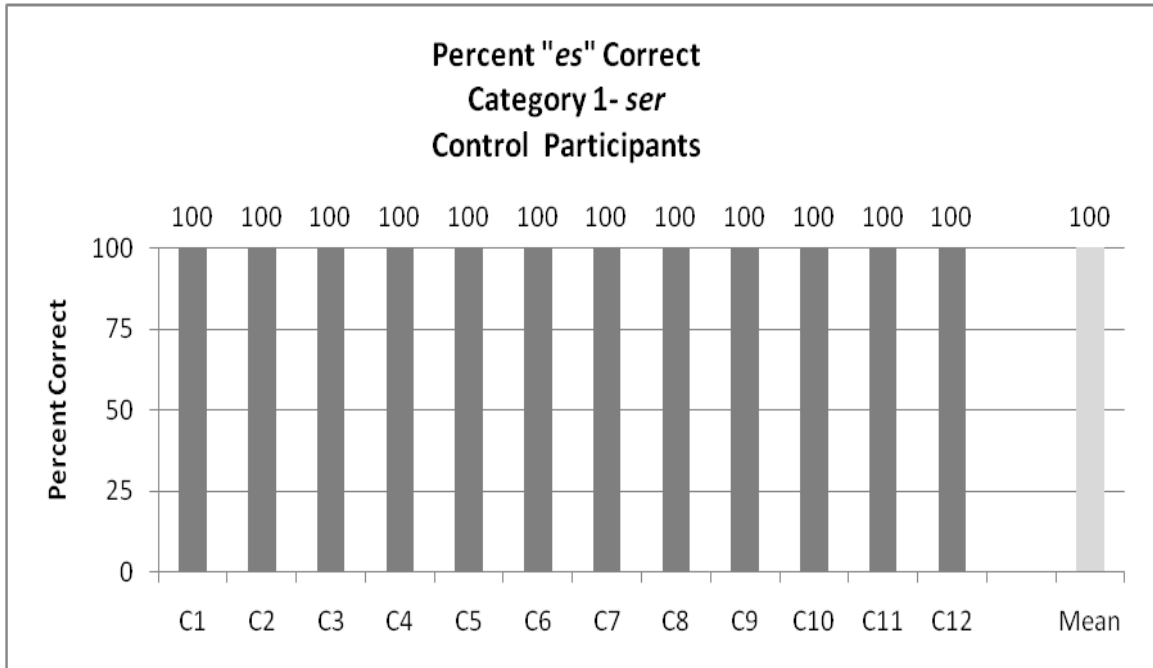


Figure 8

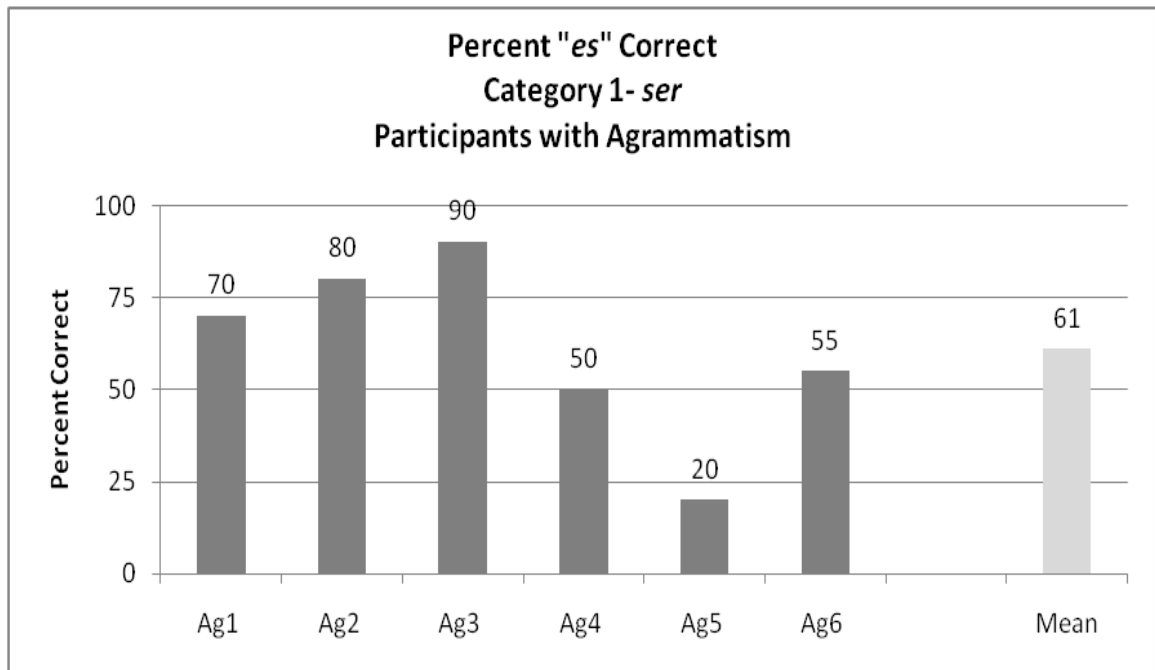


Figure 9

Category 2- (*estar* in the 3rd person singular present tense- “*está*”):

On Category 2, the control participants again performed at ceiling ($X = 99.5\%$, $SD = 1.44$), while the participants with agrammatism performed with lower accuracy on this category of sentences ($X = 68\%$, $SD = 24.98$) than the control participants.

Interestingly, two participants with agrammatism (Ag2 & Ag5) performed at ceiling on this category, similar to the controls. See Figures 10 and 11 for this comparison.

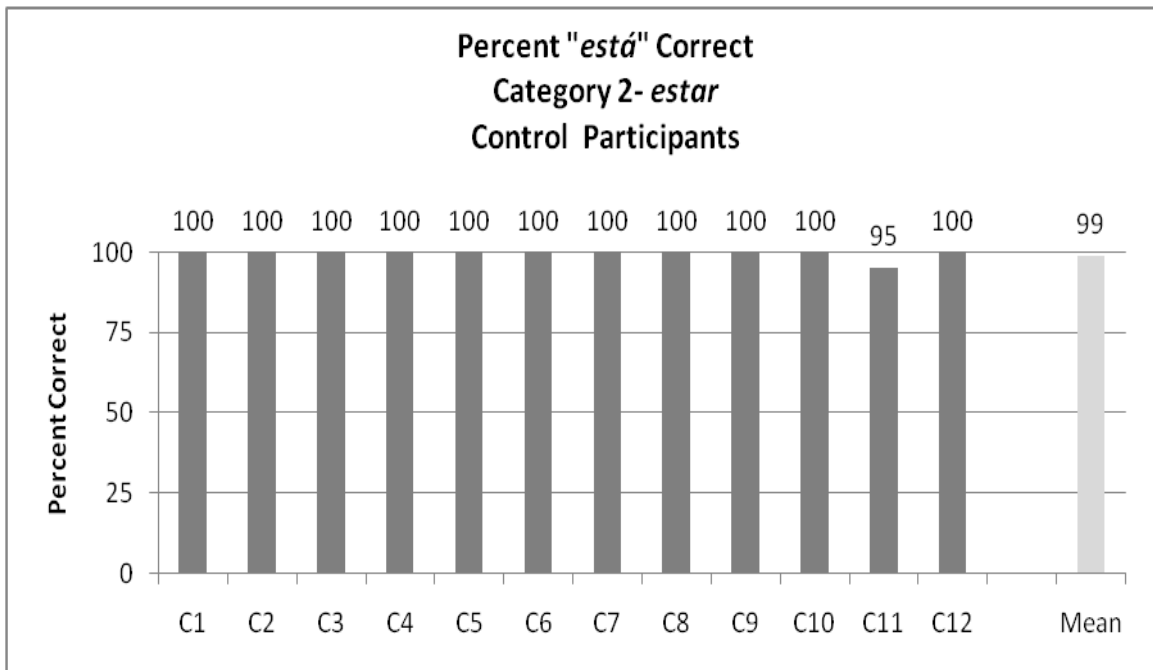


Figure 10

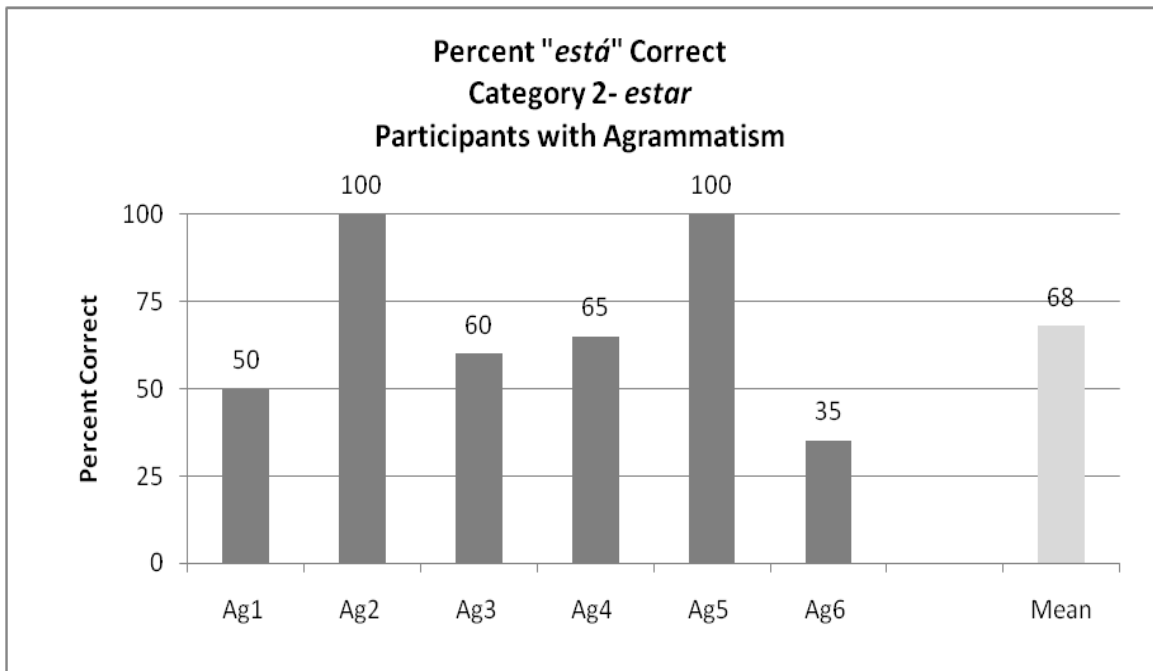


Figure 11

Of note, a review of the demographics of participants Ag2 and Ag5 revealed

similarities only in gender (both female) and L1 Spanish status. No other demographic characteristics seemed to explain their similar behavior (i.e., age, birthplace, SES, dialect, years in US, language status (bilingual vs. monolingual), educational attainment and time post-onset of CVA).

Category 3- (*ser* in the 3rd person singular imperfect past tense- “*era*”):

For Category 3, eight of the twelve control participants performed at ceiling (100%), while three additional ones performed near ceiling (90-95%). One control participant performed at 75% accuracy on this category (C7); this participant was one of the eldest participants (both C7 & C8 were 71 years old at the time of testing). In sum, the control participants performed with a mean accuracy of 96% ($SD = 7.63$) on Category 3. As a group, the participants with agrammatism performed with lower accuracy ($X = 26\%$, $SD = 29.56$) than the control participants. Ag2 achieved the highest accuracy on this task (75%). See Figures 12 and 13 for this comparison.

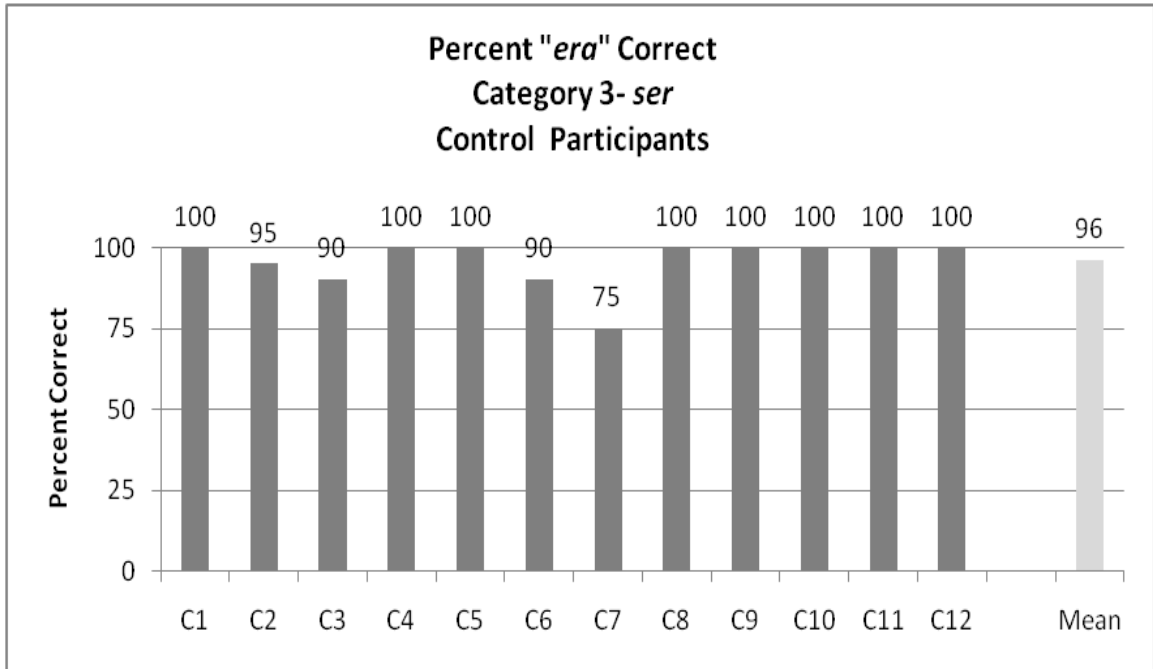


Figure 12

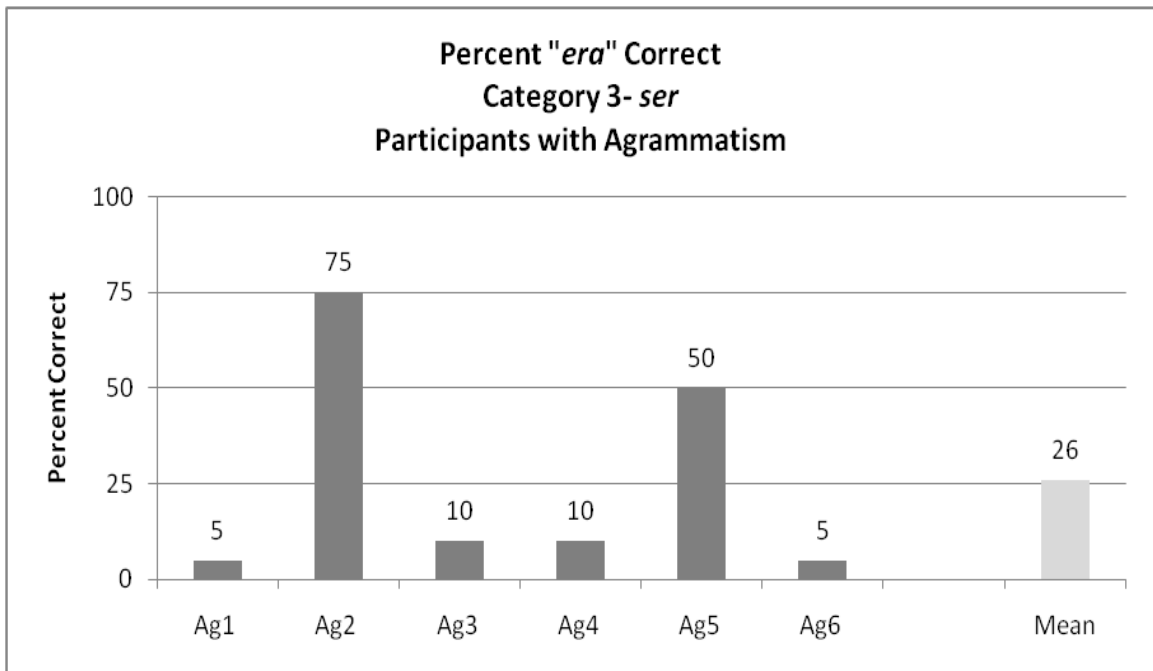


Figure 13

Category 4- (*estar* in the 3rd person singular imperfect past tense- “*estaba*”):

For Category 4, two of the twelve control participants performed at ceiling (100%), while six additional control participants performed close to ceiling (90-95%). The other four control participants (C2, C6, C8 & C9) performed at lower accuracy on this category (70-85%). Their errors will be discussed in the error analysis to follow.

In sum, the control group achieved a mean accuracy of 90% ($SD = 10.54$) while participants with agrammatism achieved a lower mean accuracy ($X = 72\%$, $SD = 14.37$).

Three participants with agrammatism (Ag1, Ag2 & Ag5) performed quite well on this task (80-85%), while the other three performed at or above the level of chance (50-70%). Of note, the mean for Category 4 was higher than the mean for Categories 1, 2 and 3 for the participants with agrammatism. See Figures 14 and 15 for a comparison of the performance of the control and agrammatic groups on this category.

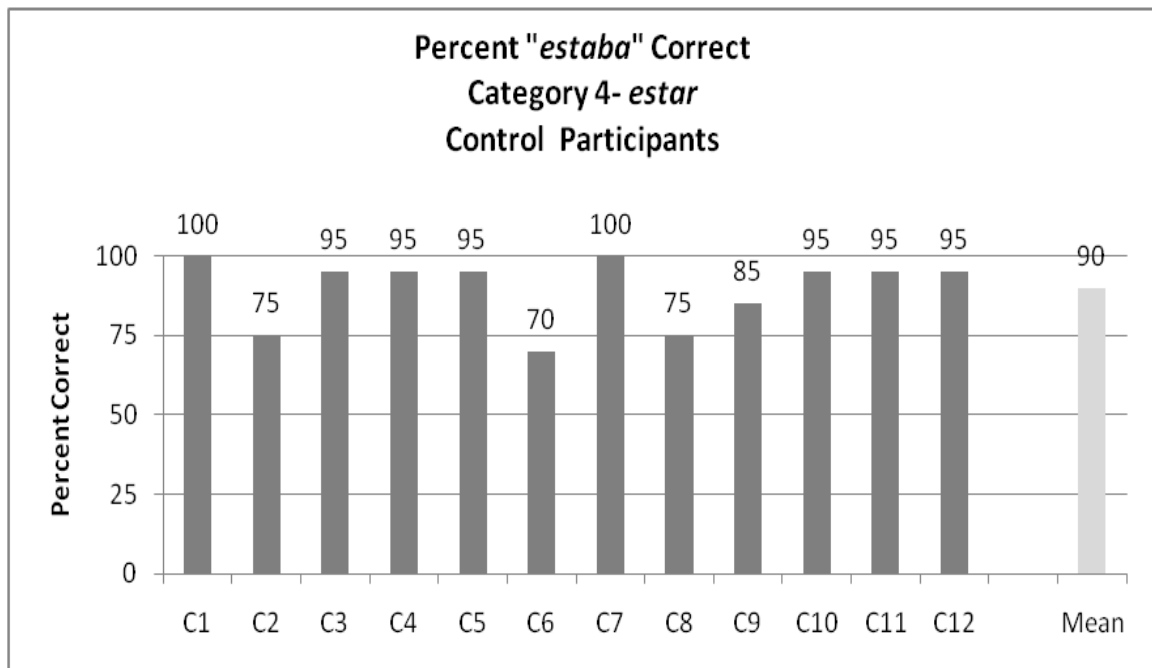


Figure 14

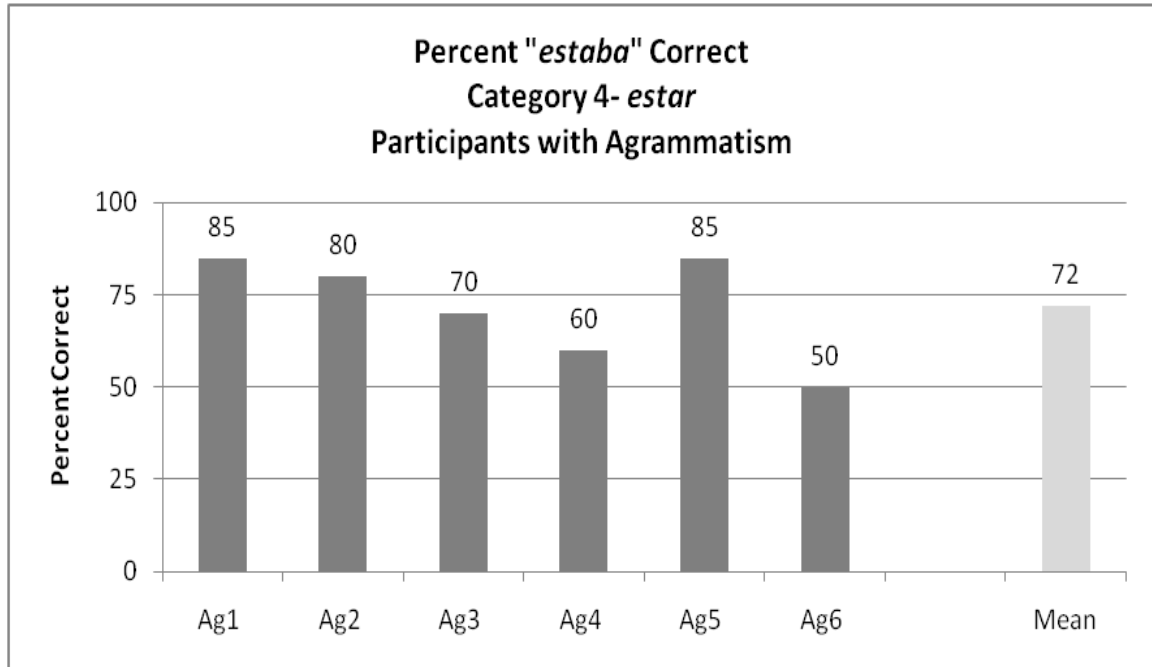


Figure 15

Categories 5 and 6- (“High CGC” *ser* and *estar* respectively, i.e., *ser* and *estar* in the 3rd person singular present tense- “*es*” and “*está*”):

For Categories 5 and 6, the control group performed close to ceiling and with equal accuracy on *ser* and *estar* ($X = 94\%$ for both Categories 5 and 6, $SD = 6.24$ and 5.46 respectively). In contrast, the participants with agrammatism performed with lower accuracy on this category of sentences. In addition, for the agrammatic group, the absolute value of the mean performance was higher for high CGC *estar* ($X = 60\%$, $SD = 18.95$) than for high CGC *ser* ($X = 40\%$, $SD = 22.78$). However, these means reflect substantial within group differences among four of the participants (Ag2, Ag4, Ag5 & Ag6), with three of them performing better on *estar* than *ser* (Ag2, Ag4 & Ag5) and the other (Ag6) performing better on *ser* than *estar*. See Figures 16 and 17 for this

comparison and Table 6 on page 64 for a summary of the Mann-Whitney U Test findings.

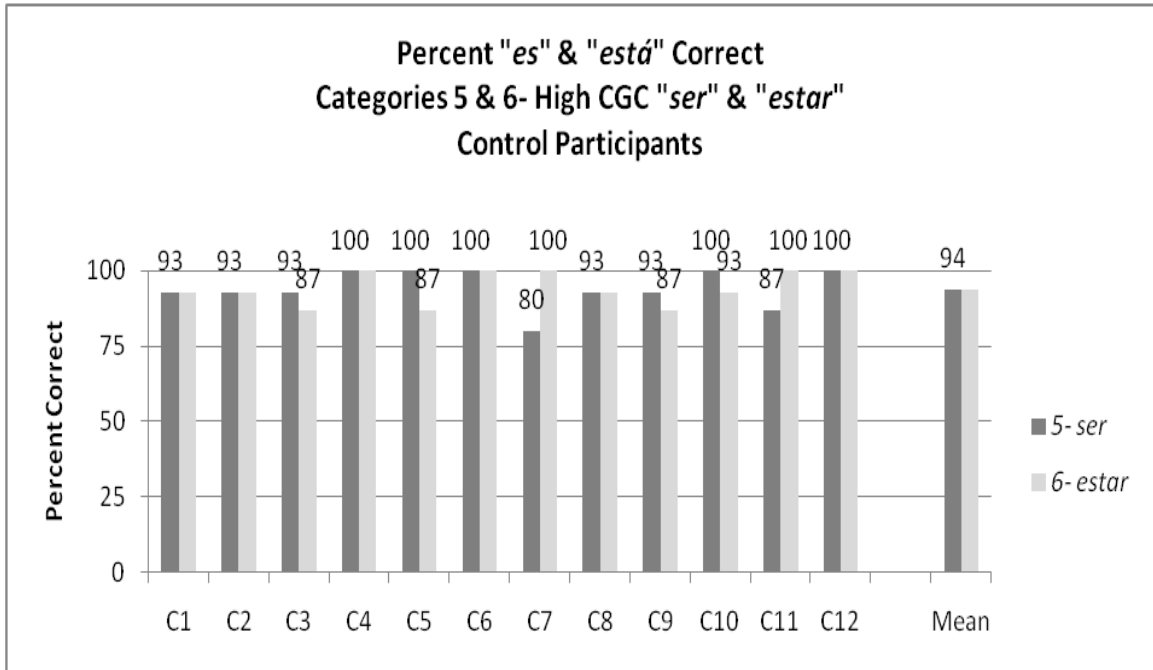


Figure 16

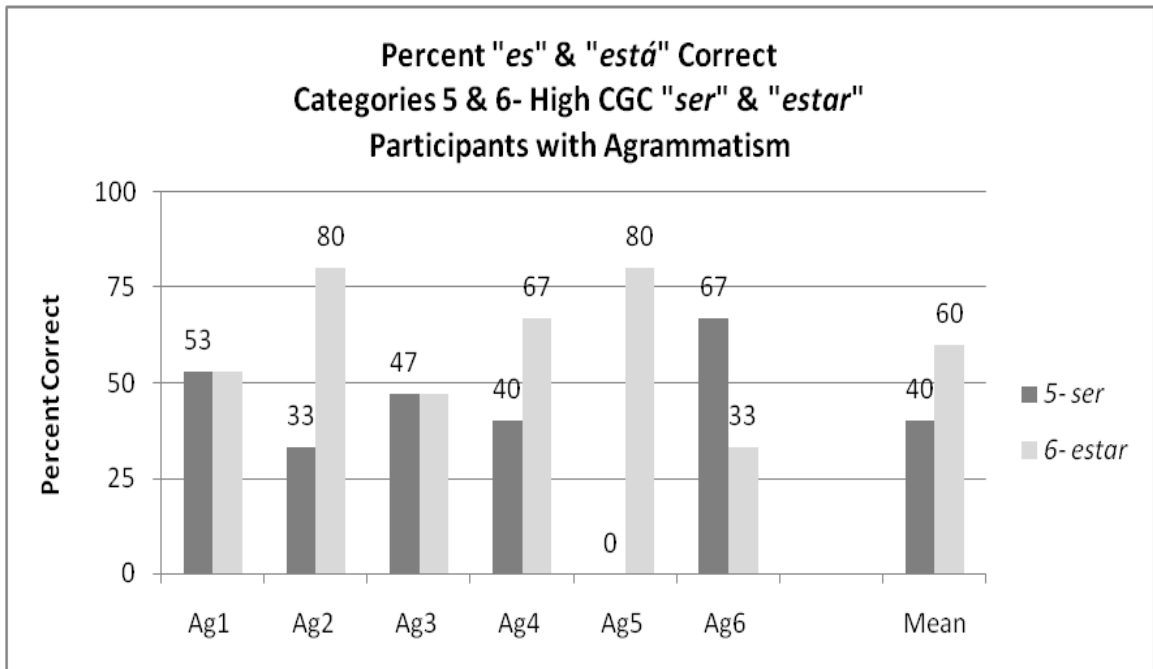


Figure 17

3.8.2 Within Agrammatic Group Comparisons for *Ser* and *Estar* Categories

To examine the performance of the agrammatic group on the three factors under investigation, within agrammatic group comparisons of our *ser* and *estar* categories were done using the Wilcoxon Signed-Rank Test.

In comparing *ser* and *estar* in the present tense (i.e., to compare Categories 1 and 2), the Wilcoxon Signed-Rank Test revealed no statistically significant difference between the performance of the agrammatic group on *ser* present tense vs. *estar* present tense ($W = 11.0, z = .106, p = .916$)

In examining *ser* and *estar* in the imperfect past tense (i.e., to compare Categories 3 and 4), this test showed that the difference between the agrammatic group's performance on *ser* imperfect past tense vs. *estar* imperfect past tense was statistically significant ($W = 21.0, z = 2.20, p = .028$).

Finally, we used this test to contrast the agrammatic groups' performance on high CGC *ser* and *estar* with rule-governed uses of *ser* and *estar* (i.e., comparing Categories 5 & 1 and Categories 6 & 2), and found that the difference between high CGC *ser* and rule-governed *ser* and high CGC *estar* and rule-governed *estar* were both statistically significant ($W = .000, z = -2.21, p = .027$). See Table 7 for a summary of the results from the Wilcoxon Signed-Rank Test.

Table 7- Wilcoxon Signed-Rank Test: Summary Table of Within Agrammatic Group Comparisons	W	z	P
Present Tense- Categories 1 vs. 2	11.0	.106	.916
Past Tense- Categories 3 vs. 4	21.0	2.20	.028
High CGC vs. Rule-Governed uses of <i>ser</i> and <i>estar</i> - Categories 5 and 1 vs. 6 and 2	.000	-2.21	.027

3.9 Error Analyses

In the error analyses, the following questions were addressed:

- 1) What were the most common types of errors (e.g., verb choice errors, tense errors) committed by the agrammatic group and the control group?
- 2) When the accuracy was low for one of the two verbs, were the errors mainly substitution of one verb for the other?
- 3) Was there heterogeneity or homogeneity in the types of errors committed within and between the two groups?
- 4) Were the errors committed by both groups mostly substitution or omission errors?
- 5) Was the ranking of errors by category type (i.e., which categories had the most, which had the fewest errors) similar or different for the two groups?

In our first pass, we looked at number and percent error by all error types and by all categories of sentences included in the study. Then, we took the three most common error types for both groups and the three most common categories where errors were committed by both groups and did further analyses to look for patterns within these

errors. In examining the pattern of errors, we also conducted a feature-distance analysis, to determine if participants in both groups made predominantly one-feature or two-feature errors throughout the task.

Agrammatic Group Errors

In examining the overall number of errors, the individual participants with agrammatism made between 28-71 errors on the task, with a combined total of 308 errors. Participant Ag2 made the fewest errors, while Ag6 made the most errors. Participants Ag1, Ag3, Ag4 and Ag5 made a similar number of overall errors. With respect to the number and percentage error by category, like the control group, the agrammatic group was heterogeneous in their error patterns. However, the three categories where most of the participants with agrammatism made errors were the three *ser* categories (in order from most to fewest errors): 1) Category 3 (*era*): $X = 29\%$, 2) Category 5 (*es*- high CGC): $X = 18\%$ and 3) Category 1 (*es*- *rule-governed*): $X = 15\%$. Figures 18-20 highlight the percentage of errors made by the participants with agrammatism on these three categories.

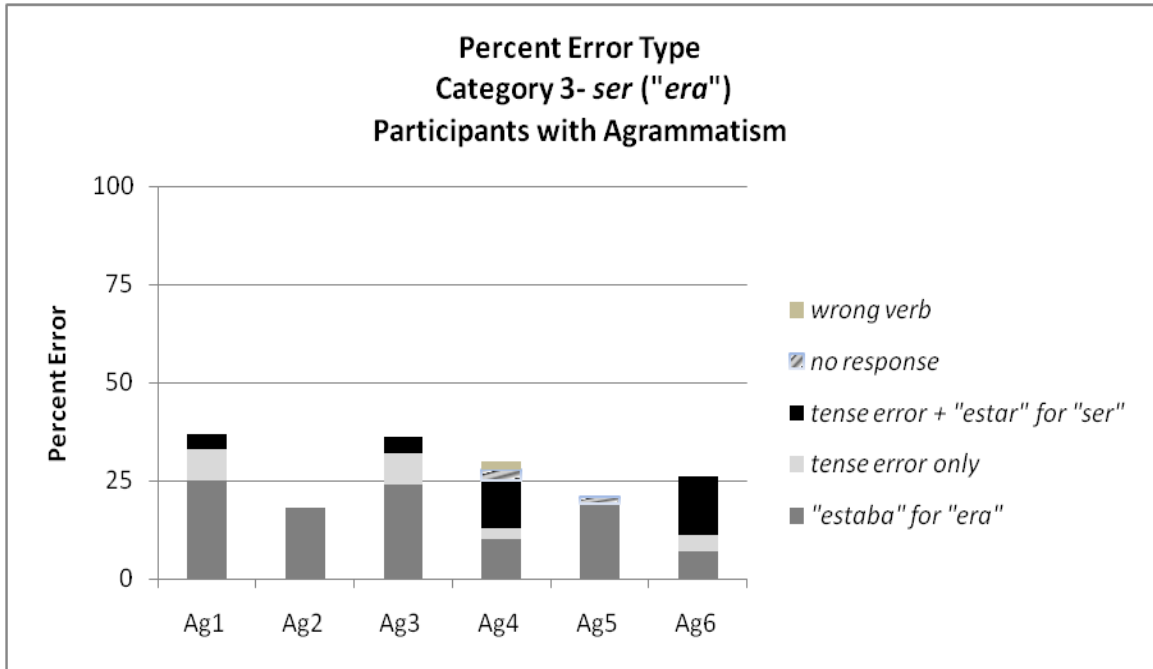


Figure 18

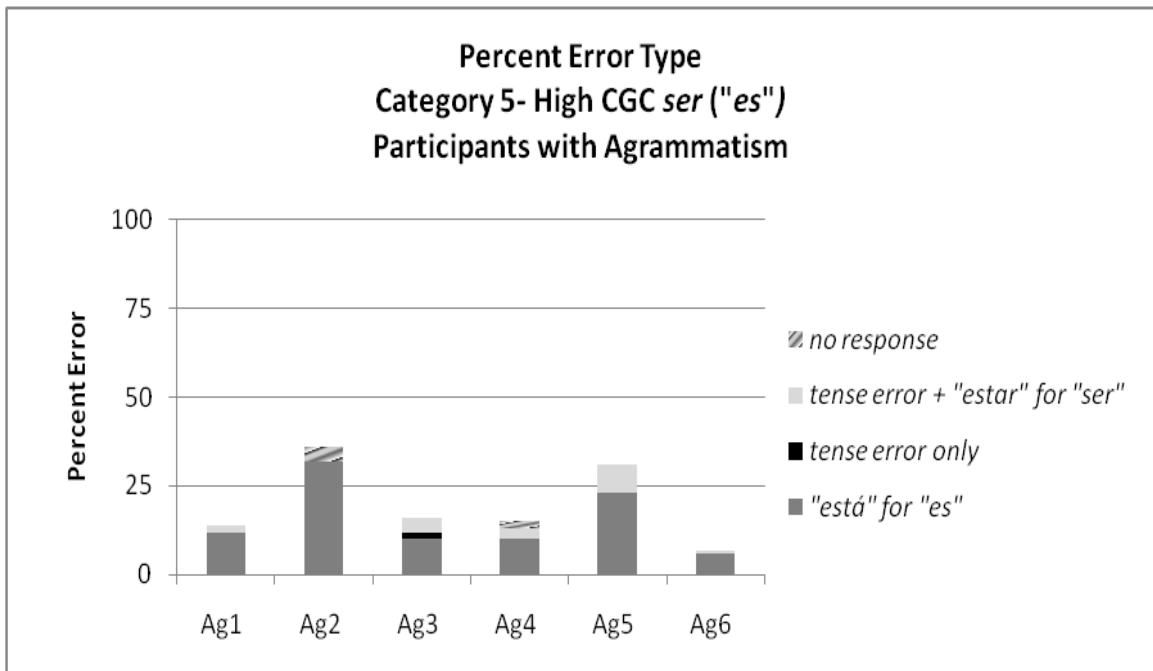


Figure 19

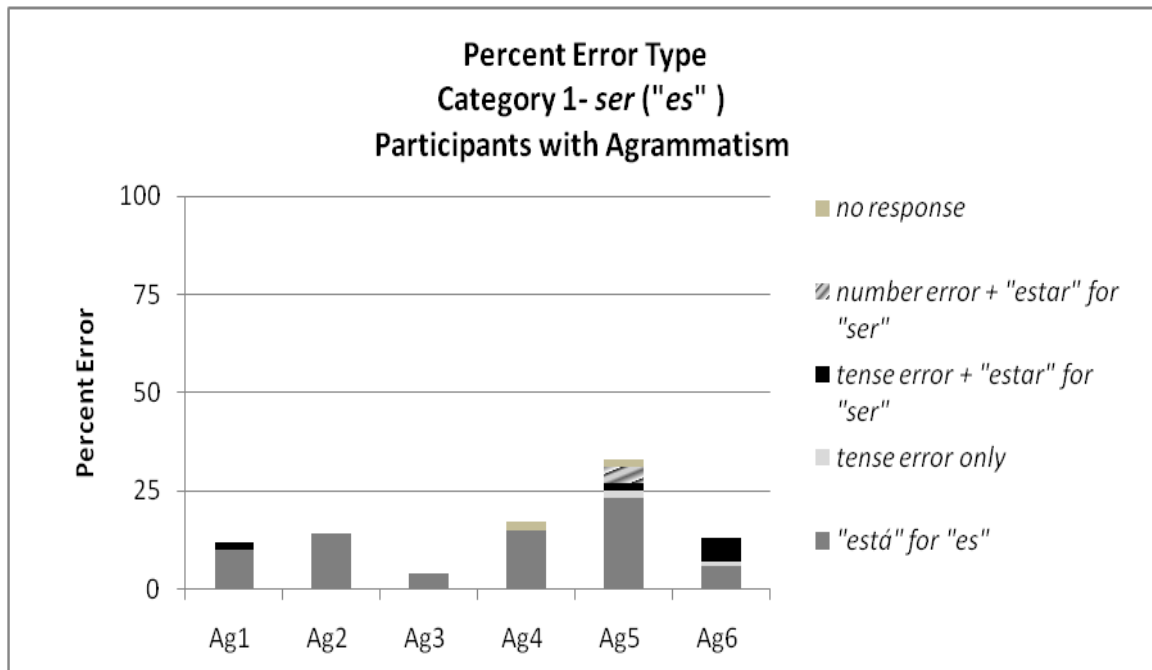


Figure 20

An examination of the types of errors made by the participants with agrammatism again revealed heterogeneity in the pattern of their errors. However, their three main error types were 1) “*estar* for *ser*” error ($X = 55\%$), 2) tense error ($X = 19\%$) and 3) “*ser* for *estar*” error ($X = 18\%$). See Figure 21 for further data on these three main error types.

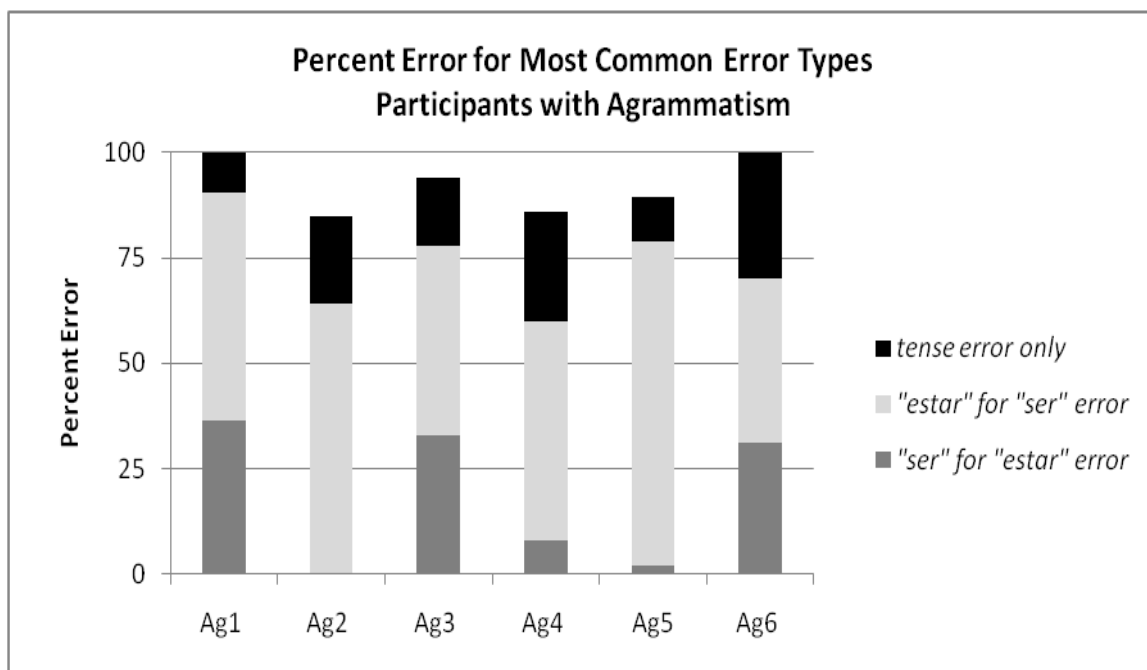


Figure 21

Within Categories 3, 5, and 1, where most of the agrammatic group errors fell, the predominant error pattern was precisely this verb choice error (i.e., for Category 3: “*estaba* for *era*” and for Categories 5, and 1, “*está* for *es*”). Indeed, these were the same three error types most common among the control participants, except that for the agrammatic group, the majority of the errors were “*estar* for *ser*,” whereas for the control group, they were “*ser* for *estar*.” See Table 8 for examples of the agrammatic participants’ errors.

Table 8- Examples of Agrammatic Participants' Errors

Ag1	#196) Rosa <i>es</i> (target <i>está</i>) triste hoy después de su vacación. (Rosa is sad today after her vacation.)
Ag2	#88) En aquella época, el hombre <i>está</i> (target “ <i>estaba</i> ”) satisfecho con su vida. (In those days, the man was happy with his life.)
Ag6	#126) Antes de su fama, Mariana <i>está</i> (target “ <i>era</i> ”) una mujer muy humilde. (Before her fame, Mariana was a humble woman.)

In terms of the ranking the errors committed by the agrammatic group from lowest to highest frequency, we confirmed that the agrammatic group did worst overall on Category 3 (*era*) and best on Category 4 (*estaba*) and Category 7 (copula choice) and that the most common error type was “*estar* for *ser*” error and the least common error type was “number error.” See Figures 22-24 for a summary of the ranking of errors made by the agrammatic group by category and error type.

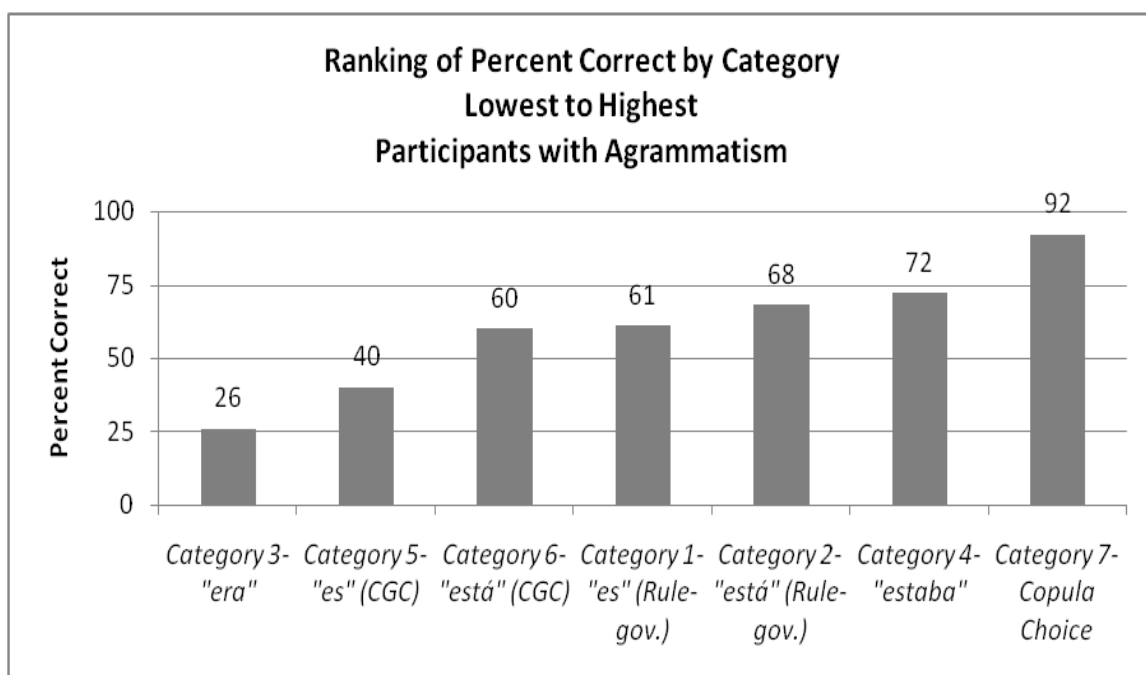


Figure 22

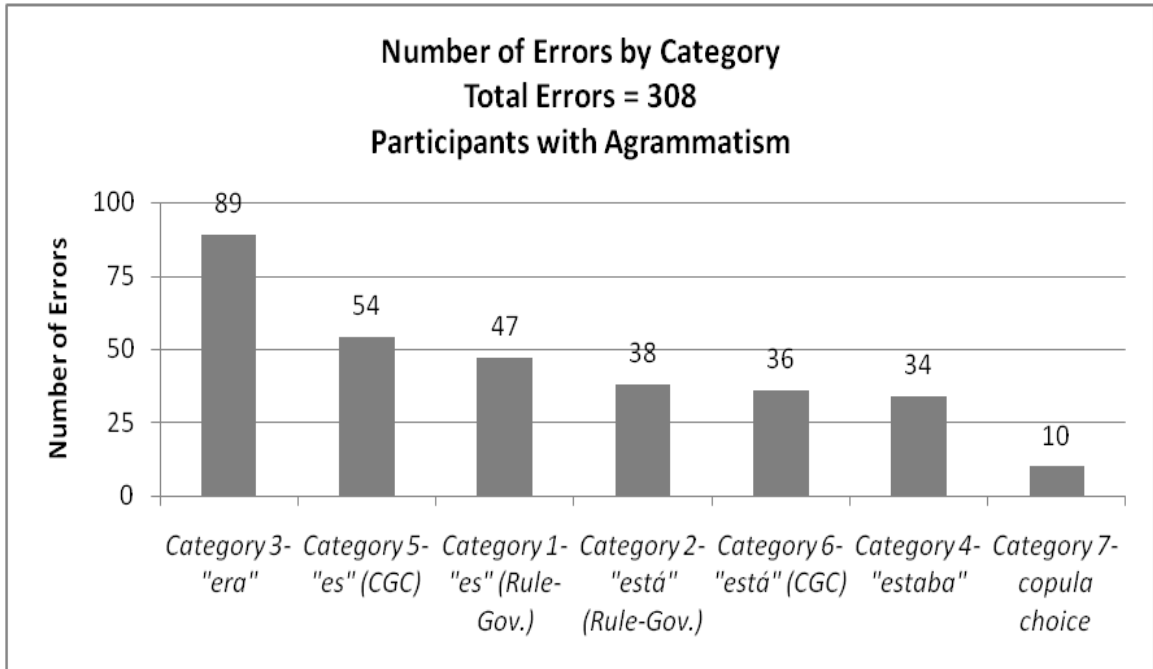


Figure 23

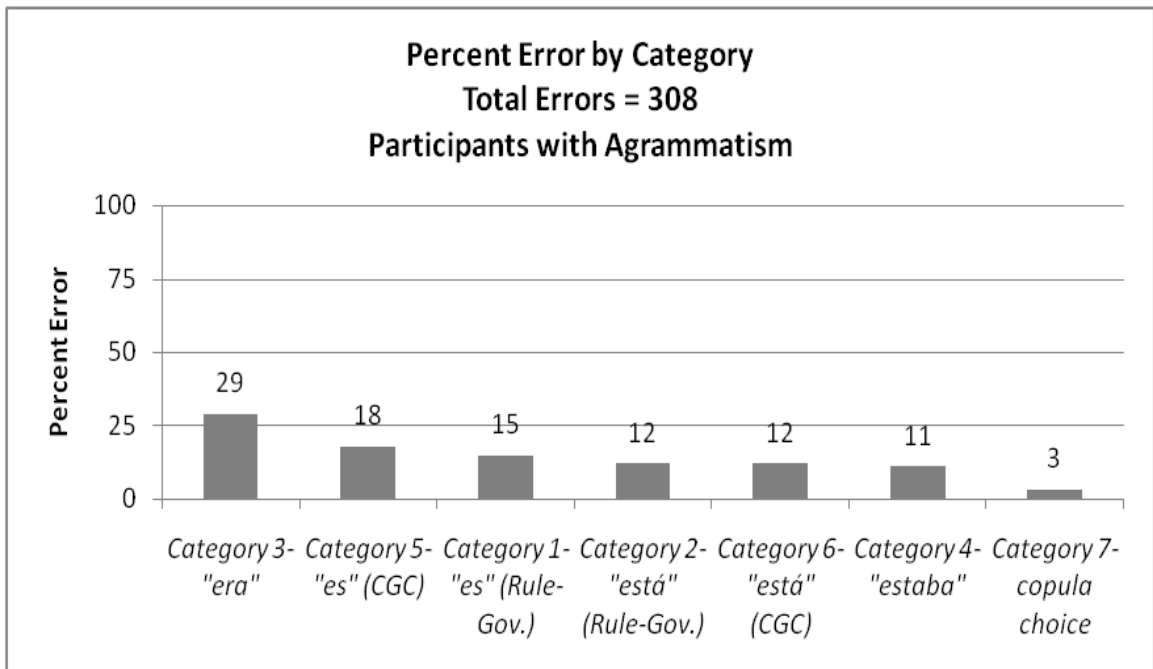


Figure 24

When participants with agrammatism committed an error on the task, the error was off from the target response by one feature (e.g., “*está*” for “*estaba*”) 83% of the time, and by two features (e.g., “*está*” for “*era*”) 17% of the time (e.g., switch from one verb to the other and choosing the wrong tense within the incorrect verb, etc). In addition, errors were predominantly substitution errors, rather than omission errors. A review of the agrammatic participants’ background/language proficiency/history questionnaires revealed both similarities and differences between the agrammatic participant with the fewest errors (Ag2) and the agrammatic participant with the most errors (Ag6). The similarities were the following: both were female, similar ages, similar severity of aphasia (namely, severe aphasia) and same number of years post-onset of CVA. The differences between these two participants were the following: different dialects (Ag2= Puerto Rican; Ag6=Dominican), bilingual status (Ag2= bilingual; Ag6= monolingual) and educational attainment (Ag2= Community College; Ag6= Grade School).

Control Group Errors

The control participants, as previously discussed, performed at ceiling and overall made very few errors on this production task. However, they made a few errors that warrant discussion. A control participants’ response was counted as an error if it differed from the majority of the other control participants’ responses in the study; recall that in the early phases of this project, stimulus sentences had been piloted to ensure at least 90% agreement on the target response for each stimulus sentence by a different set of control participants.

With respect to the overall number of errors, the individual control participants made anywhere from 1-8 errors on the task, for a total of 56 errors combined. Control participants C2, C6 and C7 made the most errors, while C4 and C12 made the fewest. In terms of the number and percentage of errors by category, although there was heterogeneity in terms of where the errors fell for the control participants, the four categories where control participants made the most errors were the following (in order from most to fewest errors): 1) Category 4 (*estaba*): X = 44%, 2) Category 5 (*es*-“high CGC”): X = 18%, 3) Category 6 (*está*- “high CGC”): X = 18% and 4) Category 3 (*era*): X = 18%. Figures 25-27 display the errors made by the control participants for these three categories.

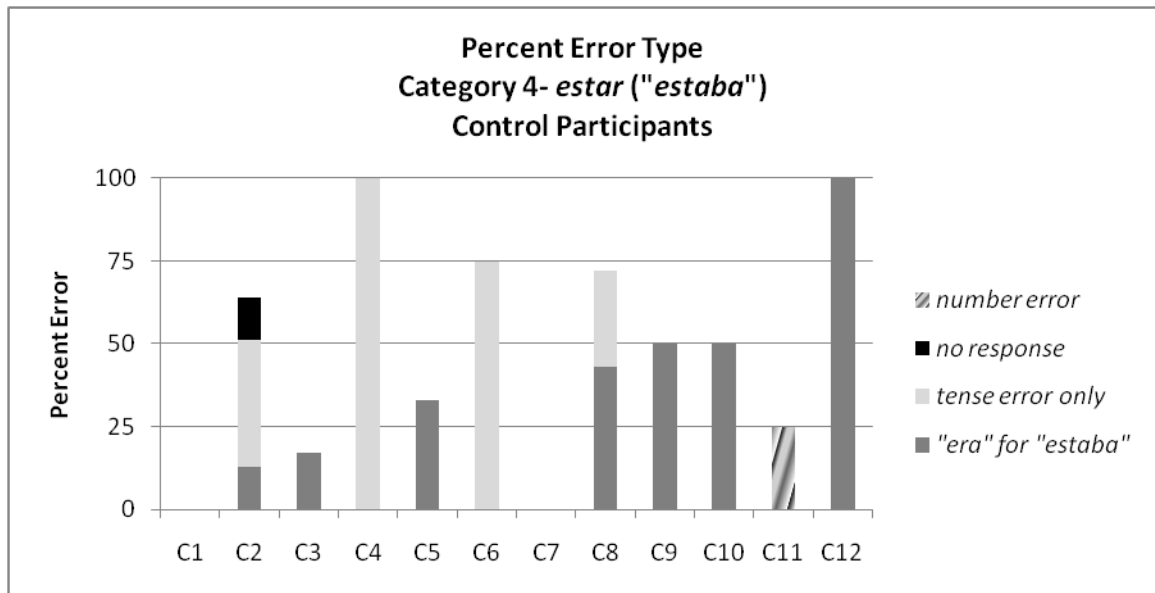


Figure 25

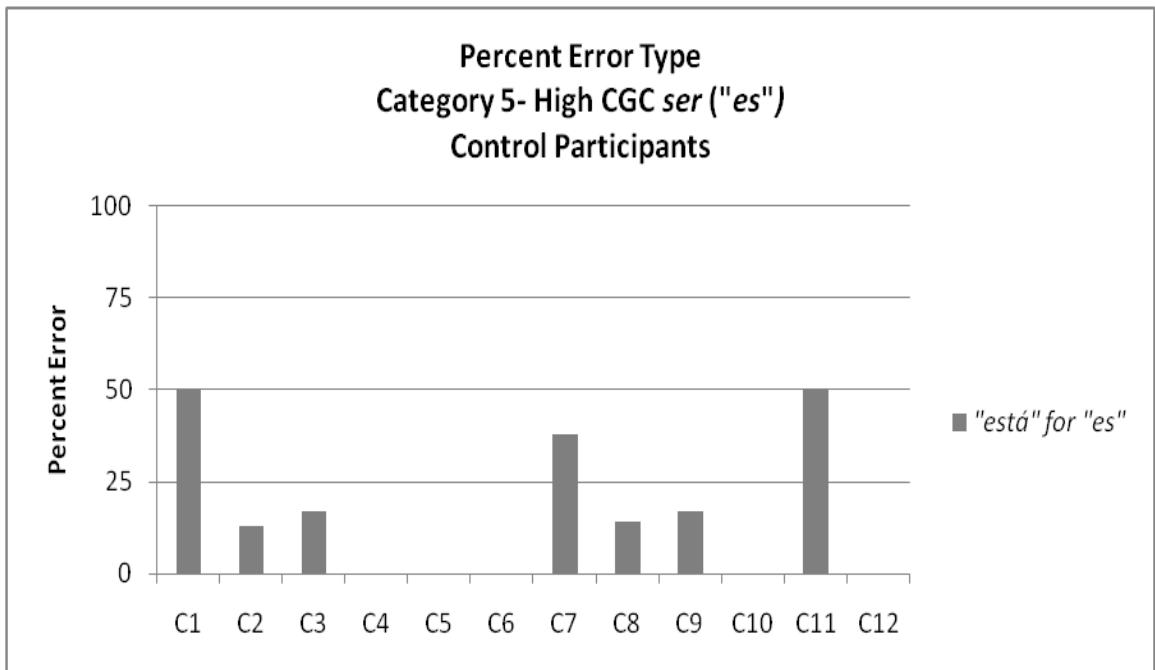


Figure 26

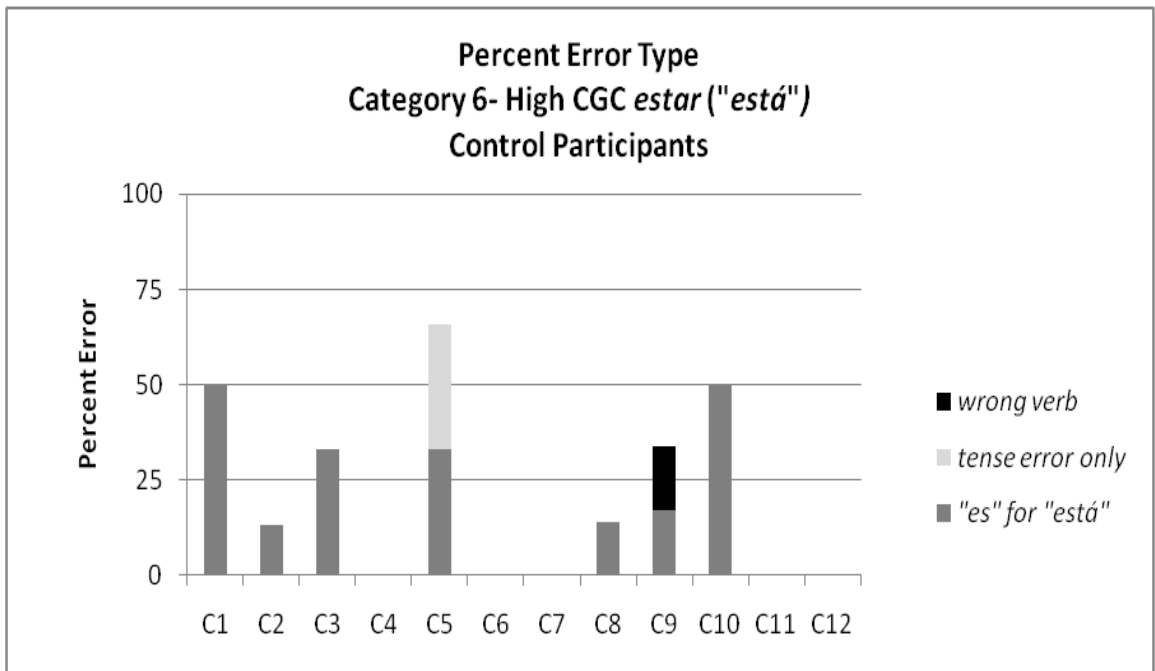


Figure 27

In terms of error types, the control participants again demonstrated heterogeneity

in the types of errors they committed. However, the three most common error types for the control participants were the following: 1) “*ser* for *estar*” error (X = 46%), 2) tense error (X = 25%) and “*estar* for *ser*” error (X = 24%). Figure 28 further illustrates the percentage of errors made within these three error types.

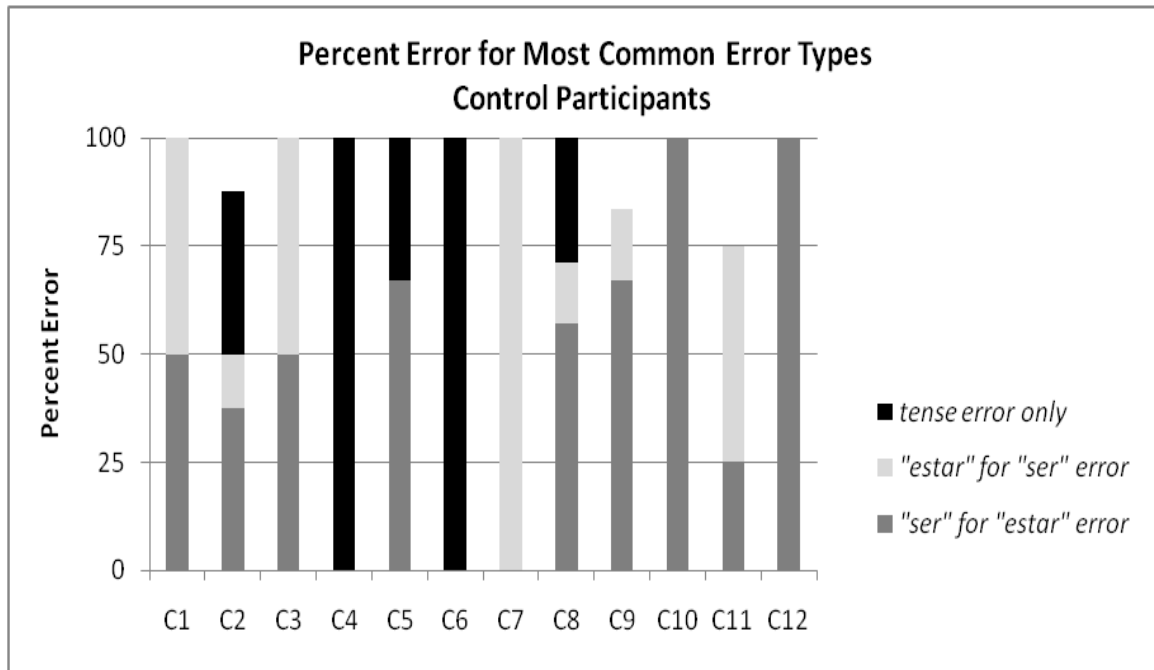


Figure 28

In terms of the ranking the categories, from the category with the most to the fewest amount of errors, we found that the control group made the most errors on Category 4 (*estaba*) and the fewest errors on Category 1 (*es*- rule-governed) and Category 7 (copula choice). Furthermore, the most common error type was “*ser* for *estar*” error and the least common error type was “number error.” Indeed, within Categories 4, 5, and 6, where most of the control group errors fell, the predominant error pattern was verb choice error (i.e., for Category 4: “*era* for *estaba*,” for Category 5: “*está* for *es*” and Category 6: “*es* for *está*”). See Table 9 for examples of the control

participants' errors and Figures 29-31 for a summary of the ranking of errors made by the control group by category.

Table 9- Examples of Control Participants' Errors

C2	#54) En aquella época, mi novio <i>estuvo</i> (target " <i>estaba</i> ") en Texas. (In those days, my boyfriend was in Texas.)
C6	#116) Durante su niñez, Juan <i>fue</i> (target " <i>era</i> ") pobre, sin bastante dinero y alimento. (During his childhood, Juan was poor, without enough money and food.)
C7	#23) El año pasado, María <i>estaba</i> (target " <i>era</i> ") una niña muy pequeña. (Last year, Maria was a small girl.)

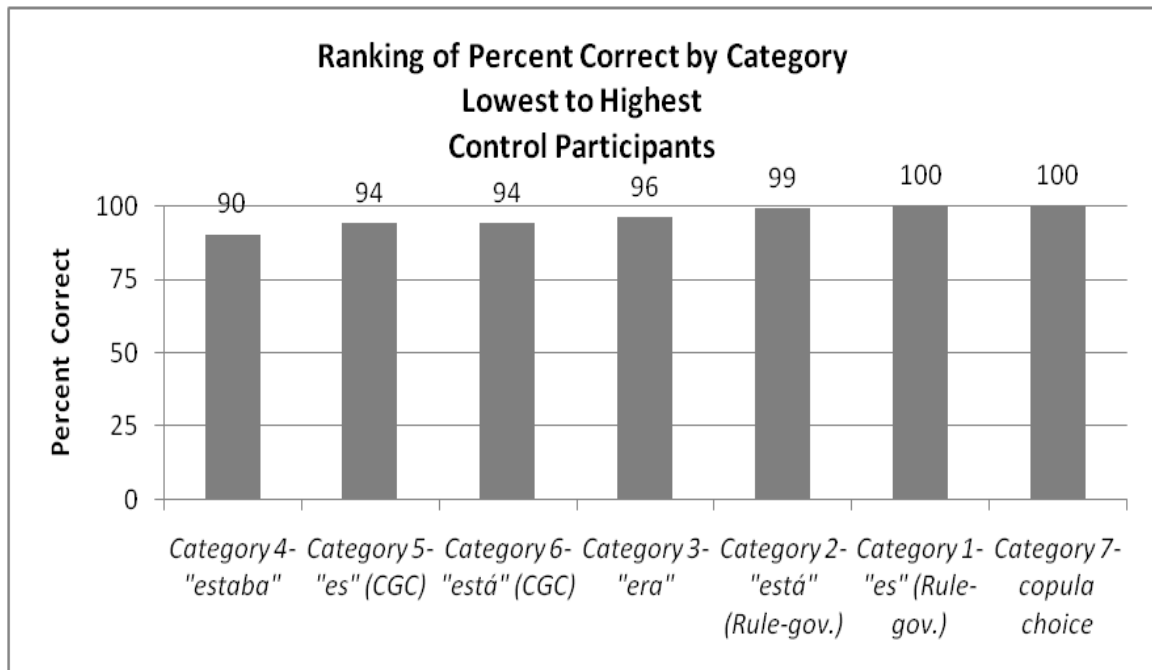


Figure 29

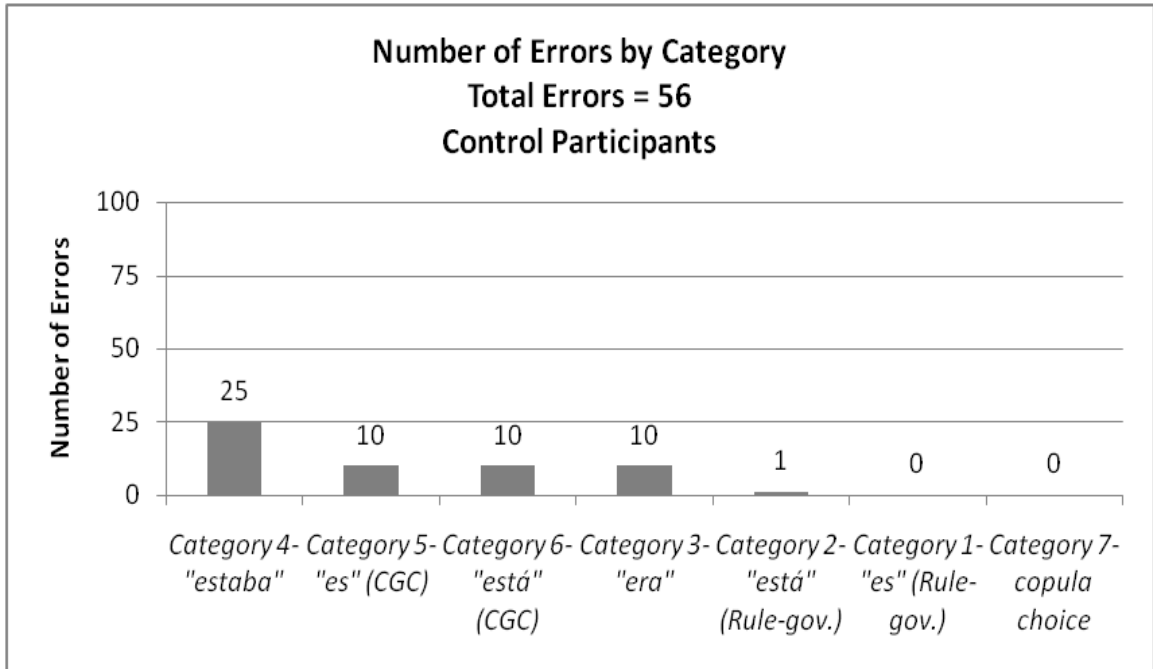


Figure 30

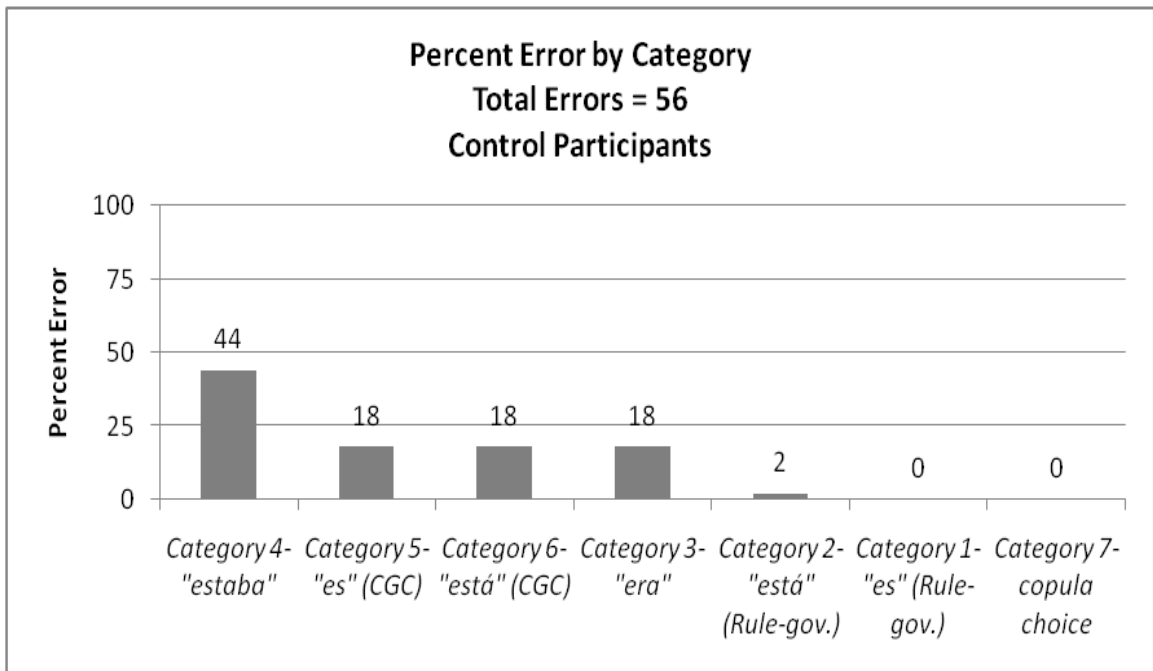


Figure 31

When control participants committed an error on the task, 100% of the time the error was off from the target response by one feature (i.e., a substitution of one copula

for the other, choosing the wrong tense within the correct verb, etc.). Similar to the agrammatic group, the control group errors were predominantly substitutions, not omissions. A review of the control participants' background/language proficiency/history questionnaires revealed the following commonalities among the control participants with the fewest (i.e., C4 & C12) and the most (i.e., C2, C6 & C7) errors: four of the five were female (C12 was male), similar age (namely, $X = 63$ for those with the fewest errors; $X = 67$ for those with the most errors) and similar SES status (namely, "middle class"). The differences were the following: different dialects: two of the participants (C4 & C6) were Colombian, two were Puerto Rican (C2 & C7) and one was Argentinean (C12) and different number of years in the US (namely, $X = 43$ for those with the fewest errors; $X = 67$ for those with the most errors). Therefore, no clear-cut explanation for why some control participants performed better or worse on this task could be found.

3.10 Summary of Results

As expected, the control participants performed with significantly higher overall accuracy on this task compared to participants with agrammatism. The more specific results were the following:

1) *Hypothesis 1 was supported*: Participants with agrammatism were more accurate on the more frequent present tense ($X = 65\%$) than the less frequent imperfect past tense ($X = 49\%$). The control participants performed at or close to ceiling on both verb TMA forms examined in this study, but they were also more accurate on the present tense ($X = 100\%$) compared to the imperfect past tense ($X = 93\%$).

2) *Hypothesis 2 was supported*: Participants with agrammatism were more accurate on the more regular *estar* ($X = 70\%$) than the more irregular *ser* ($X = 44\%$) both in the present and imperfect past tense. However, this difference was made significant by the past tense, whereby *era*, the imperfect past tense form of *ser*, was the most impaired copula verb form for the agrammatic group. The control participants were close to ceiling on both regular *estar* and irregular *ser*, but they displayed the opposite pattern to that of the participants with agrammatism. This is, the controls were more accurate on *ser* ($X = 98\%$) than *estar* ($X = 92\%$); however, this finding was not statistically significant ($p = .080$ on a Wilcoxon Signed-Rank Test).

3) *Hypothesis 3 was not supported*: Participants with agrammatism were more accurate on the rule-governed uses ($X = 65\%$) than on high CGC uses ($X = 50\%$) of the copula verbs (i.e., where copula choice results in substantial semantic consequences to the adjective that follows it). Therefore, high CGC did not facilitate copula verb production. The control participants demonstrated equivalent performance on both high CGC *ser* and *estar* ($X = 94\%$ for both) and rule-governed uses of *ser* and *estar* ($X = 100\%$ for both), but their performance pattern was similar to that of the participants with agrammatism (i.e., better overall performance with rule-governed uses of *ser* and *estar* compared to high CGC *ser* and *estar*, which was statistically significant).

4) When allowed a copula verb choice (Category 7), the majority of the control participants opted for the *ser* verb. For the participants with agrammatism, three of them chose *estar*, while the remaining three chose *ser*.

5) A trend was found towards an interaction between TMA Frequency and VF Regularity. In other words, for participants with agrammatism, the imperfect past tense

of the more irregular verb *ser* (i.e., *era*) was the most impaired verb form in the study.

6) An analysis of the errors made by the control and agrammatic groups revealed four main commonalities between the groups: I) both groups displayed heterogeneity in terms of the types of errors made, II) both groups overwhelmingly made substitution errors rather than omission errors, III) both groups predominantly made errors that were off from the target by a single feature and IV) both groups demonstrated a pattern of substituting one verb for another in their errors. However, the direction of their verb choice substitution errors distinguished them. The most common error pattern for the control group was “*ser* for *estar*” errors, while the most common for the agrammatic group was the opposite: “*estar* for *ser*” errors. Additionally, the category with the most errors for the control group (i.e., Category 4- *estaba*) was the category with the fewest errors for the agrammatic group.

7) None of the demographic factors of our groups, including dialect, could account for the patterns of performance observed in this study.

Chapter 4: Discussion

4.1 Research Questions, Hypotheses and Results

The purpose of this dissertation study was to examine the contributions of tense-mood-aspect frequency (TMA Frequency), verb-form regularity (VF Regularity) and semantics with respect to Context-Governed Choice (CGC) to verb production in Spanish speakers with agrammatic aphasia. In this study, we used the Spanish language and its dual-copula system. A sentence-completion task within seven categories of sentences was utilized to compare and test the roles of these three factors in copula verb production in agrammatism.

The results of the study were the following:

- 1) Overall, the control group was more accurate on the task than the agrammatic group.
- 2) Higher TMA Frequency and higher VF Regularity facilitated copula verb production in our Spanish speakers with agrammatism, while CGC did not.
- 3) In the copula choice category (i.e., Category 7), the control group showed a preference for *ser*; half of the agrammatic group showed strong preference for *estar*, while the other half showed a less-strong preference for *ser*.
- 4) A trend towards an interaction between TMA Frequency and VF Regularity was found for the agrammatic group; more specifically, for the agrammatic group, the irregular verb, *ser*, in the imperfect past tense (i.e., *era*) was the least accurate verb form of the study.
- 5) The error patterns for both groups were heterogeneous.

6) Errors were predominantly substitution errors, not omission errors, for both groups.

7) The agrammatic group made predominantly *estar* for *ser* errors, while the control group made *ser* for *estar* errors.

8) When participants from both groups made an error, it most often differed from the target by one-feature.

9) The ranking of categories based on the pattern of errors differed between the agrammatic and control groups. The category on which the control group made the most errors was actually the category that the agrammatic group made the fewest on: Category 4- *estaba*.

10) The demographic characteristics of our two groups did not help explain the variability in the results.

In sum, the results of this dissertation study demonstrate that copula verbs with regular inflection and forms in the present tense facilitated verb production in agrammatism. The control group also benefitted from the factor of TMA Frequency, as their performance on the present tense was better than on the imperfect past tense. However, they did not perform differently on regular vs. irregular verb forms; although the absolute numbers were higher for *ser* than *estar*, this difference did not reach statistical significance. Additionally, the factor of CGC did not facilitate copula verb production for either the agrammatic group or the control group. Finally, there was a trend towards an interaction of factors: namely, an interaction between TMA Frequency and VF Regularity whereby the imperfect past tense form of *ser* (i.e., *era*) resulted in the

worst performance by the participants with agrammatism.

4.2 Relevance of This Study to Agrammatism Research

The findings support the growing body of literature that demonstrates that both TMA Frequency and VF Regularity facilitate verb production in agrammatism. In the following sections (4.2.1 and 4.2.2), I discuss how this study contributes to the research literature on TMA Frequency and VF Regularity in agrammatism.

4.2.1 Tense-Mood-Aspect Frequency (TMA Frequency)

This study adds to the growing body of research on the importance of verb tense in agrammatism. Our results, like those of Bastiaanse (2008), Centeno (1996), Centeno and Obler (2001), Centeno and Cairns (2010), Menn and Obler (1990b), O'Connor, Obler and Goral (2007), O'Connor Wells, Obler and Goral (2009), Stavrakaki and Koukova (2003) and Yarbay Duman and Bastiaanse (2009), support the idea that production of more frequent verb tenses (e.g., present tense) trumps production of other less-frequent ones (e.g., imperfect past tense) in agrammatic speakers of Spanish and other languages. Therefore, it seems that for verb production, verb TMA Frequency does contribute to more accurate verb production.

Our finding with respect to TMA Frequency can be interpreted to mean any of three things: firstly, that the morphological features of tense and aspect are impaired in agrammatism and more frequent TMA forms are better spared than less-frequent ones which Centeno (1996), Centeno and Obler (2001) and Centeno and Cairns (2010) argued, with respect to their Spanish speakers with agrammatism. Alternately, the TMA

Frequency finding can mean that the present tense is the default tense in agrammatism, as Menn and Obler (1990b) and Stavrakaki and Kouvoa (2003) suggested. Furthermore, Stavrakaki and Kouvoa (2003) point out that although their participants were able to produce past tense forms (thus, morphology for tense was not impaired per se), as the “load of syntactic complexity” (p. 135) increased, they resorted to the unmarked present tense. Thirdly, referencing events in the past is more difficult than the present or future, as Bastiaanse (2008) and Yarbay Duman and Bastiaanse (2009) proposed.

It would be difficult to use our data to decide among these explanations, since they support all three. In order to support the notion of the present tense as the default tense, as Menn and Obler (1990b) and Stavrakaki and Kouvoa (2003) have proposed, our study would have had to include sentences varying in syntactic complexity, and we would have had to compare copula verb production in more simple vs. more complex sentence structures, as well as different TMA forms. To support Bastiaanse (2008) and Yarbay Duman and Bastiaanse’s (2009) assertion of a global deficit in time reference to past in agrammatism, this study would have had to include a subset of sentences with participles that mark present and past tense, and we would have had to compare performance on these sentences to those we included in our study, where the copula verb is conjugated to mark present or past tense. However, our finding of high accuracy on the *estaba* form provides evidence against Bastiaanse’s idea of a global deficit in referencing events in the past.

Our data, particularly for *ser*, are clearly in conflict with the findings of Clahsen and Ali (2009), Burchert, Swoboda-Moll and De Bleser (2005) and Wenzlaff and Clahsen (2004), who reported no difference between past and present tense production in

agrammatism in sentence-completion and grammaticality-judgment tasks with their English- (Clahsen & Ali, 2009) and German-speaking agrammatic participants (Burchert, Swoboda-Moll & De Bleser, 2005 and Wenzlaff & Clahsen, 2004). Our finding of better performance on *ser* in the present compared to imperfect past tense might conflict with those of these previously-mentioned studies because of the difference in our approach to the sentence-completion paradigm compared to the approach used in these studies. More specifically, in our task, participants were not given the specific copula verb forms to select from to complete the target sentence, whereas in these other studies, participants were given a choice of either two or three verbs to choose from to complete a target sentence (i.e., the target and one or two foils) and were allowed to either read the word aloud or point to it. In addition, our study did not include a grammaticality-judgment task, as theirs did, which might have contributed to their finding of no difference between present vs. past tense, since people with agrammatism typically perform well overall on such tasks (e.g., Linebarger, Schwartz & Saffran, 1983). Our results differ from theirs in that we found an interaction between the factors of VF Regularity and TMA Frequency (i.e., *era* was the worst copula verb form for the agrammatic group in our study) and the difference between production of *ser* in the present and imperfect past tense was significantly different, due to a combination of the high irregularity of *ser* and the lower daily use frequency of the imperfect past tense compared to the present tense in Spanish, as suggested by Centeno (1996) and Centeno and Cairns (2010).

4.2.2 Word Frequency

With respect to word frequency, this study shows that despite their overall high

word frequency, the copula verbs in Spanish are not resistant to agrammatism. This study did not support the factor of word frequency as facilitatory to verb production in agrammatism. Specifically, if word frequency had been a facilitating factor, then we should have found higher accuracy of performance on *ser* compared to *estar*, since *ser* is the most common and frequently-used verb in the Spanish language. In addition, we should have found highest overall accuracy for the most common form of *ser* (*es*- 3rd person singular); however, we instead found lower accuracy of this form compared to the 3rd person singular form of *estar* (*está*). Therefore, this study supports Meth's (1998) finding that verbs of higher word frequency are not better spared in the face of agrammatism compared to verbs lower in word frequency ("high frequency verbs are not significantly easier to produce," p. 51).

However, we must acknowledge that we are dealing here with two very high frequency verbs of which one, i.e., *ser*, is more frequent; therefore, our study is limited to the high end of verb frequency. As a result, our findings are not representative of the entire range of verb frequency and should not be considered so.

So, why is it that frequency of the verb tense mattered in our study, but not word frequency? It can be argued that the most frequent words in a language are functors (e.g., Bird, Franklin & Howard, 2002), and it is this category of functors that individuals with agrammatism have particular difficulty producing. However, in the face of agrammatism, our participants appeared to benefit more from a combination of the frequency of the verb tense and the regularity of the verb (as we discussed earlier, we found an interaction between these two factors) than word frequency alone. We can postulate that this interaction superseded word frequency in facilitating verb production

for our Spanish speakers with agrammatism.

4.2.3 Verb-Form Regularity (VF Regularity)

This study also supports the research literature on the importance of VF Regularity in agrammatism that has found that regular verbs are better spared than irregular verbs in agrammatism. The current finding of better sparing of the more regular copula verb *estar* compared to the more irregular copula verb *ser* is consistent with the findings of de Diego Balaguer et al. (2004), Jaeger et al. (1996), Kok, van Doorn and Kolk (2007), Miozzo (2003), O'Connor, Obler and Goral (2007), O'Connor Wells, Obler and Goral (2009) and Tsapkini, Jarema and Kehayia (2002) in that production of regular verbs trumps production of irregular verbs in agrammatic speakers of Spanish and other languages. In contrast, our data conflict with the findings of better sparing of irregular verbs compared to regular verbs in agrammatism found by Ullman et al. (1997) and the findings of no difference in accuracy between regular and irregular verbs in agrammatism proposed by Faroqi-Shah and Thompson (2003), Bastiaanse, Sikkema and van Zonneveld (2004) and Clahsen and Ali (2009). The discrepancies in the literature with respect to VF Regularity might be due to the fact that different languages (e.g., English, German, Spanish-Catalan), different tasks (e.g., production tasks vs. comprehension tasks vs. both) and different number of participants (e.g., case study vs. multiple participants) were being examined across the studies. In addition, Ullman et al., Faroqi-Shah and Thompson and Clahsen and Ali's findings with respect to verb regularity in English-speakers with agrammatism might be due the fact that in English, there is an added measure of phonological complexity to regular past tense verbs; namely, they often contain an extra

syllable or end in a consonant cluster (Faroqi-Shah & Thompson, 2003). Therefore, we are inclined to believe that for verb production, verb regularity contributes to verb production, with regular verbs being better spared than irregular verbs in more richly-inflected languages (e.g., Spanish and Greek), than in less richly-inflected ones (e.g., English).

The dissociation between regular (i.e., *estar*) and irregular (i.e., *ser*) verbs in our study supports the notion of a dissociation between regular and irregular verbs in the mental lexicon, and likely suggests that these Spanish copula verbs may be stored and/or processed via different brain networks, with the network supporting irregular verbs being more impaired in our population of agrammatic speakers than the networks supporting regular verb morphology, thus, supporting our finding of better sparing of more regular verbs than irregular ones. However, we must acknowledge that although the mean performance for regular *estar* was higher than the mean performance for irregular *ser* (i.e., $X = 70\%$ vs. 44% , respectively) for the agrammatic group, the difference in mean accuracy was more pronounced for some participants than for others (e.g., Ag4: $X = 93\%$ for *estar*, 35% for *ser* vs. Ag6: $X = 43\%$ for *estar*, 30% for *ser*). In addition, we were surprised to find that the participants with agrammatism performed the same on the imperfect past tense of *estar* (i.e., *estaba*: $X = 72\%$) and the present tense (i.e., *está*: $X = 68\%$); a Wilcoxon Signed-Rank Test revealed no difference in performance on these two forms of *estar* for our agrammatic group ($W = 11.5$, $z = .21$, $p = .83$). The fact that the agrammatic group performed equally well on the imperfect past tense and the present tense could be due to the fact that although *estaba* is more infrequent in daily use than *está*, it is more regular (since *está* contains an accent mark over the letter “a,” while other

regular *-ar* Spanish verbs in the 3rd person singular do not). Therefore, the factor of regularity facilitated production of *estaba*, while the factor of frequency of daily use facilitated production of *está*.

Additionally, our data support the idea that retrieving inflected verb forms as whole units from the mental lexicon (as is proposed for irregular verbs) may be more difficult than accessing them via the verb stem and affixing the appropriate inflection to it (as is proposed for regular verbs). However, we are aware that we would need to study a larger sample of regular and irregular verbs in Spanish if we wished to draw this conclusion.

Finally, we must again point out that an interaction between VF Regularity and TMA Frequency was found, whereby *era* (the copula verb form in our study that was both irregular and low in frequency) was the most impaired for our Spanish speakers with agrammatism. Therefore, we can conclude that a combination of low VF Regularity (i.e., irregularity) and low TMA Frequency made production of *era* more difficult and less accurate for our agrammatic group than the other copula verb forms included in the study.

In the following sections, I discuss how the results support or refute research on other factors relevant to a study of agrammatism: semantics (as it relates to our study and with respect to other semantically-weighted verb types), frequency (i.e., word frequency, affix frequency), length (i.e., word length in syllables, sentence length) and phonological complexity in agrammatism.

4.2.4 Semantics and Context-Governed Choice (CGC)

In this section, I begin by first discussing the study findings with respect to CGC and copula verb production. Following this, I link the findings to the research literature on other verb categories differing in semantic weight; namely, copula verbs, auxiliary verbs and light verbs.

With respect to semantics, we found that CGC (i.e., copula verb choice that results in semantic change to the adjective that follows the verb in a sentence) did not facilitate performance on this copula verb production task. Rule-governed uses of the two copula verbs were better spared than CGC uses. Therefore, our findings do not support the arguments of Goodglass (1993) and Goodglass, Fodor and Schulhoff (1967), who reported that in agrammatism “semantically empty words” (p. 115), which are low in saliency are less accessible for output than words high in saliency.

We can speculate that the reason CGC contributed less than rule-governed uses to copula verb production in our participants with agrammatism is because rule-governed uses of the copula verbs might be more common in everyday conversation relative to CGC uses, and recall that Centeno (1996) and Centeno and Cairns (2010) found that daily use frequency was an important factor for verb production in agrammatism, with verb forms more common in daily use frequency being more accurate and readily used than less-common verb forms. Moreover, rule-governed uses of the copula verbs do not need contextual support at the sentence level, while CGC uses rely on additional contextual information. In other words, CGC uses require more sentence-level information and correct selection of the copula verb to convey the speakers meaning (e.g., speaker would use *ser* instead of *estar* before the adjective “listo,” to mean “clever”

instead of “ready”) than rule-governed uses. Our participants with agrammatism might have fared better with Categories 5 and 6 sentences (i.e., “High CGC” *ser* and *estar* respectively), and been able to integrate the information better, if more contextual support had been provided to such sentences. However, given the nature of the task, I included as much contextual information as the sentence paradigm allowed without making the stimulus sentences in Categories 5 and 6 longer than the other categories. In addition, it is useful to recall that although the absolute numbers for the control group were in the same direction as the agrammatic group (i.e., better performance on rule-governed uses of the two verbs compared to high CGC uses), the control group performed with equal accuracy on high CGC *ser* and *estar*, while the agrammatic group performed with higher accuracy on high CGC *estar* compared to high CGC *ser*). This means that the contexts of the high CGC *ser* and *estar* stimulus sentences were clear for the control group, and thus, should have been clear for the agrammatic group as well.

However, I must point out that a very narrow interpretation of semantics was used in this study; therefore, our findings do not represent the full meaning of semantics. In this study, we examined semantics from the perspective of how copula verb choice can semantically change the meaning of the adjective that follows it in the sentence (and thus, modify the meaning of the sentence itself). We could have also examined semantics by comparing our semantically “light” copula verbs to more semantically “heavy” regular (“comer”- to eat; “hablar”- to talk) and irregular verbs (e.g., “leer”- to read; “cerrar”- to close), to examine if light or heavy verbs are better spared in agrammatism. Additionally, we could have examined semantics using *ser* and *estar* by comparing accuracy of performance when they serve as the copula vs. the auxiliary verb of a

sentence, since linguists have suggested that these two verbs lessen in semantic value when they function as the auxiliary in a sentence where there is another main verb (Roldán, 1974). In later sections (Section 4.2.4.2, 4.2.4.3, 4.4 and 4.5), I further discuss these additional ways to explore the broad topic of semantics.

4.2.4.1 Copula Verbs

This study also supports the finding of the difficulty that copula verbs pose to people with aphasia in cross-language studies of agrammatism (Menn & Obler, 1990b). Moreover, it is the only study we know of to focus on copula verb production in a dual-copula language. Although the overall findings of our study confirm Menn and Obler's (1990b) assertion that the copula verb is problematic for the agrammatic speakers of all of the languages included in their study, this study differs in the pattern of errors displayed. Whereas in the single-copula languages included in Menn and Obler (1990), the most common pattern of errors was copula *omission*, in our study, the most common error pattern was copula *substitution*. In particular, the most common substitution error pattern committed by the participants with agrammatism was “*estar* for *ser*” errors. Therefore, although we agree with Menn and Obler (1990b) on the vulnerability of copula verbs in agrammatism, we differ from the pattern of errors found in their study. Had we examined copula verb production using a discourse paradigm, as the authors in Menn and Obler (1990a) did, we might have found omission errors too, since agrammatic speakers are known for omitting functors in discourse. Therefore, the prevalence of substitution errors instead of omission errors in this study might have been due to the nature of our task: sentence completion. The participants understandably felt an

obligation to produce a verb to fill in the missing space in the stimulus sentences. In addition, we made the task relatively easy, as only one item (i.e., the correct copula verb form) was required, and we cued participants, both auditorily and visually, as to where in the target sentence the missing verb was needed.

Another interpretation could be that the participants felt the stimulus sentences were ambiguous and uninterpretable without a verb, and this pushed them to produce a verb to complete the sentence, whether or not it was the correct copula verb form. In addition, the substitution errors produced by our participants with agrammatism almost always took the form of a conjugated verb, not just the bare stem and rarely the infinitive (only twice during the study). These arguments, therefore, could be in line with Grodzinsky's (1991) assertion that in agrammatism, whether a grammatical morpheme is omitted or substituted for is not only dependent on the language, but also on whether or not omitting such a morpheme would result in a nonword (for the purposes of our study, omitting the copula verb would lead to the sentence being ambiguous and ungrammatical and omitting the inflectional affix of the verb by producing only the bare stem or infinitive would result in a nonword). In addition, when a substitution error occurs, it would likely be from the same paradigm as the target word (for our study, the participants substitute one copula or copula form for the other instead of omitting it, in order to avoid sentence-level ambiguity). Finally, we must postulate that the substitution errors produced by our participants might be due to the fact that these two copula verbs are closely linked semantically; therefore, substitution errors on the task may be a reflection of errors in copula verb retrieval and/or processing due to their close semantic ties.

4.2.4.2 Auxiliary Verbs

Besides their role as copula verbs, *ser* and *estar* also take the form of auxiliary verbs when the sentence contains another main verb. As auxiliary verbs, *ser* occurs in passive sentence constructions, while *estar* occurs in progressive forms (Roldán, 1974). Menn and Obler (1990b) found auxiliary verb omissions were also common among the languages included in their cross-linguistic agrammatism study (p. 1371). Centeno (1996) also found that auxiliaries were more vulnerable to the effects of agrammatism than past participles in Aux+PP compound constructions (e.g., “Yo he comido”- “I have eaten”). A future direction for this study would be to examine *ser* and *estar* in their function as auxiliary verbs, to see if the pattern of substitution errors found in their role as copula verbs holds or if omission errors prevail due the lowering of their semantic values in their role as auxiliary verbs (Roldán, 1974).

4.2.4.3 Light Verbs

Menn and Obler (1990b) also found that participants with agrammatism omitted a high percentage of “*have/be*” main verbs in the languages included in their cross-linguistic study, much more so than lexical main verbs (p. 1377). In addition, Barde, Schwartz and Boronat (2006), Breedin, Saffran and Schwartz (1998) and Kim and Thompson (2004) all report an advantage (i.e., fewer overall errors) of “heavy” verbs, such as “fly,” over “light” verbs, such as “do” in agrammatism, even though the “heavy” verbs were of overall lower frequency compared to the “light” verbs. In the study, of course, I focused exclusively on the copula verbs *ser* and *estar*, which may both fall under the category of “light” verbs. We did not, therefore, contrast production of these

two “light” verbs with “heavy” verbs in the language, but I propose this as a future direction for study. However, if we were to contrast these two copula verbs, based on their proposed semantic weight (as previously discussed in Section 1.4), we might classify *ser* as the “lighter” of the two verbs, and *estar* as the “heavier” of the two verbs, in line with the arguments of Roldán (1974), De Mello (1980) and Lema (1995). In doing so, our findings of better performance on *estar* (i.e., the semantically “heavier” verb) compared to *ser* (i.e., the semantically “lighter” verb) would support the findings of Barde, Schwartz and Boronat (2006), Breedin, Saffran and Schwartz (1998) and Kim and Thompson (2004). However, the patterns of errors (as previously mentioned, substitution errors prevailed in our study) are different from those found in Menn and Obler (1990b) (as previously mentioned, omission errors for “light” verbs prevailed over substitution errors in their study). We can speculate that differing task demands in Menn and Obler (1990) (i.e., spontaneous speech tasks, such as picture description and narrative discourse) and this study (i.e., sentence completion) might be a reason for the differing patterns of errors between the two studies (i.e. omission errors in the former, substitution errors in the latter).

4.2.5 Length (Word Length in Syllables and Sentence Length)

With respect to length, we found that shorter syllabic lengths (i.e., word length in syllables) and sentence length did not facilitate performance. In terms of syllabic length effects, the traditional belief in research and treatment of agrammatism is that longer words (i.e., those with more syllables) are more difficult to produce than shorter words, although mixed results have been reported. For example, Pashek and Tompkins (2002)

found a word length effect for nouns in a naming task, but not during narration for 20 participants with mild aphasia and residual anomia, while Best's (1995) case study of a male participant with anomic aphasia revealed a reverse-length effect for picture naming, whereby the participant labeled pictures with longer names better than ones with shorter names. This reverse-length effect was not found in the reading and repetition tasks also included in this study.

For the purposes of our study, we assumed that the syllabically-shorter forms of *ser* (i.e., 1-2 syllables in length) would be easier for our agrammatic group than the syllabically-longer forms of *estar* (i.e., 2-3 syllables in length). However, this was not the case. The syllabically-shorter *ser* was more difficult and less accurate compared to the syllabically-longer *estar* in the imperfect past tense (no difference was found in the present tense). In addition, the syllabically-longest verb form used in the study (*estaba*) was actually the most accurate form for the agrammatic group. Therefore, short word length in syllables was not a facilitating factor in this dissertation study. This finding is consistent with the findings of Szupica-Pyrczanowski (2009), who found no main effect for syllable number in comparing production of mono-, bi- and trisyllabic verbs in English speakers with agrammatism.

However, it is not consistent with the results of Meth (1998), who found that agrammatic speakers of English show increased phonological burden in longer stem-syllabic lengths (e.g., trisyllabic words) compared to shorter stem-syllabic lengths (e.g., monosyllabic words). Similarly, Mathews and Obler (1997, as cited in Obler, Harris, Meth, Centeno & Mathews, 1999) also found that longer syllabic length resulted in increased word production difficulty in English speakers with agrammatism. In addition,

Centeno (1996) found that longer affix length resulted in poorer performance compared to shorter affix length in Spanish speakers with agrammatism, while Jones (2002, p.93) found that her SAE-AAVE speaker with agrammatism used zero affix for phonologically-harder words (i.e., those with bi- and trisyllabic stems, as compared to monosyllabic ones). The contradictions in the literature regarding syllabic length effects in agrammatism could be accounted for by task demands. Indeed, Meth (1998) proposed that her participants' abilities to produce syllabically-longer vs. shorter words was significantly different in her repetition and sentence-completion tasks (i.e., it was significantly more difficult for her participants with agrammatism to produce verb inflections in the sentence-completion task than in the repetition task, even though the stimuli used in both tasks were the same). In the section that follows (i.e., Section 4.2.6), we hypothesize that our findings here diverge from those of these previously-mentioned studies because *estar* has a single verb stem (i.e., /*est*/), which is consistent across all of its forms and may have facilitated its production, despite this verb's longer syllabic length compared to *ser* and its respective forms.

In terms of sentence length, again the traditional belief in research and treatment of agrammatism is that longer sentences are more difficult to produce and process in agrammatism compared to shorter sentences, and agrammatic speakers exhibit communicative breakdown as the length and complexity of an utterance increases (Goodglass, 1993). Although sentence length was not specifically analyzed in this dissertation study, the sentence length range for the experimental study was the same as for the pilot studies (6-10 word sentences). In the pilot study most crucial to this dissertation, where the factor of sentence length was examined, we found an equivalent

percentage of errors for copula verb production in longer and shorter sentences. See Figure 32 for a summary of these pilot data.

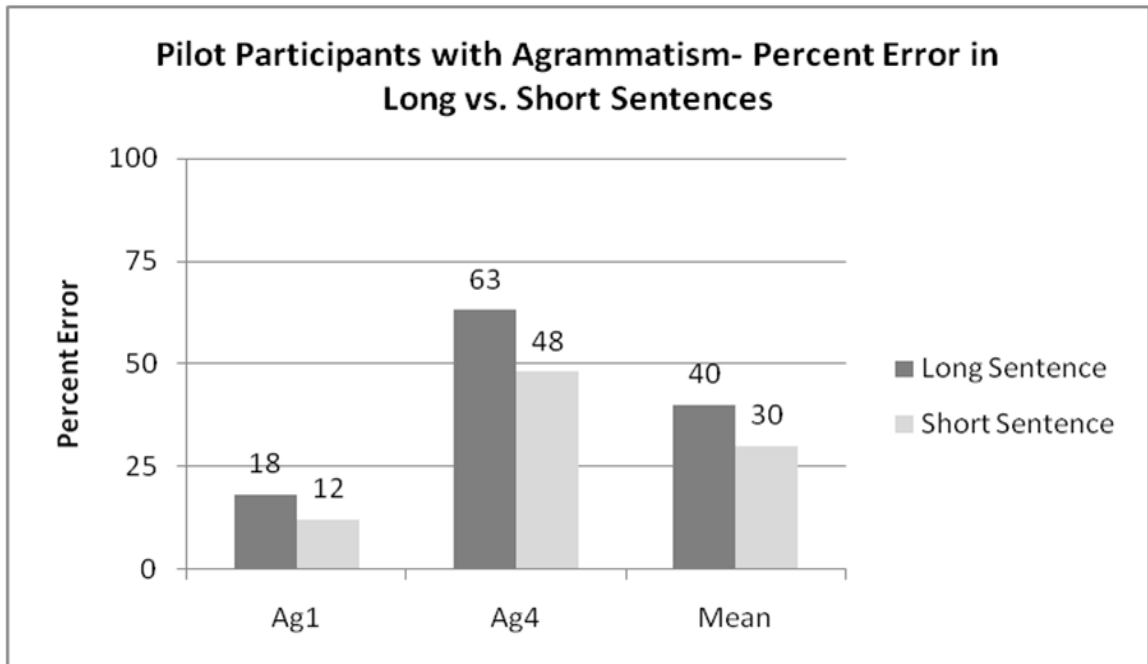


Figure 32

This may have been due to the fact that participants were given the stimulus sentences in both visual (i.e., they saw the written sentences) and auditory (i.e., they heard the sentences read aloud) modalities simultaneously in that study, thus minimizing working memory load. A similar technique of dual-modality presentation was also employed in the current study. Had the sentences been shorter (5 or fewer words) or longer (11 or more words) and/or had we used a single modality for stimulus presentation, I might have found copula verb production significantly better in shorter than longer sentences.

4.2.6 Phonological Complexity

In the Spanish language, it is rare for two consonants to come together across a syllable boundary and create consonant clusters. Although there are no /s/ clusters in initial word position in Spanish (Barlow, 2005), the stem for *estar* (/est/) contains two consonants that are produced in different syllables of the target form (i.e., /s/ ends the initial syllable and /t/ starts the second syllable in all forms of *estar*). Given this added consonant complexity compared to the singleton consonant structure of *ser*, we would have anticipated more errors on the forms of *estar* than on the forms of *ser* used in this study, even though the participants with agrammatism did not have concomitant dysarthria and/or apraxia of speech.

However, this was not the case. Therefore, the findings of our study do not support the notion of increased production difficulty for agrammatic speakers of consonant clusters vs. singletons. This partially supports Szupica-Pyrzanowski's (2009) finding that production of final consonant cluster syllabic suffix (e.g., “wanted”- [wantɪd]) vs. non-syllabic suffix “walked” [wɔlkt]) was not significantly different from each other for her English speakers with agrammatism, but is contra Meth (1998), who found that phonological shape did matter to verb production in agrammatic speakers of English and that stem-final consonant-cluster forms were harder than stem-final singleton-consonant forms. In addition, Jones (2002) found that monosyllabic negative contractions ending in consonant clusters (e.g., “can't”) were more problematic and resulted in more conversions to the positive (i.e., “can”) than bisyllabic ones (e.g., “wouldn't) by her SAE-AAVE speaker with agrammatism (p. 92). She proposed that this was due to an interaction between phonology, morphology and syntax. Here, we

propose that the phonological consistency of the bisyllabic negative contractions used in her study (i.e., “couldn’t,” “wouldn’t” and “shouldn’t” are full rhymes, and “didn’t” has the same final syllable) might have facilitated their production compared to the monosyllabic negative contractions (i.e., “ain’t,” “can’t,” and “don’t”), which are phonologically different from each other.

Indeed, for our study, we can speculate that the consistency of the verb stem for *estar* (i.e., /est/) might have facilitated its production, while the inconsistency of the verb stem for *ser* might have hampered its production. This is consistent with the findings of Abuom, Obler and Bastiaanse (submitted) that the selective deficit in past tense production in English might be due to the irregularity and variability of the verb inflection for marking past tense in English compared to the regularity and consistency of the “sole, invariant syllable” (p. 25) for marking past tense in Swahili.

4.3 Relating This Study to Research on Agrammatism Therapy

Given the difficulty copula verbs pose for individuals with agrammatism, as well as their frequency of occurrence in daily use, clinicians need to be sure to include the copula verbs in their evaluation and treatment protocols for such patients. There are limited evaluative and therapeutic tools for aphasia available in the Spanish language. However, treatment manuals for aphasia in Spanish speakers do include subsections on the *ser/estar* distinction (e.g., see Bahler & Gyékenyési Gatto, 1985, p. 199). I hope that this continues, with future evaluation and treatment tools incorporating these two copula verbs.

The findings of this study support Centeno (1996) by illustrating that in the face

of agrammatism, Spanish-speaking patients appear to rely on simple and commonly-used verb forms in the language (i.e., in our study and in Centeno (1996), the finding that the more frequent verb tense-aspect form (i.e., present tense) is better spared, most likely because it was used by these agrammatic speakers more in premorbid daily discourse than any other verb tense). Therefore, I suggest here that the present tense can be used as a “jumping off” point for retraining verb form conjugations in speakers of Spanish and other highly-inflected languages.

Our study might also support Centeno’s (1996) assertion that therapeutic protocols for verbs should be developed in a hierarchy of complexity and daily use frequency. With respect to this study, this would involve targeting the present tense of verbs first (since this study and cross-linguistic agrammatism studies, (e.g., Menn & Obler, 1990b) have found the present tense to be the ‘relied-on’ verb tense), followed by the past tense and other less-common verb forms in the language. Additionally, this might also involve targeting regular classes of verbs first and separately from irregular forms. More specific to this study, this would mean using the more regular and better-produced *estar*, and its respective forms, to facilitate overall copula verb production in agrammatic aphasia.

However, others have argued for a more “complex-to-simple” approach to treatment for agrammatism and proposed an advantage of treating complex verbs over simple verbs (e.g., Kim & Thompson, 2004). With respect to our findings, this would mean that therapeutic sessions would begin with the more complex and less frequent verb tenses (i.e., targeting the imperfect past tense of *ser* and *estar* before the present tense of these verbs), and with irregular classes of verbs before regular ones.

Finally, a hierarchically-organized approach to copula verb retraining in agrammatism might involve a hierarchy of protocols to target production of these verbs, from easiest-to-hardest or vice versa (as Kim & Thompson, 2004 have suggested). Given that Meth (1998) found that individuals with agrammatism had pronounced difficulty with verb production in a sentence-completion paradigm (i.e., sentence-completion was “a difficult task” for her participants), we agree that it would be useful to begin the retraining of copula verb production in easier tasks, such as repetition and oral reading, before moving to more complex tasks, such as sentence-completion. In sum, clinicians can approach copula verb training in agrammatic individuals using a hierarchically-based approach that incorporates a hierarchy of verbs by regularity and TMA Frequency, as well as a hierarchy of tasks of increasing or decreasing difficulty.

4.4 Limitations of This Study

As with most research studies, there are some limitations to this study. Firstly, this study is limited to: a) two copula verbs and b) only two forms of each of the verbs. A more generalized statement about verb production in agrammatism could be made if: a) other high frequency regular (e.g., “comer” - “to eat”) and irregular (e.g., “tener” - “to have”) verbs were included for comparison and b) more forms of each of the two copula verbs were included (i.e., different person forms, such as the 1st person singular, 3rd person plural, etc.; different verb tenses, such as the preterite, future, conditional, etc.). In the pilot phase of our study, the preterite and future tense forms of both copula verbs were included. These additional forms of the copula verbs yielded high overall accuracy by the control participants and low overall accuracy by the participants with

agrammatism. In the end, we chose to use only the 3rd person singular forms of *ser* and *estar* in the present and imperfect past tense for the following reasons: 1) we wanted to make the task relatively simple by limiting the target responses to only two forms of each of the two copula verbs, 2) we wanted to keep the task within 130 stimulus items and 3) we wanted to examine the effects of regularity by contrasting only more irregular *ser* forms with more regular *estar* forms. The future tense of *ser* is regular, while the preterite past tense of *estar* is irregular. Therefore, adding these additional verb tenses would have only made the picture more complex and made our three factors more difficult to compare.

Secondly, the copula distinction between *ser* and *estar* was the focus, because this dual-copula contrast is typically learned early, both in developmental and late L2 acquisition of Spanish. However, it is important to acknowledge that there is another verb that is used in some contexts in Spanish as a copula verb- *quedar*. *Quedar* is roughly translated as “to stay” or “to remain” and functions most similarly to the *estar* copula (e.g., “El pueblo más cerca *queda* 5 minutos en coche.” - “The closest town is 5 minutes by car”). It would have been interesting to have included this low-frequency verb in the dissertation study, because of its limited use as a copula verb in Spanish. By doing so, we would have been able to contrast our two high-frequency copula verbs (i.e., *ser* and *estar*) with this lower-frequency one. Of note, the control participants occasionally provided the appropriate *quedar* verb form in conjunction with the appropriate *estar* verb form in their responses (e.g., they offered both *quedaba* and *estaba* as appropriate to complete a target sentence; these responses were counted as correct, since the participant’s always self-corrected their initial response of *quedaba* by

immediately producing the appropriate response (i.e., *estaba*), and only final responses were coded), while only one participant with agrammatism (Ag5) ever used *quedaba* (one sentence only) and was unable to self-correct her response to *estaba*. This may mean that the control participants are cognizant of which sentence contexts allow *quedar* as an acceptable alternative to *estar*, while the participants with agrammatism are not, or could suggest that agrammatism renders very low-frequency verbs less accessible for use, despite the fact that *quedar* is even more regular than *estar*.

Thirdly, this study is limited in the specific methodology utilized. We selected a sentence-completion paradigm because it is a common paradigm in both research and therapeutic intervention for aphasia. However, it is a difficult task for such patients (Meth, 1998), since it requires speech output that is volitional. Additional tasks, such as grammaticality judgment, repetition and/or oral reading could have been employed. Had this study included a subset of stimuli for sentence repetition, as Centeno (1996), Meth (1998), Jones (2002) and Mathews (2003) did, I might have found better performance with these verbs in this task than in the sentence-completion paradigm I used. Indeed, Meth (1998) found that her participants with agrammatism made significantly more errors on verb inflections in sentence completion than in repetition. Conversely, we might have found no significant task effects, similar to Wenzlaff and Clahsen (2004), who employed both sentence completion and grammaticality judgment in their experimental protocol. In the end, we kept to one task (i.e., sentence completion) because we wanted to focus the investigation on more spontaneous productions of these copula verb forms than tasks like oral reading and repetition tasks might have yielded (in both of these tasks, the participant would have been provided with the copula verbs either

visually or auditorily) and we wanted a production paradigm, rather than a comprehension one (e.g., grammaticality judgment). Finally, we also wanted to keep the length of the task within 2-4 session visits, to prevent participant fatigue and loss of interest in completing the experiment.

Furthermore, the task we selected might have contributed to the pattern of errors made by our participants. In this study, there were minimal to no omission errors, in contrast to what Menn and Obler (1990b) reported as a common pattern seen for copula verbs cross-linguistically in agrammatic discourse. In a task like the one employed here, the sentence-completion task, we have argued, participants may have felt obliged by the instructions to insert a copula verb in the sentence because their attention was drawn to the place in the sentence where the copula verb must be; therefore, the errors they made were predominantly substitution errors. It will be important to analyze the spontaneous speech samples collected from my dissertation participants, to compare the substitution errors committed during the sentence-completion protocol to the errors produced during a more naturalistic task. Here, I might find omission errors similar to those reported in Menn and Obler (1990b).

Finally, a relatively small sample size of six participants with agrammatism was included, and there was clearly a degree of inter-individual variability among them. A larger sample size with more participants of different dialectal regions and of different levels of Spanish proficiency and severities of aphasia would have made the results of this study more generalizable to other Spanish-speaking populations. However, a review of current published studies of agrammatism in English and other languages has revealed a range from single participant to 10 participant sample sizes; therefore, my participant

size is in line with the published literature on agrammatism.

In this study, three of the agrammatic participants were bilingual Spanish-English speakers, while the other three were relative monolingual Spanish speakers. A mixed-effects logistic regression analysis of the bilingual vs. monolingual data (O'Connor Wells, Opler & Goral, 2009), revealed a trend ($p = 0.07$) for the mean performance of the bilinguals with agrammatism (64%) to be greater than that of the monolinguals (54%). Although the direction of their performance was the same, the bilingual participants with agrammatism appeared to outperformed the monolingual ones on all three conditions: 1) TMA Frequency (bilinguals: $X = 75\%$ for present tense and $X = 54\%$ for past tense vs. monolinguals: $X = 54\%$ for present tense and $X = 44\%$ for past tense), 2) VF Regularity (bilinguals: $X = 55\%$ for irregular *ser* and $X = 74\%$ for regular *estar* vs. monolinguals: $X = 32\%$ for irregular *ser* and $X = 66\%$ regular *estar*) and 3) CGC (bilinguals: $X = 75$ for rule-governed and $X = 52\%$ for "High CGC" *ser* and *estar* vs. monolinguals: $X = 54\%$ for rule-governed and $X = 48\%$ for "High CGC" *ser* and *estar*). However, with so few participants in each group, we were not able to see if this trend holds significance. Therefore, at this time, we are unable to conclude if bilingual status facilitated performance on this copula verb production task or not. Had we included more participants per sub-group, we might have been able to find a difference between them. In the next section, I propose this as an area for future research.

4.5 Future Directions for Research

With this study, we aimed to identify which variable(s) facilitate verb production in agrammatism. However, this study was limited only to the dual-copula verb system in

Spanish. Future research in this topic should involve additional data (i.e., more items per category, so within category statistical analyses and a three-way interaction between TMA Frequency, VF Regularity and CGC can be performed), further analyses (e.g., item analysis) and detailed comparisons of the performance of bilingual and monolingual participants with agrammatism. A future study should include more bilingual and monolingual participants in each group, to examine if the trend we found (i.e., better performance of bilinguals compared to monolinguals within the agrammatic group, not only on the overall task, but also on each of the three factors examined in our study) holds or becomes statistically significant.

As discussed in Section 4.2.4.2, it is important to acknowledge that *ser* and *estar* also function as auxiliary verbs in the Spanish language (Roldán, 1974). Our study was limited to the role of *ser* and *estar* as copula verbs in the language. Another direction for future study would be to include sentence contexts where *ser* and *estar* serve as the auxiliary verb, and contrast performance with their use as copula verbs in the language, as in the present study.

Another direction for future study would be to analyze the spontaneous production of the copula verbs in the recorded picture description and oral narratives collected along with the experimental data for this dissertation study. Given that a sentence-completion protocol can feel “artificial” to both control and agrammatic participants, the spontaneous uses of these two copula verbs can provide us with more “real-time” information about copula verb production in agrammatism. Not only should this future analysis focus in on the copula verbs per se, but also on all regular and irregular verb forms produced by the control and agrammatic participants. This would

allow us to examine if the pattern of performance we see in our study (i.e., better sparing of more regular verbs compared to more irregular ones and better sparing of present tense compared to imperfect past tense) and the pattern of errors (i.e., substitution errors as the predominant error type) holds for other verbs outside the dual-copula system in more spontaneous speech contexts.

Additionally, in order to extend the clinical implications of this study, it could be replicated with other language-disordered populations of Spanish speakers (e.g., children and adult Spanish speakers with language disorders due to developmental and/or other neurological disorders, such as specific language impairment (SLI) and traumatic brain injury (TBI)). Extending this study to such populations might have additional implications for the development and relearning of the copula verb system in Spanish. It would be interesting to see if the patterns of performance and/or patterns of errors made by the agrammatic group in this dissertation are mirrored by these other populations. If the error patterns produced by these other language-disorders groups mirror those produced by our agrammatic group, then that could suggest that the brain areas responsible for production of these copula verbs are impaired not only in agrammatic aphasia, but in these other developmental and acquired neurological disorders.

In line with this, our study also has implications for the teaching and late L2 learning of Spanish, and, in particular, the teaching and learning of the subtle vs. obvious distinctions between these two copula verbs. Tasks similar to the methodology of this dissertation could also be employed with healthy speakers trying to master the Spanish language. Teachers of Spanish and their students could use such a task to measure proficiency and to determine what stage in the acquisition process a Spanish learner is at.

As late L2 learners of Spanish work toward mastery of the dual-copula system, they may make errors similar to those made by the two groups in our study.

Future replications of this study could also consider including a brain imaging component (e.g., fMRI) as a supplement to the behavioral data found here. Such imaging techniques, in conjunction with behavioral data, would allow researchers to better investigate the brain regions involved in processing these two copula verbs. This could shed light on the ongoing debate regarding whether or not there is a dissociation between regular and irregular verb morphology (i.e., shared or distinct brain processing mechanisms for these two classes of verbs). Would these two copula verbs, differing in regularity, be processed separately or together because of their close semantic ties? These questions could be answered more readily with these additional studies than with behavioral data alone.

A final future extension of this study is to run it or an equivalent study on agrammatic speakers of other dual-copula languages, such as Catalan, Italian and Portuguese. This would allow us to develop a more generalized and cross-linguistically-applicable theory of copula verbs in agrammatism, by shedding light on whether our findings regarding copula verb production are a language-specific characteristic of Spanish or a language-universal characteristic of the disorder of agrammatism.

Appendix A: Common Conjugations of *Ser* and *Estar*

Infinitive: *ser*

Present indicative	yo soy	tú eres	usted/él/ella es	nosotros/as somos	vosotros/as sois	ustedes/ellos/ellas son
Preterite past tense	yo fui	tú fuiste	usted/él/ella fue	nosotros/as fuimos	vosotros/as fuisteis	ustedes/ellos/ellas fueron
Imperfect past tense	yo era	tú eras	usted/él/ella era	nosotros/as éramos	vosotros/as erais	ustedes/ellos/ellas eran
Future tense	yo seré	tú serás	usted/él/ella será	nosotros/as seremos	vosotros/as seréis	ustedes/ellos/ellas serán

Infinitive: *estar*

Present indicative	yo estoy	tú estás	usted/él/ella está	nosotros/as estamos	vosotros/as estáis	ustedes/ellos/ellas están
Preterite past tense	yo estuve	tú estuviste	usted/él/ella estuvo	nosotros/as estuvimos	vosotros/as estuvisteis	ustedes/ellos/ellas estuvieron
Imperfect past tense	yo estaba	tú estabas	usted/él/ella estaba	nosotros/as estábamos	vosotros/as estabais	ustedes/ellos/ellas estaban
Future tense	yo estaré	tú estarás	usted/él/ella estará	nosotros/as estaremos	vosotros/as estaréis	ustedes/ellos/ellas estarán

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