MORPHOLOGICAL AND PHONOLOGICAL FACTORS IN THE PRODUCTION OF VERBAL INFLECTION IN ADULT L2 LEARNERS AND PATIENTS WITH AGRAMMATIC APHASIA

by

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Abstract

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Małgorzata Szupica-Pyrzanowski

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Failure to supply inflection is common in adult L2 learners of English and agrammatic aphasics (AAs), who are known to resort to bare verb forms. Among attempts to explain the absence of inflection are competing morphological and phonological explanations. In the L2 acquisition literature, omission of inflection is explained in terms of: mapping (Epstein et al., 1996; Prévost & White, 2000), failed modular interaction (Lardiere, 1998), L1 morpho-syntactic constraints governing the activation of the L2 features (Hawkins & Liszka, 2003), L1 prosodic organization which differs from that of L2 (Goad, et al., 2003), and L1 phonological constraints on final consonant clusters (Lardiere, 2003).

In agrammatism, inflectional omission has been linked to: processing (Thompson et al., 2002), accessing (Kehayia et al., 1990), impaired rule implementation (Lee & Thompson, 2005), productive (Bird et al., 2003; Mathews & Obler, 1997) and receptive phonology (de Mornay Davies, 2006).

Most, if not all, investigations of inflectional omission have focused on populations whose L1 lacks the syntactic representation of inflection. In this study, we concentrate instead on two groups (L1 Polish learners of L2 English and AAs of L1

English) who can be assumed to have an underlying representation of inflectional material because the L1 already has it; yet they show difficulties in the use of inflection. With regard to production, we therefore asked: What contributes more to the problems encountered by these speakers, morphology or phonology? To test this, we administered an elicited production task varying either the morphological or the phonological complexity of the environment of the inflectional morpheme.

We hypothesized that if non-target production of inflection is constrained by morphological factors, we would likely see the following:

1. Both groups would perform better on mono- than bi-morphemic homophones.
2. The participants would differentiate between homophonous morphemes, e.g., PLUR, AGR, POSS and show different degrees of omission for these.
3. There would be no significant difference between inflection of mono-syllabic existing verbs and mono-syllabic pseudo-verbs because the rule attaching inflection is present and intact.

On the phonological side, we made the following predictions:

1. Sonority of the final segment of stems would affect the production of inflection.
2. Syllabic suffixes would be produced more accurately than their non-syllabic counterparts because of their saliency.
3. Shorter (mono-syllabic) verbs would be affixed better than longer (bi- and tri-syllabic) ones.

Results show that in the production of inflection, similar patterns were found in these two fundamentally different populations, L2 learners and AAs. Morphological constraints seem to play a greater role in the omission of inflection than phonological

ones. On the other hand, phonology is used by both groups as a compensatory strategy to preserve inflection.

This dissertation is dedicated to Darek, Filip, Jaś, my brother Maciek,

and to my parents, Krystyna & Włodzimierz Szupica

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Chapter One

Introduction

1.1. Overview

There is something uniquely interesting about the way verbs contribute to our understanding of a language. It is often said that much of what we know about a sentence stems from the verb. One can only add that much of what we know about the verb itself comes from its inflection. Inflection in a language is significant. After all, it can convey information regarding tense, agreement, person, number or aspect, to mention just a few. Why then, despite its significance, is it often omitted or substituted for? One could expect the omission of inflection by second language (L2) learners or agrammatic users exposed to a highly inflectional language with rich verbal paradigms where multiple verb forms compete for the learner's/user's attention and overwhelm the processing system. English, with its residual inflectional paradigm, should not be as challenging. The evidence, however, is to the contrary. Although in English, verbal inflection is predominantly represented by two suffixes, *-ed* and *-s*, indicating tense (T) and agreement (AGR) respectively, their production by adult L2 learners and agrammatic aphasics is often non-target-like.

Let us emphasize that inflectional inconsistency in the use of T/AGR among post-pubertal L2 learners is well documented in second language acquisition (L2A) literature (Bayley, 1996; Epstein, Flynn & Martohardjono, 1996; Goad, White, Steele, 2003; Klein, Stoyneshka, Adams, Rose, Pugach, & Solt, 2003; Lardiere, 1998 a, b, 2000, Prévost & White, 2000). As illustrated below, even advanced L2 English learners at the end-state of

their L2 development tend to be inconsistent in inflection production (Hawkins, 2000; Lardiere, 1998, 2000; White, 2003 a, b, 2008):

(1) Tense

a. *I never saw them before; they open my brain.* (L1 Mandarin)

b. *They pick me up and they brought me in their spaceship.* (L1 French)

(2) Agreement

a. *Mary gets up at 6 o'clock every morning. And then she clean her teeths and her face.* (L1 Mandarin)

b. *She's really sleepy so she goes to bed and read a little bit and at 10:45 she turn off the light and go to bed.* (L1 French)

(White, 2008, p.316)

Such data exhibit that the use of inflection by the same speaker within the same utterance tends to lack consistency. Moreover, as presented above, the absence of inflection occurs not only in the speakers whose L1s do not overtly instantiate agreement or tense (Mandarin), but also in those which do (French). Finally, the inflectional variability occurs despite the fact that inflection is present and available in the L2 input. Even though the inconsistent use of inflection was studied extensively, still not enough research has been done to investigate an intermediate L2 learner of English whose L1 not only instantiates tense and agreement but also contains phonological representations associated with English inflection, e.g., the L1 speaker of Polish. The present study focuses on such learners.

The inflectional inconsistency is not uncommon in yet another population - agrammatic aphasics who are known to omit or substitute verbal endings (Arabatzi & Edwards, 2000, 2002; Bastiaanse & Thompson, 2003; Grodzinsky, 2000; Menn & Obler, 1990; Wenzlaff & Clahsen, 2004). Optionality of T/AGR assignment is one of the major

components of English agrammatism and it usually takes the form of a selective deficit of bound morphemes such as *-ed* or *-s*. The following examples illustrate that even mildly impaired Broca's aphasics can be agrammatic:

(3)

a. *My mother died uh (…) I guess six month my mother pass away.*

(Badecker et al., 1985)

b. *My husband uh...he...uh...he… play…uh…sports*.

(Personal communication with BK, 2007)

Once again, the variability in the use of inflection emerges despite a daily exposure to the target forms in the linguistic environment of agrammatic aphasics.

In sum, the use of T and AGR is non-target-like in both post-pubertal second language acquisition (L2 learners) and in language attrition (agrammatic aphasics) even though L2 learners successfully use verb endings in their native languages, while English speaking agrammatic aphasics employ inflection comfortably prior to the onset of brain damage. We investigate the two groups because in both one can observe language development and language re-development. Together, they provide an insightful view of a language in a dynamic state.

Before turning to a more specific discussion on what triggers the inconsistency in the use of inflection in both groups, let us first consider the steps involved in inflectional processes. Regular inflection in English, the focal point of the present study, is generated by transforming a stem into the past tense or the 3rd person singular present tense by addition of phonologically conditioned morphemes *-ed* or *-s* respectively. The phonological form of both morphemes varies systematically regardless of its

environment. In other words, the shape of the morpheme depends on the phonological quality, [+/-voice], of the final segment of the stem. This final segment of the past tense suffix (alveolar stop) or the 3rd person singular suffix (alveolar fricative) is restricted by the voicing of the preceding phoneme being the last segment of the stem. Consequently, stems ending in voiced phonemes attract voiced allophones of the two morphemes ([-*d*] or [-*z*]), whereas voiceless phonemes in coda position add voiceless allophones, [-*t*] or [-*s*]. Stems with voiced or voiceless alveolar stops or fricatives in final position require an additional syllable, [-*ɪd*] and [-*ɪz*] correspondingly. Undoubtedly, phonology and morphology interplay on the inflectional ground.

The present study focuses on two domains, morphology and phonology, and their relative contributions to the way individuals in linguistically challenging circumstances, such as agrammatic aphasia and post-pubertal second language acquisition, approach verbal inflection. What is required phonologically to have an affixed surface form? What phonological processes are involved in generating an inflected verb? Generally speaking, it is necessary to convert lexical phonological representations into speech output. More specifically, this complex process requires accessing appropriate abstract phonological segments, implementing necessary phonological adjustments, syllabification, and an identification of basic characteristics (e.g. degree of sonority) as well as articulatory features (e.g., height, backness, roundness). Finally, all this information has to be combined, shaped for and reallocated to spoken output.

Morphologically, creation of an inflected form involves a transformation of abstract morphological (lexical) representation into spoken output. This involves triggering and selecting stems and inflectional morphemes as well as affixing and

combining them in morphologically complex sequences which are next syllabified and converted to phonologically permissible strings (Caplan, 1992; Levelt, 1989; Miceli, Capasso, & Caramazza, 2004).

What is behind the lack of inflectional consistency? What is the modular source of the non-target production? As already mentioned, the present study identifies two potential candidates: morphology and phonology. The following section will address the theories of optionality and will present the L2 studies which explore the morphological and phonological constraints on verbal inflection.

Chapter Two

L2 Acquisition

2.1. Background

Let us begin by acknowledging that the big picture presents the L2 research investigating inflection as divided along the question of whether functional categories have abstract representations or whether the functional categories are underspecified. In general, the "impairment" perspective [1](Beck, 1998; Eubank, 1993/1994; Eubank, Bischof, Huffstutler, Leek & West, 1997; Meisel, 1991, 1997; Vainikka & Young - Scholten, 1996) stipulates that L2 grammars lack surface representations due to the absence of their abstract equivalents. More specifically, the impairment argument is two-fold. The inconsistent use of inflection in L2 acquisition reveals either an absence (referred to as a global view represented by Meisel (1997)[2] or impairment (also known as a local view advocated by Beck, 1998; Eubank, 1993/4; Eubank et al., 1997)[3] of functional categories. On the global account, there are no abstract representations of the functional categories, whereas the local approach proposes that only the V-features of INFL are inert. In English these features are weak and that is why the verb does not move to the INFL overtly to be feature-checked in the Logical Form (Chomsky, 1995). The opposite "non-impairment" view assumes that mental representations of T and AGR are present and unimpaired in interlanguage grammars. The reason for non-target production of inflection lies elsewhere.

[1] The impairment here is understood as the lack of abstract representations /functional features.
[2] Meisel (1997) found that L2 learners of German used both finite forms in non-finite contexts as well as non-finite verbs in finite environments. This reverse contingency indicated absence of abstract manifestations of functional categories.
[3] Under the local impairment, the feature (T) is present but its strength for finiteness is inactive.

The big picture overlaps to some extent with a much narrower area investigating inflection from a different perspective. This time, the line of division is drawn along the issue of phonological (Bayley,1994, 1996; Goad et al., 2003; Lardiere,1998a, b, 2003; Klein et al., 2003; Solt et al., 2003; Wolfram,1985) and morphological (Ionin & Wexler, 2001; Epstein et al.,1996; Grondin & White,1996; Haznedar & Schwartz, 1997; Lardiere & Schwartz,1997; Lardiere, 2000; Prévost & White, 1999) aspects which impact the acquisition of inflection.

At this point we would like to state that not much in the L2 research has been done from the perspective of an L2 learner whose L1 would permit what he struggles with in the L2 (this is the focus of the present study). In the absence of such studies we will acknowledge and present the L1-based accounts examining either morphological or phonological contributions to the use of inflection.

2.2. Morphological Accounts of the Inflectional Inconsistency

Among morphological reasons for the inflectional deficit, three views prevail. The first approach emphasizes deviant morphological mapping between abstract mental representations and their surface counterparts. In other words, a discrepancy between the way the inflection is represented in the brain and the way it is articulated in speech which is known as the Missing Surface Inflection Hypothesis (MSIH) (Prévost & White, 1999, 2000; Ionin & Wexler, 2002). Under this view, the inflectional deficit occurs at the interface between the lexicon and the syntax. The second account, the Failed Functional Features Hypothesis (FFFH), addresses the inflectional inconsistency at the purely syntactic level and points to L1 morpho-syntactic constraints governing the activation of the L2 features (Franceschina, 2001; Hawkins & Liszka, 2003). According to this view,

features not instantiated in L1 are not acquirable in L2. The third approach, Modular Hypothesis, specifies the conditions in which morphological and syntactic modules interact. The next section presents the aforementioned morphological hypotheses in a detail.

2.2.1. The Missing Surface Inflection Hypothesis

The Missing Surface Inflection Hypothesis (MSIH, Prévost & White, 2000a, 2000b) and its predecessor the Missing Inflection Hypothesis (Haznedar & Schwartz, 1997) treat the inflectional problem from the representational perspective and attribute it to the unsuccessful accessing of certain lexical items**.** More precisely, the inflection is deficient at the morphological surface level rather than at the mental featural one**.** Here, the abstract representation is present in the interlanguage but the L2 learners struggle to associate this abstract feature with a corresponding inflectional (surface) suffix. Support for this claim comes from Prévost & White (2000a, b) who investigated the spontaneous production of four L2 adult learners acquiring French and German in naturalistic environments. Their longitudinally collected data report on agreement inflection being used correctly. Moreover, the results confirm the occurrence of non-finite forms in finite positions; the opposite interaction ("reverse contingency"), however, is not reported. This observation served two purposes. First, it challenged the global impairment view. Second, the very fact that non-finite forms are employed in finite-positions leads to the conclusion that those default forms are in fact finite, abstractly finite, that is. Finally, the way the L2 learners treat inflectional morphology is by no means random. When a verb is finite, it is used in an appropriate context and position. Collectively, all aforementioned facts suggest that there is no impairment at an abstract level but rather there is

inconsistent accessing of morphological forms which are, in consequence, not overtly realized.

Another instance of the abstract presence of functional categories is found in Ionin & Wexler (2001, 2002) who offer further support for the surface deficit in L2 interlanguage. Data come from the spontaneous production and performance on grammaticality judgment of L1-Russian children learning English. Their spontaneous production reveals a very high overall rate of inflectional omissions. The number of affixal omissions exceeded that of the suppletive forms. This fact cannot be linked to the transfer from L1 since Russian has neither the overt copula in the present tense nor the auxiliary '*be*' unless in the compound future. Further, error analysis indicates that the copula '*be*' serves yet another function; it marks tense and agreement in non-progressive root clauses e.g., *they are help people when people in trouble* or *he is want go up*. This finding prompts Ionin and Wexler to state that the T category is indeed present and activated by the suppletive verbs which in this study are always correctly inflected for the past tense. Consequently, the L2 child learners check the T features via suppletive forms.

In addition, to further assure the morphological (and to exclude the phonological) nature of inflectional omissions, Ionin and Wexler compared regular third person affixation with irregular agreement (*do-does, have-has, say-says* entailing a change to the stem). The rates of omission of both verb types were identical (74% for irregular and 78% for regular verbs). Non-significant difference between regular and idiosyncratic agreement rules out phonological reasons for affixal omissions. From this the authors infer that if phonology were contributing to the *-s* omissions more than morphology, idiosyncratic forms (which involve both stem change and affixation) would generate

more instances of inflected forms. Moreover, phonology was ruled out on yet another account. If the exclusion of agreement *-s* were due to the phonological constraints against coda clusters, plural *-s*, which is phonologically identical, would yield similar error rates. This, however, was not the case; in 11% of plural versus 78% of agreement forms targets were omitted. In sum, in early L2 acquisition, feature checking mechanisms for T and AGR are present and intact as indicated by correct use of suppletive forms in spontaneous production and grammaticality judgment. As for the affixal inflection, learners do not recognize both *-s* and *-ed* as inflectional morphemes. This inability to associate features with surface inflectional morphemes results in the unsuccessful mapping of the features onto the surface manifestations which in turn leads to the non-target production of those morphemes.

2.2.2. Modular Hypothesis

Unlike the first account, MSIH, where lack of surface inflection reflects accessing problems, Lardiere (1998a, b; 2000) approaches the inconsistence use of inflection in terms of a mapping difficulty. Although both models seem to make similar predictions, they cannot be equated. Under this view, inflectional problems may be due to the failed modular interaction and may occur at the interface between syntax and morphology. The morphological module fails to read the output of the syntactic domain and consequently generates absence of surface inflection.

Empirically, Lardiere (1998) is dissociating syntax from morphology in an "L2 end-state grammar "of a Chinese speaker named Patty. In doing so, she concentrates on verb raising and an apparent correlation between syntactic word order on one hand and morphological inflection (agreement) on the other. Here morphology is suggested to be a

prerequisite for syntactic knowledge. An L2 learner needs to know the agreement paradigm in order to assign a [+/-] value to the syntactic feature and assess whether verb-raising occurs in that language. The interlanguage grammar contains an unspecified ("inert") value for feature strength. Ultimately, the end-state grammar should result in a replacement of [+] to [-].

With the aim of investigating the morphological involvement, Lardiere posits three hypotheses. In the first one, the [+/-] feature determining verb-raising is theoretically linked to the morphological paradigms of verbs. Optional verb raising stems from the lack of knowledge regarding featural value. Data obtained via truth-value judgment in intermediate and advanced L2 English learners only partially support this hypothesis as both groups accepted verb raising in English. (Eubank et al, 1997)

The second hypothesis focuses on the quality of inflectional paradigm. The assumption was that morphology will never initiate the replacement of the 'inert' AGR with the appropriate value. As a result, adult L2 learners would permanently opt for verb-raising (in languages prohibiting it) even in the presence of acquired inflectional paradigm. In Eubank et al. (1997) not only two groups performed significantly differently, but also beginners' performance was similar to that of the native controls. Consequently, the second hypothesis was not confirmed.

The last hypothesis stated that UG-constrained knowledge of the featural value is separate from knowledge of the inflectional paradigm and transfers from the L1. Support for this hypothesis is provided by the studies (Gavruseva & Lardiere, 1996; Haznedar & Schwartz, 1997; Lardiere, 1998; Schwartz & Sprouse, 1996) which found that "morpho(phono)logical development, i.e., productive affixation in a post-Spell-Out

morphology component, proceeds independently of the featural knowledge typically associated with those affixes" (Lardiere, 1998, p.365).

Data for Lardiere's single case study come from spontaneous production collected over the course of 18 years. There was hardly any change in agreement marking on lexical verbs between the first and the last data recording (4.76% vs. 4.54% respectively). The rate of supplying agreement was very low, while the occurrence of thematic verb-raising over NEG and adverbs equaled zero in Patty's production. The results are in accord with the third hypothesis. Patty knows that English agreement has [-] value (her verbs never raise) despite her fossilized production of English agreement (virtually non-existing agreement inflection). Therefore, we can conclude that Patty's morphological agreement affixation proceeds independently of her syntactic knowledge of the feature strength. Consequently, the non-target like use of agreement seems to be better accounted for in terms of deviant mapping.

2.2.3. The Failed Functional Features Hypothesis

The next morphological approach to the inflectional inconsistency, represented by the Failed Functional Features Hypothesis (FFFH, Hawkins & Chan, 1997), simply states that L2 acquirers are not able to learn features that are absent from their native language. This account has a very specific application to end-state L2 grammatical knowledge. The argument is constructed around the assumption that even advanced L2 learners who often exhibit high inflectional proficiency in production do so not because they have appropriate L2-specific features in their mophosyntactic repertoire but rather because they mnemonically learn to identify contexts requiring inflection and acquire "probabilistic knowledge" of the L2 featural inventory. The first underlying notion here

is that incorrect use of inflection is closely tied to a critical period for the acquisition of certain functional categories. The second implies that there are two categories of features, parameterized and universal, and that only the former are susceptible to the critical period constraint. Although parametric differences constrain the acquisition beyond the critical period, UG continues to be accessible and actively participates in the development of L2 grammar. Unlike other hypotheses presented here, FFFH does not predict a wide range of fossilization effects but rather only errors specific to the grammatical features not specified in the L1.

In order to test this non-resetting prediction, Hawkins and Chan designed an experiment involving the grammaticality judgment of relative clauses. They selected two L1s, Cantonese and French, and tested post-pubertal learners of three levels of proficiency in each group. Under the FFFH, the absence of [wh] feature in Cantonese would lead to its lack in the interlanguage grammar of Cantonese L2 learners. Consequently, Cantonese participants would be unable to generate a relative clause through operator movement which will trigger erroneous assessment of resumptive pronouns and subjacency violations. By the same token, French speakers learning English should have an advantage over Cantonese learners because the [*wh*] feature along with subjacency and resumptive pronouns is instantiated in French.

As predicted, the parameter-resetting ability was a decisive factor as there were significant differences between the two L1 groups. French speakers outperformed Cantonese learners at all levels of proficiency. Even though, contra FFFH, Cantonese speakers' judgment improved with increasing proficiency, Hawkins & Chan explained this fact in terms of L1 confinement. The results indicate an interesting relation: Low

proficiency speakers of Cantonese accept English relative clauses with resumptive pronouns while proficient speakers reject them. On the other hand, unlike advanced participants, less proficient learners do not accept subjacency violations. This is seen as L1-based influence on interlanguage grammar. The less fluent learners reject subjacency violations not because they have mastered this structure but rather because of their general acceptance of the resumptive pronouns in relative clauses, they assume that such overt forms also appear in subjacency. On the other hand, the proficient participants who reject resumptive pronouns and treat the gap in the relative clause as a null resumptive *pro*, accept ungrammatical subjacent sentences. Therefore, although the advanced group treats subjacency violations as acceptable, in their interlanguage grammars such sentences might not necessarily be seen as violations since they were not derived via movement, which is absent in Chinese.

In sum, the hypotheses presented in the above section represent three perspectives on the way morphology interacts with verbal inflection. The inconsistent use of inflection has been said to be the result of deviant lexical accessing (MSIH), unsuccessful mapping (Modular Hypothesis) or the L1-related morphological constraints (FFFH). Let us now turn to the studies discussing phonological involvement in the non-target use of verbal inflection.

2.3. Phonological Accounts of the Inflectional Inconsistency

The phonological studies, presented below, discuss the inflectional inconsistency as occurring at the phonological level. Both accounts point to predominant native language (L1) influence as a possible explanation for the L2 (English) inflectional deficit. Within L1, it is either the L1 (e.g., Chinese) phonological constraint against final

consonant cluster, which results in a non-target production (Lardiere, 2002, 2003) or it is L1 (e.g., Turkish, Chinese) prosodic organization that differs from that of L2 and triggers a non-native production (Goad et al., 2003; Goad 2004). The former refers to the L1 absence of multiple consonants in word-final position, while the latter pertains to the difference in syllable structure between L1 and L2.

2.3.1. The Consonant Cluster Reduction Hypothesis

The first phonological model considering L1 transfer effects in the acquisition of L2 inflectional morphology (Consonant Cluster Reduction Hypothesis, CCRH) was formulated by Lardiere (1998a, b; 2002/3) and based on the analysis of spontaneous production data collected in the longitudinal case study of Patty. Unlike regular verbs (where only 6% of the verbs were inflected), irregular forms were always produced correctly. Also, Patty's written production of regular inflection was not compatible with her oral suppliance, 6% versus 78% respectively. Further, Lardiere observed that Patty deleted both [*-t*] and [*-d*] not only in non-syllabic past tense suffixes but also in mono-morphemic words which contained those segments in codas. This evidence licensed the conclusion that Patty's failure to produce regular past tense inflection is not restricted by her L1 (Chinese) which does not denote [+/-] past feature (after all Patty was able to correctly produce regular forms in writing), but rather to native language restriction against complex codas.

2.3.2. The Prosodic Transfer Hypothesis

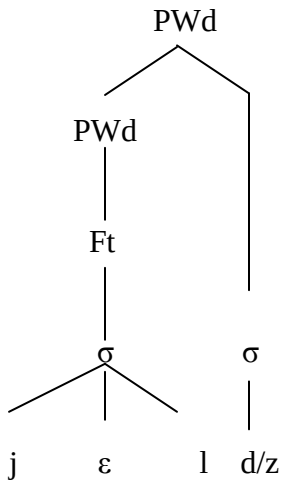
A different account of L1 phonological influences on L2 inflection is represented by the Prosodic Transfer Hypothesis. Goad (2004) gave a different phonological explanation for a discrepancy between the inconsistent use of overt morphology and a

rather steady suppliance of corresponding abstract syntactic properties in the end-state grammar of an L1 Turkish speaker. Two functional categories were the focus of the study; determiner (Det) and inflection (Infl) represented by tense and agreement (TA); both investigated in a production task. The argument goes that despite the fact that both Det and Infl as well as their featural counterparts ([+/-] definiteness, [+/-] past) are present in L2 grammar, there is an apparent difference in the use of the two functional categories in contexts requiring their presence (66% for the articles and 80% for tense and agreement). This is attributed to the L1 prosodic properties constraining Det more than TA. Although both English and Turkish are somewhat comparable in morphological terms, they differ in the prosodic structure. While in English inflectional morphemes are attached to the phonological word (PWd), in Turkish the two suffixes are PWd internal. However, even though unlike English, Turkish prosody does not permit the PWd adjunction, L2 learners can nevertheless achieve this arrangement by joining two configurations already existing in their L1: recursion of the PWd and weak layering. The latter allows for a direct attachment to the PWd and requires only a minor modification from Turkish.

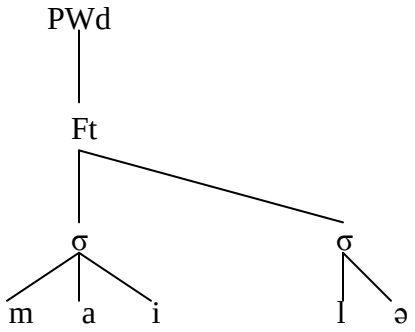
By contrast, the use of English Det by a Turkish speaker entails a much greater change from the L1 as neither direct attachment to the PPh governing the PWD nor the presence of any material left to the head of the phrase is permitted in Turkish. In that case, L2 learners of Turkish cannot resort to the L1 structures which might otherwise aid them in the acquisition of the functional category in question. Consequently, determiners are acquired less successfully than inflectional suffixes even in a stabilized end-state grammar. Goad (2004) points out that morpho-syntactic representations can be acquired

in the absence of related prosodic features and that L1 phonology can constrain the acquisition of certain aspects of morpho-syntax.

Phonology explains results obtained in Goad, White, & Steele (2003). Despite the fact that English and Chinese are both morphologically and phonologically different, the focus was on discrepancies observed within prosodic structure. As illustrated below, English inflectional suffixes (*-ed* and *-s*) adjoin to the Prosodic Word (PWd), stem-externally in other words:



Chinese marks the past tense stem internally where the perfective-aspects suffix *-l* is integrated within the PWd of base form. The following example illustrates this prosodification type:



According to Goad et al. (2003), the prosodic argument constructed this way allows for the following predictions: certain speakers will not produce English inflections at all, as they will simply hypothesize that they cannot transfer the stem-internal suffixation allowed in their L1 while other speakers will correctly inflect English verbs with stem internal prosodification (irregular forms) deleting inflection in those forms which require stem-external suffixation (regular verbs).

2.4. Assessment of the Morphological and Phonological Approaches

Bliss (2006) inquires about phonological and morphological constraints of L1 which affect L2 acquisition by revisiting Jia's (2003) data and evaluates them in the light of the aforementioned models. Jia tested the production of English plural morphology by 10 speakers of Mandarin Chinese, children and adolescent, over the course of 5 years. Data collected via elicitation tasks and spontaneous production yielded similar patterns of development between L1 and L2 acquisition of a plural suffix, e.g., overgeneralizations, variable ratio between correctly produced regular and irregular forms. What was similar among all the participants in Jia's study and distinguished them from the L1 learners was their inconsistent use of plural morpheme, failure to reach 'plural mastery' after 5 years of exposure (3 out of 10) as well as erroneous use of plural when singular was

contextually suggested (e.g., *a goats, milks*). Bliss points out that Lardiere's predictions cannot be extended to justify the errors observed in Jia (2003) because in addition to omission errors, the participants also produced overgeneralization errors in which they inaccurately supplied the plural morphemes and consequently created complex codas. Further, the articulatory nature of Lardiere's claim could be rejected on different grounds. In Liszka's (2001) study, advanced L1 Chinese/L2 English learners, on one hand, omitted past tense suffix in mandatory contexts (*passed, spent*), on the other hand, they were 100% accurate in the production of complex codas in mono-morphemic words (*past, front*). L1 articulatory constraint against consonant clusters cannot account for these patterns of production.

Under this prosodic view, where Turkish and Chinese speakers' inability to produce English past tense is attributed to different prosodification mechanism between the two languages and English, regular forms which involve adjunction to the PWd are more challenging for the learners than their irregular counterparts. Bliss (2006) evaluated this hypothesis (originally applied to the past tense) and extended its ramifications to the production of English plural due to its parallel allomorphic distribution. She concluded that the Prosodic Transfer Hypothesis is unable to justify the co-occurrence of the omission and overgeneralization errors of regular forms to both irregular and non-plural. This fact indicates that stem external prosodification was not only recognized but also applied by the L2 acquirers. Bliss concluded that the following three characteristics of Jia's data are best accounted for in terms of the Failed Functional Features Hypothesis:

1. a total number of overgeneralization errors, 2. a high rate of overgeneralization non-plural errors, in other words plurals used in singular contexts 3. the lack of consistency in the use of the plural morpheme.

Considering the first point, the FFFH predicted that the learners would extend the use of plural to the idiosyncratic cases. In view of the second characteristic, Bliss argues that contextually unsuitable forms (e.g. *a goats*) and pluralized massive nouns such as *milks* (Chinese lacks mass/count distinction) are in accord with the FFFH postulation that a feature not parameterized in L1 will not be activated in L2. In order to account for the third assertion, which pertained to the learners who used English plural inconsistently for the same noun even during the same testing session, the FFFH stated that the acquisition of plural is not necessarily a gradual process, where one phase smoothly feeds into another. The 'probabilistic' nature of the FFFH, in Bliss's view, accounts for correct and incorrect forms fluctuation and for the failure of multiple hypotheses before the mastery of plural occurs. In conclusion, Bliss states that only the FFFH justifies the three characteristics observed in the course of the English plural acquisition by L1 Chinese speakers.

Evidence gathered by Liszka (2001) opposes the processing reasons for selective fossilization of L2 inflection as presented by Prévost & White (2000). Once again, Prévost & White are the proponents of the view that L2 processing strategies differ from those used in L1. However, those processing challenges do not seem to affect the acquisition of Case by L1 Chinese/L2 English speakers. Moreover, if indeed mapping were responsible then it ought to affect L2 English learners irrespectively of their native

language. Accordingly, L1 German speakers should not react to the "communicative pressure" differently from L1Chinese learners (Liszka, 2001).

Franceschina (2001) assessed the modular approach (Lardiere, 1998a, b; 2000) and provided counterevidence for its major claims. In her study, an advanced L1 English learner of L2 Spanish erroneously supplied gender for determiners, pronouns and adjectives but never for nouns. The point made by such an example, in Liszka's terms, is that there is no apparent reason for why morphology fails to read the syntactic output of some features but not others. By the same token, Franceschina questioned why the modular incompatibilities should affect various L1s differently.

In sum, both PTH and FFFH predict L1-based influences on the L2. Under both FFFTH and MSIH, morphological aspects (free vs. bound or regular vs. irregular) should not have an impact on the L2 because, as White (2008) emphasized, the motives for differences in mapping of various morphological aspects are not known. Similarly, according to PTH, task differences (inflectional inconsistency more likely to occur in production) and phonologically based distinctions are expected (bound morphemes more difficult than free, regular verbs' production more deficient than irregular; White, 2008).

Moreover, most of the studies presented in this section collected their data via spontaneous production (Ionin & Wexler, 2001; Jia, 2003; Lardiere, 1999, 2000; Prévost & White, 1999). Next, they were either case studies (Goad, 2004; Lardiere, 1998, 2003; Franceschina, 2001) or they based their results on a small number of participants (Prévost & White; Hawkins). Also, the level of proficiency represented two extreme ends of the acquisitional spectrum, end-state (near-native) and thus mature grammars on the one hand (Lardiere; Goad; Franceschina) and developing grammars of the early stages of L2

acquisition (Eubank, 1993-4; Prévost, 2003; Prévost & White, 2000a, b; Ionin & Wexler, 2001) on the other. Among L1s, Chinese was targeted in the majority of the studies followed by Russian, French and German. As pointed out by Prévost (2008), it is imperative to collect and examine more cross-sectional data. Finally, none of approaches currently yields to full resolution of the inflectional deficit.

In the present study we argue that more light needs to be shed on the intermediate stages of L2 acquisition as well as on the cross-sectional nature of data. There is no consensus as to the exact source of differences between the way inflection is used and treated by native and non-native speakers. In order to adequately assess the phonological and morphological contributions to the L2 acquisition of inflection, one has to diminish the L1 interference and select the L1 which would allow for investigation of both domains equally. Therefore, it is legitimate to inquire: what if one decreases the influence of L1 transfer, both phonological and morpho-syntactic, then, how would the modular interaction between the domains on the L2 inflectional grounds appear. We will address this point more thoroughly in the method section. Next, we turn to agrammatism where, as in the case of L2Ls, inflections are also produced inconsistently under linguistically challenging circumstances.

Chapter Three

Agrammatism

3.1. Background

The following section discusses some problematic aspects of agrammatism, its definition, detection and challenges associated with this phenomenon. Defining agrammatism has never been an easy task. Its definition evolved from a rather generic statement which emphasized that the source of linguistic impairment in language breakdown was manifested in regression to a previous "ontogenetic level" (Pick, 1931). In this light, agrammatism was seen as a decline in language development whose specific features were equivalent to characteristics of reduced forms of language, e.g., pidginized speech or child language. (This perspective may easily be extended to another population discussed here. Elements similar to certain aspects of agrammatic production can also be detected at various levels of fluency of post-pubertal second language learners).

Pick recognized two types of expressive agrammatism: The first type, frontal, was represented by decreased sentential complexity as well as omission of function words and inflection. The second, temporal, was characterized by incorrect inflection, non-target use of auxiliaries and erroneous prefixes and suffixes. The former type roughly overlaps with modern descriptions of grammatical disturbance linked to Broca's aphasics while the latter is compatible with modern conceptions of paragrammatism. Although Pick's contribution to understanding the symptoms of agrammatism was vital, it was more descriptive than explanatory and lacked the assessment of the mechanisms behind the deficit. The next attempt to capture the complex nature of agrammatism was undertaken by Goldstein (1948). His approach was even more focused as he considered it from the

narrow perspective of “motor agrammatism” or a selective disturbance to only one class of lexical items, the grammatical words.

Even though both Pick and Goldstein delineated agrammatic symptoms rather than defining them in theoretical terms, their work, nevertheless, prompted others to consider agrammatism in linguistic terms. This necessary next step was taken by Jakobson (1956) who was among the first researchers to employ linguistic theory in aphasiology. Initially, Jakobson linked phonological breakdown in aphasia to phonemic complexity. He began by depicting an order of phoneme acquisition in child language where nasals were learned first followed by glides, then stops, liquids, fricatives and affricates. This order of acquisition, he claimed, was identical yet opposite to the sequence of language breakdown (that came to be known as the Regression Hypothesis). According to this hypothesis, the sound learned last would be more susceptible to loss in a language breakdown situation. Later, Jakobson (1960) broadened this observation to include the order in which grammatical morphemes were acquired and impaired. He proposed that the sequence of morpheme acquisition mirrors the order of morpheme dissolution, e.g.,*-ing*, plural *-s* followed by the third person singular *-s*, past tense *-ed* , and possessive *-s*. Simply put, the last morpheme to be acquired would be the least resistant to impairment.

A more current definition of agrammatism stresses that it is a form of speech impairment where “users of language resort to the most essential elements in an attempt to maintain communication” (Menn and Obler, 1990). Among its major components three are predominant: selective deficit of function words and bound morphemes manifested by their omissions and/or substitutions, reduced phrase length (telegraphic

style), and sentence comprehension deficit (Taylor Sarno, 1998; Faroqi-Shah & Thompson, 2007). Although these symptoms may be shared by different aphasic patients, agrammatics are by no means a homogeneous population. Patients with similar error types and performance patterns may vary with regard to the underlying deficits[4].

Agrammatism is only a symptom of a much more complex phenomenon known as aphasia. Presently acknowledged characteristics of agrammatism overlap with those of Broca's aphasia: non-fluent and effortful speech, slow rate of speech, poor repetition (Grodzinsky, 1990). Despite the fact that it has initially been associated with Broca's area, damage to this region does not necessarily guarantee agrammatism. Furthermore, it seems neither to be exclusively tied to Broca's aphasia nor is every Broca's aphasic agrammatic. Even more interesting is the fact that other forms of aphasia may also result in agrammatic speech (Brown, 1988). Brown states that "clinically there are links

[4] Rapp & Caramazza (2000) illustrated this point in a very clear way. The authors gave a detailed analysis of two patients who, in accordance with the aforementioned criteria, were considered agrammatic. Their underlying impairments, however, were fundamentally different. As indicated by the features of the spontaneous speech, FS (Miceli & Caramazza, 1988) and ML (Caramazza & Hillis, 1989a), both speakers of Italian produced very similar surface errors; they both omitted function words and substituted inflectional affixes. However, when the two patients were compared on their repetition of three categories of single lexical items (prefixed, suffixed, and function words), ML made no errors whereas FS's performance was equally non-target-like on all three word categories.

Further, a more thorough comparison of error types reveals a discrepancy between the speech output and underlying deficits. ML erred neither in her spontaneous speech nor in any task requiring single word production, e.g., reading, repetition or writing, which fact, as suggested by the authors, allowed for an exclusion of a lexical deficit as a potential factor in the production of morphological affixes. In contrast, FS's non-target performance was comparable for sentence production as well as single word repetition. As a result, in FS's case, a lexical deficit could not have been eliminated as a causal factor contributing to his erroneous production.

More specifically, analysis of FS's error pattern on a single word repetition task revealed that 84.5% of the errors were morphological in nature and the majority of these mistakes were substitutions with correct stem production. Interestingly, phonemic paraphasias constituted only 15.5% of the errors. As pointed out, this patient must undoubtedly have had difficulty accessing, selecting or generating certain sounds. However, this fact alone could not have justified the high occurrence of morphological errors. Rather, the problem lay in a deficit which altered morphological structure. What is even more relevant here is that these morphological errors were predominantly inflectional. This was interpreted as being indicative of a very specific lexical impairment which targeted inflectional processing. The above example demonstrated that special attention needs to be paid to grouping and testing agrammatic individuals with similar surface errors. It is evident that the surface patterns can be deceptive with regard to the underlying impairments.

between agrammatism and transcortical motor aphasia" (p.296). Finally, more recently Taylor Sarno (1998) observed that even patients with "the commonly encountered Wernicke's aphasia can be agrammatic, too" (p.31). Evidently, the scope of behavioral and anatomical manifestations of agrammatism still remains a subject for further investigation. One aspect of it is certain, however; it is no longer synonymous just with Broca's aphasia.

Furthermore, the precise locus of agrammatic impairment has also been debated. For some researchers it is very narrow and specific and can be identified as a single module of the grammar (Mauner, Fromkin, & Cornell, 1993; Grodzinsky, 2000; Grodzinsky & Finkel, 1998). For instance, Grodzinsky & Finkel (1998) claim that agrammatics are selectively impaired in generating structures requiring traces of maximal projection (e.g. passive sentences). Yet for others (Bird, Ralph, Seidenberg, McClelland, & Patterson, 2003) the range of agrammatic impairment is much wider and shows deficits not only in morpho-syntactic competence but also in phonological processing**.**

Whether considered morphologically or phonologically, agrammatism stems from a complex problem where there is more than one dimension of impairment. The focal point of the present study is agrammatic treatment of verbal inflection. In the literature so far, among potential problems leading to inflectional deficits the following ones prevail: the difficulty of accessing the inflection, the challenges regarding its production, the amount of material encapsulated in suffixes (Bates, Wulfeck, & MacWhinney, 1991), the deep and the surface structure of the utterance (Bradley, Garrett, and, Zurif, 1980). Meth (1998) develops the notion of verbal affixation in agrammatism further and states that inflectional dissolution can occur at various points: "awareness of the need to say a word,

finding the targeted inflectional ending, generating some kind of motor plan, putting together the stem and the morpheme, and actually speaking the word" (p.14). Here, we narrow the scope of inquiry and ask about the role two different sets of constraints, morphological and phonological, play in agrammatic production of inflection.

3.2. Phonological Contributions to the Inflection Deficit in Agrammatism

This next section oscillates around a major question of whether inflectional inconsistency in agrammatism manifests deficits at the phonological level: phonological representation, processing, perception or perhaps low-level phonotactic constraints.

The earliest phonological description of aphasia is presented by Jakobson introduced in the previous chapter. Jakobson's predictions prefigure some studies presented in this section.

Chronologically, Kean (1977) represents the next phonological account of the inflectional production in agrammatics. Initially, she held sonority, one of the basic phonological features, responsible for inflectional deficit. In her opinion, affixes were "omission-prone" owing to their phonetic nature. Inflectional affixes are either alveolar stops ([-*t*], [-*d*]) or alveolar fricatives ([-*s*], [-*z*]) and as such are less sonorant than a vowel [*I*] preceding consonantal phonemes [-*z*] or [- *d*] in syllabic variants of the suffix. In the production of suffixes containing [-*s*] and [-*z*], the airflow is so severely blocked that it causes friction. In suffixes including [-*t*] and [-*d*], the air stream is stopped by the tongue making a complete closure. The vowel occurring prior to the final consonant in syllabic suffixes makes them easier to articulate and more resistant to the omission. Consequently, non-syllabic suffixes are less susceptible to unsuccessful production.

Although they are not discussed solely in terms of sonority constraints, the following two studies provide some experimental evidence for partial support for Kean (1979). A phonological perspective on aphasia is continued in Meth (1998) who argues that in agrammatism the impaired area is located where the stem and suffix combine in speech. Since Meth concentrates on both motoric (phonological) and grammatical (morpho-syntactic) aspects of agrammatism, the corpus of her stimuli includes not only phonological (syllabic length, phonemic length, initial versus final consonant clusters, the influence of stress) but also morphological variables (part of speech, prefix versus suffix, affix category, derivational versus inflectional endings). She tested eight Broca's aphasics with agrammatism and used three tasks to determine whether and, if so, how stem length affects affixation and which component dominates. The results point to various aspects of length (e.g., segmental - #CC vs. #C, syllabic- mono- vs. bi- vs. tri-syllabic words) as decisive factors. The longer the verb stem the less likely it was to be inflected.

Moreover, the patterns of production revealed that zero affix was the easiest to produce followed by the 3rd person singular *-s*, and the past tense *-ed* [5]. The reason for less successful production of the inflected words as compared to their uninflected counterparts cannot be attributed to affixation alone. Meth reports that the past tense suffix *-ed* was significantly more difficult than ø suffix which fact indicated that it is the nature of the suffix that influences the inflection production. A primarily morphological deficit was further excluded on the basis of a correct production of this morphological form in reading and repetition which suggested inflectional accessibility. As for the other domain in question, phonology, Meth stipulates that it adds to the erroneous inflectional

[5] These findings are consistent with the results obtained by Goodglass & Berko (1960)

production even in aphasics who are non-dysarthric or having no neuromuscular problems that may affect speech articulation. Undoubtedly, evidence favours phonological factors as a driving force behind the inflectional deficit, as the lexical phonological variables (lexical length, final consonant cluster) contributed significantly.

Further, Centeno (1996) took the discussion on agrammatism and its relation to morphology and phonology one step further and he considered the much richer inflectional system of Spanish. Spanish provides an ideal case for testing a phonological condition such as affix length. Unlike in English, Spanish inflectional affixes may not only be stressed (two-syllable ones fall under the general penultimate syllable-stress rule) but also are subject to length changes. In a sentence repetition task, affix length was contrasted with a non-phonological measure (daily frequency-of-use). In this study, as in Meth's, phonology was also an active contributor to inflectional impairment. Phonologically complex affixes were produced less correctly and more frequent affixes were better preserved.

Despite the fact that the agrammatics in the above studies (Meth, 1998; Centeno, 1996, Meth, Centeno, Obler, Harris & Mathews,1999) were either non-dysarthric or had no other neuromuscular disorders, their deficits were nevertheless triggered by lexical phonological factors: final consonant clusters, syllabic complexity, affix length, and were interpreted as being due to phonological damage at base. The authors analyzed the results obtained as support for a functional theory (Libben, 1990, 1993) according to which in agrammatism the phonology- morphology interaction seems to be dominated by one of the two domains, phonology. Libben states that phonological complexity decreases **"**resources available for morphological access" (p.239).

In the same vein, Kean (1979) continued the phonological approach suggesting that agrammatic production failure is due solely to damage to the phonological system. This time, her argument was widened by a claim that both T and AGR are clitics which are not assigned word-stress and, for this reason, are omitted by agrammatics patients. This is fuel for the argument that only phonological representations provide substantial analysis of agrammatism because they allow for the partition of agrammatic data into those components that are intact (stems being phonological words and thus non-clitics) and those that are impaired (suffixes which are clitics). A morphological explanation of inflectional deficit in agrammatism was not plausible, in Kean's view, because N, V, and ADJ could not be naturally grouped in such a way so as to account for those elements that are retained and those that are absent in agrammatic production.

Study of a French-speaking agrammatic by Nespoulous & Dordain (1990) lends support to Kean's (1979) account. French provides an opportunity to concentrate not only on production of free-standing grammatical morphemes but also to test poly-morphemic prepositions, e.g., *à cause de*. In a series of repetition and reading tasks as well as in spontaneous production, the patient, Mr. Clermont, had a success rate for difficult-to-process prepositional locutions of approximately 25%. His erroneous production never included open-class components of the poly-morphemic prepositions (e.g., *cause*), whereas the closed-class elements were omitted or substituted for, e.g., *à*, *de*. For example, in the aforementioned preposition (*à cause de*) either the element preceding the open-class member or the part following it was truncated or replaced with a different preposition. Nespoulous & Dordain rejected the possibility that the deficit was syntactic. Within-category substitutions observed in Mr. Clermont's performance made a case for

preserved ability to process syntactic frames. However, the authors perceived the locus of impairment to be "at the level of the implementation of the phonological forms of closed class items" (p.274). Their data demonstrated, consistent with Kean (1979), the retention of open-class elements (e.g., phonological words such as *cause*) and deficiency of closed-class components (e.g., phonological clitics such as *à*, *de*).

Kean's hypotheses sparked a heated debate and were rejected on two major accounts. First of all, they were not universal but, rather, English specific and, thus, lacked explanatory power as they were unable to explain paradigms without the ø inflection option. For instance, in Russian an uninflected stem would constitute a permissible string but not a "phonological word" while in Hebrew uninflected stems would neither be phonologically permitted nor pronounceable. Second, within English, Kean's predictions could only give explanation for concatenated inflection ("operation external" e.g., *walk-walked*) but not non-concatenated paradigms ("operation internal", e.g., *ride-rode*) (for a critique see, Grodzinsky, 1990; Klosek, 1979). One point is worth emphasizing: Kean proposes that in agrammatic production lexical items are reduced to "phonological words". If this were the case, Grodzinsky notes, Kean's phonological hypotheses would wrongly predict that both scenarios presented above (Russian and Hebrew on one hand and English on the other) would not pose any difficulty for agrammatics since uninflected stems become phonological words when inflected. Following this line of reasoning, no errors should be expected in agrammatism.

Another interesting example illustrates that inflectional breakdown can occur at various places within phonology. Jarema and Kehayia (1988) examined French-speaking agrammatic aphasics and placed the locus of the deficit at the level of surface post-lexical

phonology. In the production of French plural, in a form of an article followed by a noun e.g., *les éléphants,* the participants initially accessed the plural and affixed the article *les.* However, when faced with the implementation of liaison, they opted for various avoidance strategies. They altered gender and number of both the article and the noun (*le elephant*), phonologically reorganized the target words (*les l'elephant; les…z… elephants*) or deformed the lexical items in question (*le zéléphants*). Jarema and Kehayia emphasized that the participants were able to retrieve the plural morpheme from the morphological component but failed to produce it correctly at the surface post-lexical phonological level.

Continuing the phonological path, de Mornay Davies, Ludy, & Dronkers (2006) investigated the link between English inflectional morphology and receptive rather than productive phonology. An auditory discrimination task involved past tense forms followed by either their present tense counterparts or repeated target forms. Their eight agrammatics participants were to identify whether the pairs they heard were the same or different. Among three categories of stimuli, each accompanied by its phonological control items, were: regular (*killed-kill,* phonological control *kilt-kill*), pseudo-regular (*guild-gill,* phonological control *guilt-gill*) and irregular (*heard-hear*, phonological control *hurt-hear*). Despite similar patterns of performance on language tasks (e.g., PALPA), the individual findings of the experimental part exhibit a lack of homogeneity among the eight agrammatic participants. Individual results indicate that all participants showed more errors on regular than irregular past tense forms. Six of the eight participants were more accurate at discriminating irregular forms than pseudo-regulars.

Only in two cases was there no difference between the number of errors on irregular and pseudo-regular forms.

The group results imply that all participants showed a regular-irregular difference on the lexical decision task. All agrammatic aphasics were better at discriminating irregulars than regulars. Although this discrepancy is triggered by the morphological category, regularity, de Mornay Davies et al. interpret their results to indicate a "subtle" impairment to receptive phonology rather than an underlying impairment of morphophonology. This deficient receptive phonology is said to affect regular past tense forms which are not embedded in a context. Despite the fact that the authors controlled for phonology as a possible confounding factor by testing the participants on their ability to discriminate word-final segments, the participants were, nevertheless, impaired in their perception of segments in coda position. As a result, they argued, the locus of impairment was found in receptive phonology.

To further explore the relationship between the two domains in question with regard to inflection, Bird et al. (2003) investigated phonological involvement in inflectional morphology. The prediction was the following: if there were an irregular verb advantage over the regular form in Broca's aphasia which originated from a deficit to a procedural (morphological) system, then it would have had to be observed in phonologically controlled forms. If, on the other hand, the problem with regular inflection stems from its phonological complexity, then it should be eliminated by phonologically matched items. The study consisted of a three-fold experiment. The first part included three tasks: sentence completion, reading, repetition. Overall, the outcome of the first experiment showed that the participants were impaired in the production of the

past tense inflection in sentence completion and repetition. More specifically, they demonstrated a highly significant advantage for irregular verbs over their regular counterparts.

For the purpose of the second experiment, Bird et al. generated two lists of the two verb types, subsets of which included real and pseudo-verbs. Also, Bird et al. tested the production of three allophones of the past tense, [-*t*], [-*d*], [-*ɪd*]. The individual results of the phonologically controlled subsets revealed that the irregular verb advantage observed in both sentence completion and repetition in the previous part was no longer significant for those two tasks in experiment 2. In addition, none of the participants showed a significant difference between regular and irregular verbs. The lack of the previously seen difference between the two verb types and the absence of the selective deficit detected earlier supports the argument that the discrepancy between the production of regular and irregular verbs was due solely to the phonological complexity of the former. Even more interesting is the observation that both stem errors as well as morphological errors (e.g., verbs inflected with a mismatched morpheme, most likely -*ing*) were comparably frequent in regular and irregular verbs. This pattern is interpreted as a phonological deficit in a broader sense rather than a much narrower argument of a different phonological complexity of the regular-irregular dichotomy. The liaison between phonological processing and working memory is well established (Caplan, 1987). Non-fluent aphasics are known for their limited capacity of working memory. If this restricted ability of working memory coincides with a task demand (e.g., sentence completion) it may lead to unconscious resorting to either default forms or over-applied -*ing* suffix.

The final part of Bird et al.'s second experiment was devoted to investigation of the three phonologically conditioned allophones of the past tense. Although the verbs selected to be tested in this part differed in the phonological realization of their suffix, they were controlled for frequency, imageability, and CV structure of the stem. Sentence completion and reading did not show any suffix effect on inflection production. Only in the repetition task was the syllabic suffix produced more successfully than its non-syllabic mates [-*t*], and [-*d*]. This suggests that better repetition of the phonologically more salient suffix might originate in receptive phonology.

Experiment 3 contained a receptive task in the form of an auditory, same/different, judgment task. This part was conducted to test whether problems with identification of the final alveolar stop are due to a more general phonological impairment or to a more specific morphological deficit. It also investigated the consistency and inconsistency of voicing of the final segments and their influence on past tense suffix production. The majority of non-fluent aphasic patients were impaired at differentiating regular stems from their past tense forms, such as *pray-prayed*. Moreover, they were equally deficient at discriminating between non-morphologically related pairs for which phonological contrast was the same as present/ past tense regular verbs, e.g., *chess-chest*. It is evident that this lack of auditory recognition could not have originated from a morphological deficit. The poor performance on the phonemic contrasts can be attributed to impairment to phonological processing.

In addition, pairs with consistent voicing across final and penultimate phonemes proved to be more difficult to detect as different (e.g., *chase-chased; own-owned* and *chess-chest, an-and*). Word pairs containing the final unvoiced phoneme and the

penultimate voiced phoneme, e.g., *an- ant*, were less challenging. Given the evidence obtained by Bird et al., the deficit appears to be phonological rather than morphological in nature[6].

In sum, the hypothesized locus of impairment has been found in receptive and productive phonology. It has been defined in terms of process (post-lexical phonology), phonological shape (various sonorous segments) as well as phonological status (word versus clitic). Together, the studies discussed in this chapter enhance our understanding of phonological involvement in inflectional impairment in agrammatism. However, past research has shown that none of the hypotheses, predictions, or conclusions currently yields to full resolution of the inflectional inconsistency in phonological terms. We now turn to research that addresses the agrammatic inflectional deficit from a morphological perspective; morphology is the second domain under investigation in the present study.

3.3. Morphological Contributions to the Inflectional Deficit in Agrammatism

What might be the morphological reason for the inflectional breakdown in agrammatism? There have been various attempts to explain the deficit through morphology. This section is divided along the question of whether the morphological deficit reveals impairment of lexical representation or, rather, the process engaged in access to or application of morphological rules.

3.3.1. Morphological Accessing

Morphological accessing or retrieval of morphological material from a mental dictionary (Stemberger, 1985) was considered by Kehayia, Caplan and Piggott (1984)

[6] Re-analysis of Bird et al.'s (2003) study attempted by Braber et al. (2005) yielded parallel results. The findings indicated that vowels were the best preserved as opposed to the consonants which were susceptible to errors regardless of their position, onset versus coda. All eight patients phonologically simplified target lexical items. This is consistent with the prediction that Broca's aphasics struggle with regular inflection owing to the phonological damage triggered by the complexity of regular spoken forms.

who analyzed the errors made by agrammatic aphasics to determine whether these are a sign of accessing the lexicon or whether they indicate accessing the part of morphology responsible for the application of morphological rules. Their results pointed to a difference between complex words which are preserved in the lexicon in their entirety and those complex lexical items which are generated by morphological rules/principles (regular inflection). Only the latter have a single entry in the lexicon and entail morphological decomposition which might be impaired in agrammatism.

The accessing approach seems to be favored by data in another study by Kehayia, Jarema & Kądzielawa (1990). In this cross-linguistic experiment agrammatic aphasics from three different populations (English, Polish and Greek) repeated, assessed and produced sentences including various aspects of their L1 inflection, plural, gender and case. The three languages were selected not because they differ in the quality and complexity of the morphological paradigms but because they vary in the lexical organization of morphological categories, stems and affixes Inflectional affixes can either be required for the stems to surface (e.g., as they are in Greek and in a subset of Polish words in class II) or inflectional affixes may not be necessary in order for the roots to become words (e.g., English and Polish except for a small cohort of class II words).

The patterns of errors in repetition reflected the difference in the role of affixes in morphological paradigms. The participants erred less in Polish and Greek than in English. Greek-speaking agrammatics substituted the most while English-speaking participants most often omitted inflections. In all three languages, participants treated singular, nominative and masculine forms as defaults. The authors univocally state that morphological rules and principles are indeed present in aphasics of different L1s.

However, accessing the inflectionally complex words is additive for the aphasic participants in the study. Specifically, the accessing problem is said to occur at different levels. Aphasics may either struggle with accessing complex words from the lexicon or with implementation of post-lexical phonological rules at the surface level. The former possibility implies access in the lexicalist terms where the morphological module contains the lexicon listing of idiosyncratic and regular, derivational and inflectional, complex lexical items along with the corresponding rules. Under this view, words are retrieved from the lexicon fully inflected. The latter point assumes, again from the lexicalist perspective, that the outcome of the morphological module is incorporated into the syntactic structure to which the rules of post-lexical phonology apply.

3.3.2. Morphological Processing

Morphological processing pertains to the way the brain manages information encoded in morphology (Baker, 1988) and can manifest itself in various ways.

In his initial attempt to address Kean's proposal (1979), Lapointe (1983) provided a morphologically motivated answer and claimed that the phonological description of agrammatism was not the only possible account of the problem and that the retained-omitted distinction had its natural explanation in morphological terms (open versus closed class elements). Two years later, Lapointe (1985) elaborated on his attempt to explain patterns of production in agrammatism and focused both on what is produced and what is omitted by agrammatic aphasics from the processing perspective. In his search for the reasons for omitting inflection, he pointed to the morphological properties of the verbs. Certain features of the omitted elements, he argued, are prone to exclusion owing to their difficulty of processing. Since agrammatics' processing mechanisms are weaker

than those of their healthy counterparts, they are unable to generate complex forms and, in consequence, exclude them from production or replace them with less marked (less complex) variants**.** The opponents of Lapointe's proposal stated that it fit in the spectrum of "descriptive generalizations" and as such failed to provide explanation (for a critique see Grodzinsky, 1990).

The next study in this section addresses the inflectional deficit at the lexical-syntactic interface. In order to examine processing of inflection, Thompson, Fix, and Gitelman, (2002), tested RB, a monolingual English-speaking neurological patient with certain agrammatic characteristics, namely the impaired production of bound inflectional morphology. Grammaticality judgment and four narratives, three oral and one written, were gathered. Results point to AGR as the most severely impaired in all tasks (cumulatively 7% correct). In addition, RB produced the 3rd person singular *-s* with other pronouns, e.g. *I, you*, and *they* as well as in structures involving both infinitival and uninflected forms. In the past tense context, RB used predominantly present tense forms. The correct use of the past tense, at the rate of 33%, was nevertheless better than that of AGR. The two homophonous nominal suffixes, PLU and POSS, were supplied with 54% and 94% accuracy respectively. In the authors' view, POSS was so well preserved because, in contrast to other inflectional forms, it lacks a zero form and thus is not susceptible to omissions.

Like typical agrammatics, RB used morphological rules inconsistently. Unlike the patients with a classic form of agrammatism, she overproduced affixes and generated forms with two inflections (e.g., *I thinks*, *feets*). Despite the fact that RB's performance cannot be described as purely morphological as she is not a typical agrammatic patient

but one who had some agrammatic characteristics, her performance is analyzed in morphological terms and the source of her inflectional problems is found in morphology. First, Thompson et al. rejected a feature-checking explanation for the inflectional deficit on the basis of RB's intact word order which would otherwise be impaired. Second, double affixation detected in RB's data could not even be explained in terms of an enhanced lexicon which contains erroneous entries e.g., *-s* [+1SG], *-s* [+2SG]. Such featural increase in the lexicon is not expected post- stroke.

In order to account for the observed errors, Thomson et al. turned to Distributed Morphology (DM) where an additional level of derivation in the form of Morphological Structure (MS) is postulated and serves as a liaison between syntactic material (features) and morphemes. MS creates morphologically complete representations which are next relocated to Phonological Form where they are interpreted phonologically. This morphological rule or the computation referred to as late insertion occurs post-syntactically and leads to defective feature-to-morpheme mapping which accounts for a wide range of RB's errors, e.g., omissions, overuse and double affixation.

3.3.3. (Lexical) Representational Approach

Motivation for the representational deficit is embedded in the Morphological Decomposition Hypothesis (Miceli & Caramazza, 1988) which was supported by a case study of an Italian agrammatic speaker, FS, whose production suggested dissociation between derivational and inflectional morphemes production. In spontaneous production and repetition tasks FS erred substantially. The vast majority of his non-target responses constituted morphological substitution errors. In particular, these errors involved inflectional components of a word (gender and number for nouns, tense, aspect, person

and number for verbs). The production of inflectional morphology stood in sharp contrast to derivational morphology which was intact.

The representational aspect of FS's morphological deficit was further observed in his tendency to resort to infinitival forms for verbs, singular forms for nouns and masculine for adjectives regardless of the frequency of the lexical items. His preference for default forms was held constant regardless of the frequency of lexical items in a given inflectional paradigm. On this account, morphological processes, inflectional and derivational, are represented independently in the lexicon as two autonomous subcomponents. Consequently, agrammatic aphasics resort to default inflectional forms because stems and affixes are kept separately within the lexicon. Miceli & Caramazza accounted for the selective impairment of inflectional morphology in terms of damaged lexical morphological representation.

3.3.4. Impaired Rule Implementation

In search of an explanation for the way agrammatic aphasics produce inflections, Lee and Thompson (2005) investigated three functional categories: CP, T, and AGR. Since their focus was on production rather than reception, two elicitation tasks were carried out. In the first, Lee and Thompson examined CP versus IP. The second concentrated on three English inflections: singular present, plural present and past tense. Although, in the first experiment there were two participants, only one pattern of production was detected. In particular, CP was intact while lower nodes, i.e., AGR and T, were impaired. As for the IP exponents, the two participants showed higher scores in AGR than T. Moreover, both FG and LC made parallel patterns of errors. Specifically, substitutions rather than omissions dominated their production. Within substitution

errors, one direction prevailed: *-s* was frequently substituted for *-ed*. The second task, which was completed by only one participant, yielded similar results, FG performed slightly better on singular present than plural present and the past. As in experiment 1, this time also FG oversupplied the present singular suffix *-s* and extended its use to present plural and past tense. Another consistent finding that emerged is that he hardly made any omissions. According to the authors, the deviant morphological rule application rather than the syntactic representation deficit explains the patterns. They observed that FG can produce affixes as seen by the correct use of inflections as well as overuse of certain suffixes. His problem, thus, lies in mis-selection of appropriate morphological rules.

In sum, we have seen that nearly every aspect of phonological material contributes to the non-target production of inflection. We have observed that morphology is also a factor in the inflectional inconsistency. Is it then possible in a controlled experiment to determine which of the two domains contributes more, which, in other words, is more vulnerable and more susceptible to linguistically challenging situations? The present study seeks to address this question.

Chapter Four

Method

4.1. Rationale

There has been no consensus as to what brings about the deficit of verb inflection or what is responsible for it in the two populations: L2 learners and agrammatics aphasics. The studies presented above failed to adequately define the two domains. None of the studies has *a priori* asked the question of the extent to which both domains (morphology and phonology) interact in verbal inflection. Most of the studies have not attempted to carefully isolate the areas and to test their effects on the use of inflection. Finally, none of the studies approached this question from two perspectives, language acquisition and language breakdown, in one experiment. Therefore, the aim of the present study is to contribute to a better understanding of the interaction between different language constraints and inflection in two populations.

Furthermore, the choice of L1, Polish for the L2 English learners, was not coincidental. Polish seems to be an ideal candidate for the present study owing to the fact that its nature allows for investigation of which of the two domains, morphology or phonology, appears to be more vulnerable. Polish is a highly inflectional language therefore L2 learners of L1 Polish would already have a morphological predisposition in their linguistic system. Despite the richly inflectional nature of Polish morphological paradigms, their roles are similar to those of English. As in English, Polish inflectional affixes are not necessary for the roots/stems to surface, except for a small group of class II items (for discussion see Kehayia, Jarema, & Kądzielawa, 1990). In addition, English verbal inflection often results in consonant clusters occurring in coda positions. This is

known to be an obstacle for some L2 learners whose native languages do not permit final consonant clusters. Polish, however, allows for complex codas. In addition, in Polish multi-syllabic words are frequent and some frequent lexical items tend to be multi-syllabic. Therefore, although, a complete elimination of L1 transfer is not feasible, with Polish, we get as close as possible to decreasing the influence of a native language (L1) on a target one (L2). Thus we asked, if we decrease the L1 influence in a population that despite this fact is known to struggle with the acquisition of English inflection (Johnston, 1997), what modular interaction will we witness?

Note that, by including these two populations in one experiment, we do not attempt to equate L2 learners with agrammatic aphasics. Together, however, they provide an insightful view of brain architecture with respect to language. There are certain characteristics shared by both groups which cannot be ignored. Undoubtedly, we can state that, in both populations one can witness the way the brain struggles with a language. In both, one can observe an inadequate processing capacity where "overwhelmed" linguistic systems resort to default forms with no verb endings. In general, in both cases, the inflectional deficit, as reflected in the errors, might have a more temporary nature. L2 learners may simply be in a process of shifting from one stage of their interlanguage to another. In agrammatism, certain symptoms might be recovering owing to the less severe character of some types of brain damage. Alternately, in both groups inflectional damage may be permanent due to a severity of brain damage in agrammatics and fossilization or a failure to reach an ultimate attainment in L2 acquirers.

A major difference between the two groups is reflected in the fact that the L2 learners have one intact linguistic system, the L1, whereas in the case of the monolingual

agrammatic aphasics, their only linguistic system is damaged. Both groups have lost certain linguistic abilities. However, monolingual agrammatics struggle because they have lost the only linguistic system available to them while L2 learners struggle because the only complete system they possess, the L1, may get in the way of learning another one.

Additional differences between the two populations are rather superficial, but, nevertheless, worth mentioning. On the surface, it looks as if one is comparing a healthy brain of an L2 learner to an impaired brain of an agrammatic aphasic, and language acquisition to language attrition. A more thorough comparison reveals a different picture.

Let us use the following analogy to illustrate the point we would like to make here. An average adult L2 learner, although weaker in certain aspects of language acquisition, is nevertheless capable of being quite successful at other tasks learned later in life. Horseback riding, driving, carpentry, calligraphy or whistling can be acquired post puberty and still be performed "natively". Moreover, those who learn, for example, how to drive as adults, do not drive with an accent, do not fossilize and can be evaluated as native drivers by those whose onset of driving occurred earlier in their life. Naturally, driving cannot be equated with language acquisition, but the point we are making here is that the brain is able to learn new tasks later in life and still aid us in being successful at them. Language does not seem to be one of those tasks. So, even though we refer to an L2 learner's brain as healthy, it is linguistically "challenged" in a sense that it does not always perform to its fullest capacity (as compared to a native speaker's capacity) and cannot always guarantee a fully successful attainment.

Finally, in order to investigate which of the two domains, morphology or phonology, is more vulnerable, it is imperative to have a single behavioral task which was 1) applicable to both populations, 2) an effective measure of both domains, 3) able to test both hypotheses, 4) able to measure both T and AGR. Further, this one task-two hypotheses ratio is necessary to exclude the nature of the task as a potential confounding factor. We designed such a task, that is, an oral sentence completion with pictures. Its benefits are many. It can be successfully used in both agrammatism and L2A, it is not demanding in terms of processing, and the picture component further enhances the elicitation of desired target forms and decreases processing load. It has been pointed out by Meth (1998) that sentence completion creates a more natural environment because the participants respond to the auditory stimulus and use sentences to provide a context for the target lexical items. It is qualitatively closer to natural speech than other tasks frequently used in aphasia research, e.g., repetition, reading or pure sentence completion.

4.2. Research Question

Considering all the abovementioned arguments, the following research questions presented themselves as necessary steps. Therefore, we ask:

4.2.1. Strong Version

What factors in the morphological and phonological domains account for the well-attested problem with inflection production among post-pubertal L2 learners of English and L1 English agrammatic aphasics?

It is plausible that both domains might contribute to the inconsistent use of inflection, with one being more dominant. For that reason, we propose a slightly weaker, if not more interesting, version of the research question.

4.2.2. Weak Version

Assuming that both play a role, what factors in the morphological or phonological domains contribute more to the well-attested problem with inflection among post-pubertal L2 learners of English and L1 English agrammatics aphasics?

4.3. Research Parameters:

Two working definitions along with two corresponding hypotheses stem from the above research questions.

Here, morphology is operationally tested in terms of:

a) a difference between mono- (*pact*) and bi-morphemic (*pack+ed*) homophones: pact -packed, mist-missed, band-banned, guest-guessed, past-passed, tide-tied

b) a contrast between homophonic morphemes, AGR –s (*marks*), PLURAL-s (*marks*), POSSESSIVE-s (*Mark's*).

c) a discrepancy between affixation of existing (*rake*) and non-existing stems (*roop*).

Phonology is operationally defined as:

a) a difference in syllabic length of a stem(mono-bi-tri-syllabic→count, collect, decorate)

b) a contrast between presence/absence of the final consonant cluster (syllabic *wanted* [wɔntɪd] versus non-syllabic suffix *walked* [wɔlkt]).

c) a variance in sonority of the last segment of a stem (consonant *collect* vs. vowel *copy*).

4.4. Hypotheses

4.4.1. Morphological Hypothesis:

We hypothesize that if non-target production of inflection is constrained by morphological factors, we would likely see the following:

1) Morpheme Number

L2 learners'/agrammatics aphasics' performance would be more accurate on mono-morphemic (*pact*) than bi-morphemic homophones (*packed*) because the former are morphologically less complex than the latter.

Mono-morphemic> Bi-morphemic homophones

2) Morpheme Type

Members of both groups would perform on homophonous morphemes, e.g., PLUR *-s*, AGR *–s*, and POSS *-s* with different degree of success owing to the morphological dissimilarity of the three morphemes.

PLUR > POSS > AGR[7].

3) Stem Status

From the morpho-syntactic[8] point of view, there would be no significant difference between inflection of mono-syllabic existing stems and mono-syllabic pseudo-stems because both verb types would be created by the same (intact) mechanism and result in identical bi-morphemic structure, stem + suffix.

Mono-syllabic existing stems ≈ Mono-syllabic pseudo-stems

[7] Larsen-Freeman (2006); Zobl & Liceras (1994); Jakobson (1960); Berko & Goodglass (1960, 1964); Goodglass (1973)

[8] However, we acknowledge a dual nature of this prediction.

From the processing perspective, there would be a significant difference between inflection of mono-syllabic existing stems and mono-syllabic pseudo-stems because search cost would affect the affixation of the latter.

Mono-syllabic existing stems > Mono-syllabic pseudo-stems

4.4.2. Phonological Hypothesis:

On the phonological side, we made the following predictions:

1. Syllable Number

There would be a significant difference in affixation of mono-syllabic, bi-syllabic and tri-syllabic verbs as they vary phonologically.

Mono-syllabic> Bi-syllabic >Tri-syllabic [9]

2. Suffix Syllabicity

Syllabic T/AGR forms resulting in a breaking of a consonant cluster would be produced more accurately than their non-syllabic counterparts owing to saliency of the former.

Syllabic Suffix > Non-Syllabic Suffix [10]

3. Sonority Type

Sonority of the final segment of a stem (consonant versus vowel) would affect the production of inflection.

…V# + C > …C# + C[11]

4.5. Participants

The study included two experimental groups: L2 learners and agrammatic aphasics. There was also a control group consisting of 10 L1 speakers of English matched for age and education.

[9] Meth (1998).
[10] Klein, Stoyneshka, Adams, Rose, Pugach, Solt (2003); Windsor, Kelly, & Hewlett (2002).
[11] Sonority Scale -Burquest & Payne (1993); Selkirk (1974); Goodglass (1973).

4.5.1. L2 Learners

The first experimental group comprised thirty L1 speakers of Polish with post-pubertal onset of L2 English acquisition. The participants in this group were controlled for the context of learning (formal classroom setting) as well as the length of stay in the US (up to five years). They were enrolled in ESL classes at the Polish & Slavic Center American Language Guild at the Queens and Brooklyn branches or at the Callan School of English in Ridgewood, Queens where they received 6 hours of weekly instruction. Their ages ranged from 21 to 65.

4.5.2. Agrammatic Aphasics

Agrammatic aphasics constituted a second experimental group investigated in the present study. This group was composed of seven mildly to moderately impaired adult agrammatic aphasics with brain impairment onset in adulthood and no outstanding neuromuscular speech disturbances. The recruitment took place at two Aphasia Support Groups, one at St. Vincent's Hospital and the other at the Speech Pathology Clinic at Lehman College.

We chose non-dysarthric individuals so their inflectional deficit can neither be attributed to difficulty articulating various classes of sounds nor associated with production of phonemes in coda position. Moreover, the participants were non-apraxic so the phonological planning deficit should not interfere with the performance on phonological variables. They were monolingual speakers of standard American English. With the exception of one participant who earned an associate degree, all had at least college education.

In order to be included in the study, they needed to show evidence of a clinically detected Broca's or transcortical motor aphasia along with agrammatism evaluated by at least one speech language pathologist. Participants were considered agrammatic following their non-target performance on the *Cookie Theft Picture*. The omission of three functional categories (e.g., articles, bound inflectional morphemes, prepositions) during the *Cookie Theft Picture* session sufficed to be included in the study.

The participants had chronic aphasia and were at least one year post-onset. Six of the seven participants were pre-morbidly right handed. Four had right-sided hemiplegia. As it is often the case with aphasic patients, the participants' pre-morbid use of English was not known. All individual profiles are included in the *Appendix*. The participants were tested individually in a quiet and friendly environment.

4.6. Michigan Proficiency Test

The Michigan Test was an L2 inclusion criterion. In order to assess L2-learner participants' proficiency we used the Michigan Test Listening Comprehension component. The participants listened to an auditory prompt which they next matched with one of the three answers in a multiple choice format. The learners, who scored 50% and below were excluded from the study. Initially, the participants were placed in two groups based on their proficiency score (lower and higher group). This is further discussed in the results section.

4.7. The Cookie Theft Picture

The BDAE Cookie Theft picture (Goodglass and Kaplan, 1983) was employed as a pre-screening measure for the agrammatic group. Following simple instructions: *Tell me what you see in this picture*, the agrammatics described the illustration to the best of

their abilities. This standardized test assessed not only participants' spontaneous production but also their agrammatism. The occurrence of three inflectional errors sufficed to be included in the study.

4.8. Grammaticality Judgment

Grammaticality Judgment is said to be one of the closest tasks to test comprehension rather than performance. Here, grammaticality judgment is used to tap the underlying presence of the two rules, the past tense as well as the present tense rule. Regarding the present study, its indisputable advantage lies in the fact that it can be employed in both populations tested in the present study, L2 acquirers and agrammatic aphasics. Previous studies using grammaticality judgment tasks reported that aphasics usually perform better on grammaticality judgment than on sentence comprehension tasks (Linebarger et al., 1983)[12].

The grammaticality task involved 60 sentences, 50 of which were target sentences and 10 fillers. The target sentences included two violation types: overgeneralizations and deletions manifested as zero morpheme forms. The participants were asked to evaluate the sentences as either correct or incorrect. In those sentences which they assessed as incorrect, however, they were further required to identify the error. Performance was evaluated as the total of correctly assessed grammatical sentences and accurately rejected

[12] In their experiment four patients with agrammatism who failed on sentence comprehension task when forced to rely on syntactic structure alone, were very successful at the grammaticality judgment task. Linebarger et al. presented evidence that this difference in performance between the two tasks could not have been possible without an intact grammatical knowledge available to those patients. Instead, in their view, the problem in agrammatism lies not in processing of syntactic structures but rather in mapping them onto the semantic interpretation. The observation that Broca's aphasics are successful at grammaticality judgment task has also been confirmed in numerous other studies investigating various syntactic structures (Wulfeck & Bates, 1991; Wulfeck, Bates, & Capasso, 1991; Schwartz, Linebarger, Saffran, & Pate, 1987) as well as in different languages, for instance, Italian (Wulfeck et al., 1991), Mandarin Chinese (Lu et al., 2000) and Serbo-Croatian (Lukatela, Crain, & Schankweiler, 1988).

incorrect sentences. The following examples illustrate the different sentence and violation types included.

a) Every day he works hard.

b) He arrived late yesterday.

c) She goed to the movies last night.

d) She go to school every day.

e) They watch TV yesterday.

The above examples show correct sentences along with deletions and overgeneralizations of the past/present tense rules. The incorrect rejection of a) and b) would stem from the absence of the present and past tense rules respectively. Acceptance of c) and d) and e) would be indicative of an inconsistent use of the rules.

Chapter Five

Procedure

All participants signed the consent forms. The recruitment as well as the execution of the experiment was in compliance with the IRB protocol.

5.1. Elicited Production Task

The experimental task was run after a series of warm-up sentences and a short practice session familiarizing participants with the lexical items involved in the experiment as well as with the format of the task. In order to ease the task execution we divided the stimuli into four sections. Consequently, four pre-familiarization lists were created. Each list was carefully presented and reviewed before every testing session. Additionally, the L2 participants were given a copy of the pre-familiarization list prior to the testing session and were encouraged to study the stimulus items at home.

The task included 125 stimuli representing investigated aspects of morphology and phonology. In it, first, the auditory component was presented during which a participant listened to a leading sentence e.g., *Rebecca likes to dance.* Each context sentence served two purposes. First, it introduced an uninflected target lexical item which was later expected to be used in a different, inflected, form, *dance* in this case. Second, it set the grammatical context, here the present tense. Next, the participant was presented with the picture illustrating the leading sentence e.g., Rebecca dancing.

Finally, the visual element was followed by a productive component and the participant verbally completed a sentence provided under the picture. Each target form was followed by a vowel so as to ensure the saliency of the inflectional part, e.g.,

Every day she _____ around the house. (**dances**)

However, we were faced with a challenge. The first morphological category, morpheme number, contained mono-morphemic homophones which were also nouns (e.g., *pact*, *band*). Since nouns are more difficult to elicit using this sentence completion format, we needed a slightly modified version of elicitation. The original format designed for verbs would not allow for testing nominal affixation. For this reason, the leading sentence did not include the target item but rather provided a semantic prompt related to the desired word, in the form of a definition, e.g.

I enjoy going to the concerts. (auditory stimulus)

A group of people playing music professionally is called a _____. (**band**)

In this case also, the visual component enhanced the possibility of eliciting the preferred lexical item. This slightly modified format, however, was not a confounding factor in the study because both L2Ls and agrammatic aphasics were not only able to provide the target words but also performed at ceiling (see the results section). The design aimed to provide the participants with all target items in order to minimize the word-finding problems. All that remained to be produced was an inflectional suffix. Unlike the L2 learners, participants with agrammatism were asked to read the sentence silently and only produce the target word. Those who insisted on reading the sentences aloud were permitted to.

Stimuli were counterbalanced and presented on paper in random order. Half of the participants had the stimuli presented to them in ABCD order while the other half was exposed to a BDAC arrangement. All context sentences were pre-recorded by a native speaker of standard American English. Each stimulus was recorded individually onto a digital tape in a sound-proofed booth by a female native speaker of American English. Next, the digitized stimuli were converted into sound files for manipulation using Sound

Forge software. The responses were audio-taped by highly professional and sensitive equipment (Edirol) and later transcribed by an experimenter and an independent rater who was a native speaker of English. Also, to assure both accuracy and reliability, participants' answers were noted on-line by the experimenter. Participants listened to the stimuli without headphones at a comfortable volume and pace that they could control and responded orally.

Members of both groups, L2 learners and agrammatic aphasics, produced multiple attempts and self-corrections respectively. Under these circumstances false starts were edited out and the final responses, which were often incorrect, were accepted and scored. A phonemic prompt (usually in a form of an initial segment) was given in cases when the participant did not respond at all. In cases when participants were not satisfied with their responses, they tended to revise them until they indicated satisfaction with the form they produced. In the agrammatic group, participants either dropped their intonation to indicate that they arrived at their target form or motioned to the experimenter to indicate that they had produced their final response. The scores were limited to correct-incorrect. Percentage of correct answers was calculated for each participant and compared for all categories (independent variables). No-response items, rare in the present study, were not included in the analysis. We followed the rationale presented in Meth (1998) that "including (false starts) would have resulted in inaccurate percentages correct since there would have been an exaggeration in the number of errors made by each subject" (p.36).

Since the present study attempts to separate out the effects of phonology and morphology, and tries to assess their individual contributions, the focus was on regular inflection. In English, regular inflection is of a greater phonological complexity than

irregular forms. As has been previously emphasized, regular affixation involves the addition of a suffix to the verb stem in the form of a separate phoneme. Consequently, regular verbs place greater demands on the phonological system. Irregular forms were excluded from the present study due to their phonological dissimilarity between infinitives and their irregular past tense counterparts (Tyler et al., 2002). Finally, in order to eliminate the morpho-phonological overlap and tease apart both domains, the present study not only included homophones (e.g., *packed-pact*, *missed-mist*) but also controlled for the phonological environment of the final segment (e.g., *rose-blows*, *fox-locks*).

Chapter Six

Results

6.1. Michigan Proficiency Test

Regarding the proficiency issue in our study, the participants scored in the lower/higher intermediate range and were initially labeled Lower Proficiency and Higher Proficiency groups. However, we ran an independent- samples t-test and the difference between the two levels, higher and lower, was not significant on three factors: the overall total correct (p=.071), overall inflection present (p=.423) and overall inflection correct (p=.187). Therefore, in the current study the L2 groups will be analyzed as including one level of proficiency, an intermediate one.

6.2. Grammaticality Judgment

Table1 summarizes the results of grammaticality judgment. The assessment of correct sentences indicates that the groups access inflection from the morphological component at the accuracy rate of 90% for L2 learners and 85% for agrammatics. The overall evaluation of incorrect sentences reveals differences between the two groups, 81% for L2 learners versus 51% for agrammatics (p=.002). Overgeneralizations were assessed alike by second language learners (75%) and agrammatics (77%) (p=.823). Further, overall, both populations performed similarly on judgment of sentences including T (89% for L2 learners 80% for agrammatics, p=.093). As for the total correct number of sentences which contained AGR, although, as indicated by the means, L2 learners' performance was more successful (77%) than that of the agrammatics' (62%) the difference between the two groups only approached significance (p=.068). More specifically, the participants in both groups judged sentences including correct AGR

identically (92%, L2Ls versus 91% agrammatics, p=.932). Performance on sentences with incorrect AGR was the least successful of all categories for agrammatics (37%). In addition, there was a significant difference in the way the L2 learners (70%) and agrammatics (37%) judged incorrect agreement (p=.021). Finally, the evaluation of sentences with correct tense yielded no significant difference (p=.322) between the two experimental groups, 93% for the L2Ls and 86% for the agrammatics. The difference in the way the two groups treated incorrect tense (L2 learners, 83%, versus agrammatics, 51%) was comparable to the way the two groups assessed incorrect agreement.

Next, we turn to a comprehensive analysis of performance assessing both the accuracy rates and the error types. The Accuracy Analysis consisted of two sub-analyses: Inflection Present and Inflection Correct, presented respectively.

6.3. Two-Level Accuracy Analysis

Table 2 reviews all predictions. Mean values for the variables are presented in Table 3. A repeated-measures ANOVA yielded the following results.

6.3.1. Inflection Present Analysis

6.3.1.1. Morphological Predictions

6.3.1.1.1. L2 Learners

The results indicate that the participants performed significantly better on mono-morphemic (97%) than bi-morphemic (81%) homophones, $F(1,29) = 23.019$, $p<.001$. Further, there was a main effect of the morpheme type ($F(2,58) = 94.331$, $p<.001$). The pairwise comparisons were significant for PLU (80%) and POSS (18%), $p<.001$, as well as AGR (79%) and POSS ($p<.001$). However, the participants did not perform significantly differently on PLU and AGR (p=.794). Finally, the last morphological

prediction, stem status, was not confirmed as there was a significant difference in the affixation of existing (85%) and pseudo-verbs (69%), F(1,29)=8.072, p=.008).

6.3.1.1.2. Agrammatic Aphasics

Unlike in the other analysis, inflection correct, here the morpheme number condition approached significance (F(1,6) =5.588, p=.056) with 95% for mono- and 84% for bi-morphemic homophones. Thus, taking into consideration psychology's arbitrary .05 level for significance, the first morphological prediction was not confirmed. There was a main effect of the second morphological variable, morpheme type (F(2,12) =8.538, p=.005). The pairwise comparisons were significant for PLU (69%) and POSS (26%) (p=.032) as well as AGR (74%) and POSS (p=.007). No statistical difference was observed between PLU and AGR (p=.604). The last morphological prediction, stem status, yielded a significant difference (F(1,6) =10.989, p=.016) between pseudo- (54%) and existing verbs (83%) and, thus, was not confirmed.

6.3.1.2. Phonological Predictions

6.3.1.2.1. L2 Learners

There was a main effect of the syllable number condition (F(2,58) =9.065, p<.001). Within this condition, there was a significant difference between mono- (81%) and tri-syllabic (69%) verbs (p<.001) as well as between bi- (79%) and tri-syllabic verbs (p=.013). However, the performance on mono- and bi- syllabic verbs was not significantly different (p=.108). Moreover, although the difference in the production of syllabic (54%) and non-syllabic (81%) suffixes was significant (F(1,29) =44.946, p<.001), it was not in the predicted direction. Lastly, the sonority prediction was not confirmed. The difference between the two sonorous segments, vowels (66%) and

consonants (76%) was significant (F(1,29) =8.055, p=.008) but not in the hypothesized direction.

6.3.1.2.2. Agrammatic Aphasics

None of the phonological predictions was confirmed. First, a main effect was not observed of the syllable number (F(2,12) =1.301, p=.308). No sub-variable factor reached the conventional level of significance within this prediction, mono- (83%) vs. bi-syllabic (73%) (p=.192), mono- vs. tri-syllabic (74%) (p=.070) and bi- versus tri-syllabic (p=.919). In the suffix syllabicity condition, the p-value was a long way from reaching significance (F(1,6) =.264, p=.626) and there was no significant difference between syllabic (80%) and non-syllabic suffixes (83%). Lastly, contrary to prediction, the stems ending in the most sonorous segment, vowel (69%) and those ending in a consonant (73%) were not produced significantly differently (F(1,6)=.256, p=.631).

6.3.2. Inflection Correct Analysis

6.3.2.1. Morphological Predictions

6.3.2.1.1. L2 Learners

The production of mono-morphemic (97%) and bi-morphemic homophonous (73%) was significantly different (F(1,29) =36.674, p<.001). Moreover, there was a main effect of the morpheme type (F(2,58) =77.561, p<.001). The three homophonic suffixes in this condition were produced differently. There was a significant difference (p<.001) between PLU (78%) and POSS (18%) and also between AGR (76%) and POSS (p<.001). The difference between PLU and AGR was not significant (p=.721). As for the last morphological variable, stem status, the pattern of performance was similar to the one

observed in the previous analysis. Contrary to prediction, the difference between pseudo- (60%) and existing verbs (70%) was significant ($F(1,29)=6.877$, $p=.014$).

6.3.2.1.2. Agrammatic Aphasics

There was a significant difference between the production of mono-morphemic (95%) and bi-morphemic homophones (66%), ($F(1,6) = 26.189$, $p=.002$). Moreover, there was a main effect for the morpheme type ($F(2,12) =6.187$, $p=.014$). The pairwise comparison revealed a significant difference in performance on PLU (69%) and POSS (26%) ($p=.032$) as well as in the production of AGR (63%) and POSS, ($p=.007$). The only non-significant difference was between PLU and AGR ($p=.703$). Finally, the stem status condition was the only morphological prediction not confirmed as there was a significant difference between real (51%) and pseudo-verbs (35%) ($F(1,6) = 6.004$, $p<.050$).

6.3.2.2. Phonological Predictions

6.3.2.2.1. L2 Learners

There was a main effect of syllable number ($F(2,58) =10.504$, $p<.001$). The production of mono- (76%) and tri-syllabic verbs (61%) ($p<.001$) was significantly different as was the difference in performance on bi- (69%) and tri-syllabic verbs ($p=.012$). The difference in the production of mono- and bi-syllabic verbs approached significance in the direction of better performance on mono-syllabic verbs ($p=.086$). Moreover, the suffix syllabicity prediction, the second morphological variable, was not confirmed. Despite the fact that the difference between syllabic (43%) and non-syllabic suffixes (76%) was significant ($F(1,29) =59.730$, $p<.001$), it was not in the predicted direction. Finally, the two sonorous segments, vowels (57%) and consonants (69%), were

produced significantly differently (F(1,29)=11.652, p=.002). This last phonological prediction was not confirmed as the direction differed from the predicted one.

6.3.2.2.2. Agrammatic Aphasics

There was no main effect of syllable number (F(2,12) =.795, p=.474). No significant difference was found between mono- (61%) and bi-(57%) (p=.606), mono- and tri-syllabic (52%) (p=.075), and between bi- and tri-syllabic verbs (p=.602). Similarly, the suffix syllabicity condition was not confirmed. The difference in the production of syllabic suffix (56%) and non-syllabic suffix (61%) was not significant (F(1,6)=.526, p=.496). Finally, the sonority prediction was not confirmed as there was no significant difference in the production of stems ending in a vowel (45%) and those ending in a consonant (57%) (F(1,6) =5.453, p=.058). Although the difference approached significance, it was not in the predicted direction.

6.4. Error Analysis

Table 5 presents error category type by group. Each erroneous response was coded according to a manner in which segments or sequences of segments (clusters or syllables) have been manipulated: omitted, substituted or inserted. Following this division, we distinguished among four major error categories.

a) Omission- an omission of a segment or a sequence of segments (syllable or cluster), e.g., *cook* for “cooks”;
b) Substitution- a replacement of one consonantal segment for another, e.g., *cooks* for “cooked”;
c) Non-Inflectional (Segmental) Substitution- a vocalic or consonantal replacement occurring within a stem, e.g., *[blouts]* for “blows”;

d) Insertion- a vowel inclusion resulting in a syllabic suffix, e.g., *[beyket]* for "baked".

Owing to the controlled nature of the experimental task, there were no lexical selection errors involving stems.

Members of both groups omitted much more than substituted. However, the omission-substitution ratio for the agrammatics was different from the L2 group. Agrammatics omitted less often than the L2 learners, but they substituted to a greater extent than their non-impaired counterparts. Regarding the remaining error types, in the L2 group insertions dominated, followed by non-inflectional substitutions. This profile was different among the agrammatic aphasics where non-inflectional substitutions exceeded insertions.

The data reveal that errors can also be divided along a different dimension: place of occurrence/manipulation. In consequence, omissions, substitutions and insertions can be grouped together as they all affect suffix and are therefore labeled suffix-based, e.g., *cook* for "cooked". Segmental or non-inflectional substitutions influencing the stem are stem-based errors, e.g., *[ordet]* for "ordered" or *[kolets]* for "collects". Tables 6 and 7 present place-of-occurrence errors vs. successful use of inflection.

This error grouping indicates that of all the stem-based errors in the L2 group (N=159), 148 (93%) contained inflection, (of those affixed forms 129 (87%) were inflected correctly and 19 (13%) inflected with a mismatches suffix) while 11 (7%) lacked the inflectional suffix. On the other hand, the total number of the suffix-based errors was 1249. Of those errors 983 (79%) were not inflected while 266 (21%) included suffixes none of which was correct.

In the agrammatic group, the total number of suffix-based errors was 359. Sixty percent (N=214) of all suffix-based erroneous responses did not include any overt inflection while 40% (N=145) were suffixed. As in the L2 group, here also, none of the suffixes was correct. The overall number of the errors labeled as stem-based was 50. Of those erroneous responses 76% (N=38) were affixed (of those affixed 26(69%) included correct inflection while 12 (31%) were affixed incorrectly), 24% (N=12) had no overt inflection.

Chapter Seven

Discussion

7.1. Previous Theories and Their Relation to Current Approach and Data

Recall that, previously, we contrasted different explanations to the inconsistent use of inflection, some of which were morphological while others phonological. The L2 research, thus far, offers the following explanations for the inflectional variability in the interlanguage: mapping/access (Lardiere ,1998a, b, 2000; Ionin & Wexler, 2001, 2002; Prévost & White, 1999, 2000a, b; White, 2008), an L1-induced deficit of featural representations (Franceschina, 2001; Hawkins, 2000, 2003; Hawkins & Chan, 1997; Hawkins & Liszka, 2003), an L1-based problem with prosodic representations (Goad et al., 2003; Goad 2004), and transfer effects pertaining to the structure of codas (Lardiere1998a,b; 2002, 2003). To our knowledge, the literature provides no straightforward account of a second language learner whose L1 in fact: 1. contains grammatical representations of inflection and 2. allows similar morpho-phonological sequences as the L2. This is the case of the L1 speaker of Polish learning English. In the absence of studies examining populations whose L1 and L2 are similar, as well as without theories accounting for the problems such learners might face, we acknowledged the L1-based accounts available to us (e.g., PTH, FFFH, and CCRH).

The following dominate among the reasons for the inflectional deficit in impaired speakers: accessing (Kehayia, Caplan and Piggott, 1984; Kehayia, Jarema & Kądzielawa, 1990), processing (Thompson, Fix, and Gitelman, 2002), impaired rule implementation (Lee and Thompson, 2005), damaged lexical morphological representation (Miceli & Caramazza; 1988), lack of stress (Kean, 1977, 1979), syllabic length (Meth, 1998), affix

length (Centeno 1996), and receptive phonology (de Mornay Davies, Ludy, & Dronkers, 2006).

Earlier accounts often considered competence to explain the inflectional inconsistency. There, the locus of deficit was found at the level of syntactic representation. In the L2 research this view is represented by Hawkins (2000, 2003), Hawkins & Chan (1997), Hawkins & Liszka (2003) for whom syntactic features absent in the L1 are non-acquirable in the L2. In agrammatism also the inconsistent use of inflection is posited to entail damage to the syntactic structure (Grodzinsky, 2000). However, both Hawkins & et al.'s as well as Grodzinky's claims are compatible neither with our approach nor with our data. In the present study a different assumption was made regarding syntactic representations. As it has been mentioned previously, we did not test whether the source of the inflectional problem is representational because our L2 learners instantiate inflection in their L1. Moreover, we did not investigate missing phonological representations either because the L2Ls have complex codas in the L1. Instead, we focused on morphological and phonological constraints on the output because despite the aforementioned advantages (e.g., L1-instantiated T & AGR or complex codas in the native language) L2Ls of L1 Polish are known to struggle with English inflection in production (Johnston, 1997). We further assumed that mildly - moderately impaired agrammatic aphasics as native speakers of English would have both syntactic and phonological representations available to them.

Damage to a different kind of representation, phonological, is assumed under the Consonant Cluster Reduction Hypothesis, an L1-based account (Lardiere1998a, b; 2002, 2003). The central claim made by Lardiere, that English inflection is omitted because it

creates challenging clusters in word final position, is not compatible with our approach and data. After all, the L2 learners of L1 Polish are accustomed to having complex codas similar to the ones created by English inflection, e.g., *trakt*, *koszt*, *keks*, *gwarant*. Lardiere's approach would be in line with our data only if one speculated the existence of a markedness requirement specifying that word-final consonant clusters will be difficult in the L2A even though they existed in the L1. The assumption that even learners with strong phonological predisposition have to re-build complex codas for the L2, although theoretically plausible, seems highly unlikely. (The unlikelihood of such explanation is further supported by the fact that clusteral omissions coincided with the inflectional function assigned to them as illustrated in the *Morpheme Number* condition)

Both our data and approach are best explained in terms of the Missing Surface Inflection Hypothesis (Prévost & White, 1999, 2000a, b; White, 2008) where an L2 learner has to calibrate the particular lexical instantiation of the syntactic feature in the lexicon and connect it to the corresponding syntactic node. It is at the lexical level or more specifically at the interface between the lexicon and the syntax where the vulnerability arises. The L2 learner needs to associate feature with morpheme and figure out the details of the target inflectional system e.g., the fact that in English the third person singular spells out as *-s* while the regular past tense surfaces as *-ed*.

Similar assumptions are postulated in the aphasia research (e.g., processing - Thompson, Fix, & Gitelman, 2002 or impaired rule implementation- Lee & Thompson, 2005). The general point here is that in the system of an impaired native speaker the features are present and fully specified, but the problem occurs at a later time in the derivation. The vulnerability involves the morphological instantiation of syntactic

features at a post-syntactic level and takes the form of either the late insertion rule or processing.

In sum, our data are at odds with the theories that deny any syntactic access. The accounts that clearly line up with both our approach and results relegate the difficulty with English inflection to the interface between syntax and lexicon at the level of spell-out.

In addition, we recognized two potential explanations for variability in the use of inflection: morphological and phonological. Each set of predictions included three different constraints to be tested. In the morphological set, we investigated: morpheme number, morpheme type, and stem status. Phonological constraints contained: syllable number, suffix syllabicity, and sonority type. Before we turn to the discussion on how the inflectional difficulty manifests itself in oral production and which constraints emerged as decisive in the present study, we will first address the representational aspect of inflection as established through the grammaticality judgment task.

7.2. Do Our Participants Know that English Verbs Have to Be Inflected?

Non-production (judgment) data were obtained via a grammaticality judgment task which, by definition, minimizes production cost and generally demonstrates whether functional categories are present in the mental representations. Here, it served as a criterion for the underlying knowledge of inflection.

Overall, L2 learners' assessment of both correct and incorrect sentences was more successful than that of the agrammatic participants'. The grammaticality judgment task demonstrated that even learners at the intermediate level of L2 proficiency are able to detect the correct use of inflectional morphemes. High accuracy in the correct sentence

assessment alone (e.g., correct sentence overall, correct T, correct AGR) indicated the underlying presence of the inflection and full specification of functional categories (White, 2008). In order to judge our participants' knowledge of English it was necessary to examine not only what they included but also what they excluded from their grammar (Mackey & Gass, 2005). For that reason they were also asked to evaluate the incorrect sentences.

First, we need to acknowledge a subtle difference, $F(1,29)= 4.389$, $p=.074$, in the learners' overall evaluation of correct (90%) and incorrect sentences (81%). This ratio is more revealing when contrasted with the pattern observed in the agrammatic group: 85% of accuracy for correct and 51% for incorrect sentences ($F(1,6) = 4.688$, $p=. 045$). More thorough analysis reveals a significant difference between correct and incorrect sentences including AGR (L2Ls $F(1,29)= 14.480$, $p=.001$; agrammatics $F(1,6)= 13.207$, $p=.011$) and correct versus incorrect sentences containing T (L2Ls $F(1,29)=4.065$, $p=.050$; agrammatics $F(1,6)=5.760$; $p=.046$). All incorrect sentences in the grammaticality judgment task contained forms with no overt suffixes (e.g., *She always go to school by bus.* (AGR) or *They wash their car yesterday.* (T)) and this fact did, on occasion, seem to interfere with the evaluation of the sentence type in question, more so in the agrammatic group. Considering the aforementioned facts, one can state that in both groups incorrect sentences were assessed less accurately than the correct ones. We will address this point next.

The big picture reveals that, akin to the L2 group, the assessment of correct sentences by agrammatic participants was quite accurate. However, unlike the other group, in agrammatics the evaluation of incorrect sentences was at chance and, in one

case, below (e.g., sentences with incorrect AGR). This fact, however, does not entail the loss of mental representations for the two functional categories in question. Anecdotal evidence confirms that the underlying knowledge of inflection is indeed present in agrammatic aphasia. Recall that the task required all the sentences to be read silently. Despite this fact, two participants, BK and HM, insisted on reading them out loud. While doing so, whenever they encountered an incorrect sentence they read the target verb devoid of any morphemes as if it were inflected. They continued reading such sentences often three or four times until they finally reached a decision, whether correct or incorrect. This fact prompts us to argue three points, that: 1. the problem observed here is that of the reading mode, 2. the suppliance of the missing inflection while reading the incorrect sentences would not have been feasible had the knowledge of the abstract features been absent, and 3. the grammatical judgment might not be an adequate measure of the knowledge of inflection.

Furthermore, the participants were not only asked to judge the sentences but also to correct those forms which they assessed as incorrect. AM, another member of the agrammatic group, was able to detect the erroneous forms swiftly, however, he usually provided the incorrect inflection. Although he did not access the appropriate suffix, he nevertheless had the general knowledge that the verbs needed to be inflected. In order to affix the verb, AM must have had the linguistic knowledge of inflectional rules in his underlying system. This does not, however, mean that every sentence or utterance "bears witness of this knowledge" (Platzack, 2008). For all three participants, BK, HM, and AM the knowledge that verbs in English are inflected is not lost. In addition, in the case of BK and HM the features are present and specified.

Also, L2Ls evaluated overgeneralizations, or forms including extra-presence of the past tense rule, e.g., *goed, taked,* (75%) less accurately than correct forms (90%), $F(1,29) = 10.348$, $p = .003$, but not significantly differently from the incorrect sentences where the inflection was omitted (81%) ($F(1,29) = 2.113$, $p = .157$). This was not the case in the other experimental group where there was no significant difference in the assessment of overgeneralizations (77%) and correct sentences (85%), $F(1,6) = .624$, $p = .460$. However, overgeneralizations were evaluated more successfully than incorrect sentences (51%) ($F(1,6) = 7.097$, $p = .037$). The order of judgment accuracy obtained in both groups is as follows: the L2Ls were equally accurate in their assessment of the absence of inflection and the presence of the regular *-ed* while the agrammatics were better at detecting the erroneous presence than the absence. The between-group analysis demonstrated no significant difference in the way both groups evaluated overgeneralizations. We argue that participants' performance on sentences involving overgeneralizations does imply inflectional accessibility.

Accepting overgeneralizations might indicate the access of the past tense (T) feature and an over-productive implementation of the regular rule. On the other hand, it might be taken as evidence for incomplete and on-going acquisition of idiosyncratic forms. Overuse of the regular rule situates the L2Ls along the developmental continuum of the irregular verb acquisition. Regularized forms constitute an intermediate stage between sporadic use of the irregular verbs (treated as lexical items not necessarily conveying the past tense meaning) and consistent and steady use of irregular verbs. It is evident that the participants have the past tense rule in their system but are not yet certain about the lexical items to which the rule applies. Agrammatic aphasics, the native

speakers, also struggle with "attaching" the past tense suffix exclusively to regular verbs. They do so, however, more consistently than the non-native speakers.

Our data suggest that the grammaticality judgment as a task did not seem to pose a challenge to either of the two groups. High accuracy in the assessment of the correct sentences as well as good performance on the fillers (which included erroneous word order) supported the view that the nature of the task was not problematic for either of the two experimental groups. It is not the task itself what members of both groups found difficult but rather what they needed to notice and assess in it. What they had to detect and evaluate was in the form of two morphemes, -ed or -s. Inflection constitutes a small orthographic unit and as such might not be easily detected.

Overall, similar patterns of assessment were observed in L2Ls and agrammatics. Members of both groups evaluated correct sentences more successfully than the incorrect ones across the board (e.g., overall correct vs. overall incorrect, correct AGR vs. incorrect AGR, correct T vs. incorrect T). The difference, however, between accurately assessed correct sentences and incorrect ones was greater in the agrammatic group.

Several conclusions can be drawn from these judgment data. First, adult L2 learners, guided by L1, UG or the L2 input, performed better than impaired native-speakers. Monolingual impaired native speakers are not guided to the same extent by their L1. In this case, the L1 is the only linguistic system they have at their disposal and its navigation is damaged. Second, the overall results suggest underlying manifestations of English inflection. Both groups have the syntactic structure and, in many cases, apply the appropriate rule (this is in accord with Ionin & Wexler, 2002 for L2Ls, and Lee & Thompson, 2005; Mimouni, Kehayia & Jarema, 1998 for agrammatics). In addition, in

the Accuracy Analysis (see *Results*) the means are always higher under Inflection Present than Inflection Correct analysis in both groups. This fact suggests the discrepancy between the underlying presence of the features and their surface realization. Third, both the L2 learners and the agrammatic aphasics tended to accept incorrect sentences in which inflection was omitted. The appropriate assessment of incorrect sentences was markedly lower than the analogous evaluation of correct sentences. In other words, both "non-fluent" agrammatic aphasics and non-fluent adult L2 learners demonstrated the same general problem; they were worse at detecting something that was missing. Previous research has shown that detection of the absence of something is cognitively more challenging than the recognition of its presence (Miller, Leonard, and Finneran, 2008). If this is so, then we could infer that in grammaticality judgment, extra-linguistic factors, e.g., cognitive factors, rather than lack of the mental representations influenced the participants' performance and interacted with the language domain.

7.3. Phonology and Its Lesser Role in the Current Study

In both experimental groups phonology, as defined in the present study, played a minor role in the non-target production of inflection as compared to morphology. Two of the three phonological predictions were not confirmed in the non-native group. The patterns were consistent under both analysis types, Inflection Present and Inflection Correct. Only slightly different profiles were observed in the agrammatic group where none of the phonological conditions was confirmed and both analyses yielded identical results. First, we present what the two populations have in common regarding the phonological constraints.

The first prediction, that a syllabic suffix will be produced more successfully than its non-syllabic counterparts, was not confirmed in either group. Even though this prediction was not borne out in either group, each group approached suffix syllabicity in a different way. Against our prediction, L2 learners performed better on the non-syllabic suffixes while agrammatic aphasics treated both suffix types equally.

In the L2 group, consonant cluster split, as offered in a syllabic suffix, did not result in a more successful production of inflection. Quite the opposite, consonant clusters present in the non-syllabic suffixes did not alter the affixation. Unexpectedly, syllabic suffix did. We attempted to reduce transfer effects by including an L1 that permits complex codas and indeed we gained the L1 benefits. The results, indirectly, support Lardiere's argument (2002) for L1 constraint against consonant clusters in codas. Following this line of reasoning, one can state that lack of the L1 constraint should result in target-like production. After all, in the absence of the L1-related obstacles, the production of the #CCs should proceed smoothly. And that is what we have observed in the case of non-syllabic suffix in the L2 group.

Why does the syllabic suffix impair the inflectional affixation? One possible explanation is offered by the fact that even though it split the consonant cluster (by virtue of having a vowel), the syllabic suffix added one more syllable and, thus, increased length. The following parts of the discussion will show that length (syllabic length that is) was a significant variable in the other condition, syllable number, discussed below. Also, Young (1991) observed that the plural /-s/ was the least likely to be produced by L1 Chinese speakers when preceded by a sibilant or a lateral. How does it relate to the current study? Sibilants, as final stem segments, are the triggers of syllabic suffixes. The

sibilant preceding the plural /-s/ would require epenthesis which results in syllabic suffix e. g., *races* [rejs-z]. Once again, addition of a syllable via epenthesis (as in syllabic suffix) is more problematic in production than the lack of syllabic increase (as in its non-syllabic equivalents). Added syllabicity makes production of inflection more challenging regardless of the L1, Chinese (Young) or Polish (the present study).

Problems with syllabic suffixes in oral production may also be L1- related (personal communication with Elaine Klein). English syllabic suffixes not only require epenthesis, but also entail voicing of the consonant. In Polish, on the other hand, voiced consonants occurring word-finally are subject to de-voicing. We speculate that the L2 learners of L1 Polish may experience more difficulties with syllabic suffixes because of the voiced consonants they include. By nature, voicing involves more effort. Instead of expending the effort the L2 learners omit syllabic suffixes altogether. Lastly, syllabic suffix is shown to be challenging for yet another L2 group. Rohde (2002) noted that none of the four German-speaking children learning English ever used the syllabic allomorph of the past tense. This, in the author's view, suggests late emergence of [-id] in production in L2 child acquisition.

Further, the results do not contradict the predictions made by the Perceptual Saliency Hypothesis (Klein et al., 2003; Solt et al., 2004). Under this view, both perception and production of syllabic suffix will be better than that of the non-syllabic suffix owing to the saliency of the former. Two tasks were employed to test this prediction. In the perception task, the participants were asked to decide whether the verbs they had heard were the same or different. They did so by checking the appropriate box. In the perception/production task the focus was on writing verbs that were auditorily

presented in a story read by a native speaker. More specifically this time the participants were asked to write down the verb they had heard. In both experiments the L2 learners of different L1s did not perceive the regular past tense in a native-like way. In the perception task the learners perceived syllabic suffixes better than the non-syllabic ones. This profile of performance was observed across different L1s (Chinese, Russian, and Spanish). In addition, Russian speakers whose L1 permits clustered codas performed slightly better than both Spanish and Chinese speakers. Further, the perception/production task displayed both the proficiency as well as the L1 differences. In contrast to the high proficiency learners (91% correct), low proficiency participants performed at chance (53%). This time also, Russian speakers outperformed their Chinese and Spanish counterparts.

Klein et al. showed that the L2 learners are able to hear/perceive syllabic suffix and write/produce it, though we argue that this perception/production task was very different from the actual use of inflection during speech. Low performance on syllabic suffixes in the present study indicates that the syllabicity is a constraint on oral production rather than perception. The two studies, therefore, are not in contradiction but describe different aspects (perceptive vs. productive) of the same phenomenon (syllabic suffix). Taking into consideration all aforementioned facts we conclude that saliency, at least in oral production, does not appear to aid L2Ls in their performance on verbal inflection.

Although the prediction was not confirmed in the agrammatics, the participants in this group treated both syllabic and non-syllabic suffixes equally. Considering the Inflection Present analysis (80% correct for syllabic and 83% for non-syllabic suffix),

agrammatic production is reminiscent of that of the controls' (native speakers in the control group performed at ceiling). Not surprisingly, agrammatics are native speakers who, unlike the L2 learners, not only know the lexical items, but also have (or used to have) a better command of inflection. The lack of significant difference between two suffix types is further supported in the Inflection Correct analysis. This time, the means (56 % correct for syllabic and 61% for non-syllabic) suggest that selection of the appropriate inflection, regardless of the suffix type, is problematic for this group. Clearly, syllabic suffixes did not contribute to a more correct production of inflection.

In agrammatism, different phonological realizations of the past tense morpheme were tested by Bird et al. (2003). Two of the three tasks used in this study, sentence completion and reading, showed no suffix effect on affixation. The syllabic suffix was produced more correctly than its non-syllabic counterparts only in the repetition. In the authors' view, the outcome implies that better repetition of the phonologically more salient suffix "might be largely receptive in origin" (p.513). We can draw a parallel between the productive (oral) nature of the present study vs. perceptive tasks used by Klein et al. on one hand and productive (sentence completion, reading) vs. receptive (repetition) methods in Bird et al. on the other. Two different groups, language acquirers and language "attriters", exhibit an analogous pattern: syllabicity inhibits the oral production of inflection but facilitates its perception.

In sum, in the L2 group the mean numbers indicated that contrary to prediction, syllabic suffix was consistently produced less correctly. In the agrammatic group, the mean numbers revealed that participants treated both suffix types equally, again going against the prediction. Therefore, the clustered codas (#CC) of non-syllabic suffixes were

never produced less successfully than the VC sequence occurring word finally, as in the syllabic suffix. Second, the saliency associated with the syllabic suffix did not assist the participants in a better production of inflection. Following White (2008), we acknowledge a possible phonological/phonetic explanation of the fact that syllabic suffix was more challenging in oral production. White points out that there is a tendency to think of English inflectional morphology as non-salient. Against such claims, Ladefoged (2001) demonstrated that the non-syllabic allomorphs of agreement and plural, [-*s*] and [-*z*], "have greater energy at higher frequencies in the acoustic signal suggesting that they are in fact salient" (White 2008, p.303; White & Goad, 2004b). In consequence, non-syllabic suffixes might not be as non-salient as initially thought.

As a final point, we would like to mention that the controlled nature of the task in the present experiment might have eased the production of inflection, even the non-syllabic one. Ellis and Larsen-Freeman (2006) observed that the /t/ and /d/ allomorphs form "phonologically challenging consonant clusters" which tend to be omitted especially when the next word begins with yet another consonant. This, however, was not the case in our task where the lexical items following the target forms always began with a vowel. We argue that this small aspect in the task design also could have contributed to participants' more successful performance on the non-syllabic suffixes.

The next phonological constraint, the sonority type condition, yielded identical patterns of performance in both experimental groups. In order to test this prediction members of the two extreme ends of the sonority spectrum were selected, vowels opposite to stops and fricatives. Stems ending in a consonant and, thus, creating a cluster when suffixed, were produced more accurately than verbs ending in a vowel. Once

again, consonant clusters were easier in production. The data demonstrate that the sonority hierarchy did not predict error rate. L2 learners and agrammatics did not err more because of decreased sonority of certain segments. The outcome of this prediction is consistent with the results of the previous condition (suffix syllabicity). The sonority of the sequence, including final consonant of a stem and suffix, was not a significant variable nor was the syllabic suffix (being more sonorous than its non-syllabic counterpart) a confounding factor. We conclude that vowels in coda position as well as syllabic suffixes interfered with verb inflection in the present study.

Group differences emerged in the last phonological condition, syllable number. In the L2 group this prediction was confirmed under both analysis types, whereas in the agrammatic group the prediction was not borne out under either Inflection Present or Inflection Correct. However, we need to emphasize that although both groups behaved differently on sub-variables (there was a main effect of syllable number in the L2 group, $p<.001$, but not in the agrammatic group, $p=.474$) under the between-group analysis they seem not to differ ($p=.856$, Inflection Present and $p=.170$, Inflection Correct). In the L2 group, the increasing stem length inhibited the successful production of the inflectional forms. There was a significant difference between affixation of mono- and tri-syllabic verbs as well as bi- and tri-syllabic ones. No significant difference was found between affixation of mono- and bi-syllabic verbs. The findings show that once the verbs were longer than bi-syllabic, they significantly impaired inflectional process.

Why of the three phonological constraints tested in the present study was syllable number the only prediction confirmed in the L2 group? Why did the stem type interact with affixation? In order to address these questions we need to examine more closely all

three phonological predictions. In the first two constraints, suffix syllabicity and sonority type, the locus of variation is instantiated across boundaries where the stem combines with the suffix e.g., wa*shes* for syllabic suffix and stud*ies* for sonority type. The interacting material (the final segment and affix) is located in the adjacent segments and is, thus, restricted by a locality condition specifying the domain of the application of a rule: "phonological rules apply only between the elements which are next to each other on a given tier" (Crystal, 2003, p. 276).

In the remaining phonological prediction including stems of a different length, the locus of variation occurs somewhere within boundaries, within a stem e.g., **co**llect, **de**co**rate**. It is not immediately evident what, within a stem longer than one syllable, interacts with the inflection. We are not certain what constitutes a trigger, what the intervening material is, and whether the adjacent segments (e.g. the last segment of the multi-syllabic stem attached to a suffix) are indeed contributing factors in affixation. We, therefore, claim that the first two conditions are purely phonological while the third one, the syllable number, involving extra phonological factors such as processing, is more complex. The data in the current study reveal that true phonological, locality-based, conditions (e.g., suffix syllabicity, sonority type) affect both groups similarly. Whereas more complex conditions involving processing, e.g., syllable number, have a greater influence on non-native speakers.

This last phonological prediction was not borne out in the native group as the agrammatic aphasics inflected verbs with a comparable degree of accuracy (contra Meth, 1998). Under the Inflection Present analysis, the incidence of occurrence of inflection was higher than under Inflection Correct. The difference between the two analyses

clearly illustrates that the agrammatics have inflection in their grammar. It surfaces, however, either as a default form or as a mismatched suffix.

Let us first try to account for slightly different results between the present study and Meth (1998) where there was a significant contrast between mono- vs. bi- as well as mono- vs. tri-syllabic verbs. Since it is not apparent what within a multi-syllabic stem might have a direct impact on the occurrence of the suffix, it is plausible that the manner of elicitation interacts with the accuracy of affixation. Recall that in our experiment, before each testing session, participants were pre-trained on the set of lexical items used on a given day. Next, during the experiment they had the opportunity to hear the experimental words embedded in the auditory stimuli. Finally, the participants saw the illustration depicting the meaning of the word currently being tested. In other words, the target lexical items were articulated, heard and seen before they were produced. The neural network may have remembered them and they did not need to be activated again. It is highly probable that the lexical activation might have eased the access of the words and consequently facilitated the affixation. Once the words were easily available the participants could more freely concentrate on their affixation.

Agrammatic aphasics are known for their limited capacity in verbal working memory (Caplan, 1987). When they are presented with the sentence completion task which makes "substantial demands", they might unconsciously opt for default forms because they are simpler and already available in the prompt (Bird et al., 2003). Regarding affixation, sentence completion in Meth's study was the most difficult of the three tasks as opposed to reading and repetition. Let us examine the task employed by Meth. In her experiment, for each token the stimuli were presented in a cohort of three,

one leading sentence followed by two testing sentences. The two target sentences included one eliciting the present and the other the past tense. Even if the participants were not required to read everything out loud, they, nevertheless, had to process everything in order to arrive at the target form. And what they were processing varied in its complexity e.g.:

a. It is nice to take a **pause**.

When she runs out of breath she _____.

The first time she _____.

b. When I saw the ghost I tried not to **scream**.

He scared me so that I _____.

Each time she sees a ghost she _____.

In a. the prompt is in the present tense and it elicits both the target forms in the present and in the past while in b. the prompt is in the past and it models for the present as well as the past tense. The prompts are neither consistent in the tense they elicit nor in the structure which varies from simple to complex sentences. We suggest that one cannot exclude the possibility that in the sentence completion task the phonological shape of a stem interacted with the decreased resources available for the lexical processing.

In conclusion, the results clearly show that phonological factors are not decisive in the correct use of inflection. In the L2 group, two of the three predictions were not confirmed. Phonology is shown to play an even lesser role in the agrammatic group where none of the phonological predictions was borne out.

7.4. Morphological Nature of the Inconsistent Production of Inflection

Morphological conditions had much greater weight on the production of inflection. In the two groups both levels of analysis yielded nearly identical patterns of production (with the exception of the morpheme number prediction approaching significance under Inflection Present analysis in the agrammatic group); the first two morphological predictions (morpheme number and morpheme type) were confirmed, while the third one (morpheme status) was not.

Morphological complexity or morphological shape in the form of a stem and a suffix (as in bi-morphemic words e.g., *packed*) was more difficult than its homophonous mono-morphemic counterpart consisting solely of a stem (e.g., *pact*). As illustrated above, both mono- and bi-morphemic lexical items included here shared indistinguishable phonological structure. In both, word-final consonant clusters were phonologically identical but morphologically very different. The final segment of complex codas in bi-morphemic words had a morphological function which influenced the on-line production of inflection.

Our data are in clear contrast to Abrahamsson's (2003) "recoverability principle" according to which the inflectional function of a segment guarantees its retention. In his study, the Chinese-Swedish speakers omitted various segments in coda clusters but always preserved the plural segment. In a different study involving L1 Chinese and the production of English consonant clusters, Eckman (1987) observed that Cantonese speakers did simplify the complex coda but preserved the /s/ segment which often indicated plural. Our findings go against the functional approach because the

morphological complexity of the bi-morphemic forms increased difficulty of production and invited default forms.

Next, the outcome of the present study does not correspond to the results obtained by Lardiere (2002). First, Lardiere points to the L1 restriction as a source of the simplified codas. She reported that in her longitudinal case study, Patty omitted final consonant clusters in both mono-morphemic and inflected verbs. Lardiere attributed Patty's failure to produce overt tense to properties of her native language phonology. Naturally, the L1 cannot be held responsible for the patterns observed in the present study because consonant clusters in word final positions are permissible in Polish. Second, our participants simplified consonant clusters in morphologically complex but not in morphologically simple words. Unlike in Lardiere's study, the performance on codas in mono-morphemic words was at ceiling in the current study. Lastly, even though the L2 learners have developed a sequence of complex codas (#CC) in their L1 they often resorted to the unmarked syllable structure in the L2 e.g., #C.

The findings of the studies presented thus far are to be contrasted with Hawkins and Liszka's (2003) research examining the acquisition of the past tense. The L2 speakers' inability to mark verbs for T is, in the authors' view, strongly influenced by the absence of a [+/-] past tense feature in the speakers' L1 (Mandarin). In support of this claim, the study reports that Chinese speakers are more likely to omit /t/ and /d/ in inflected forms (37%) rather than in mono-morphemic words ending in clusters (18%). This result eliminates phonological involvement in the reduction of codas. Like the Chinese speakers in Hawkins and Liszka's study, our participants were more correct on mono-morphemic words. Unlike their experimental group, the L1 speakers of Polish not

only instantiate the inflection in their L1, but also have the L2 inflectional features present in mental representations, as shown by the grammaticality judgment task. We, therefore, conclude that the inflectional problem in our study is neither L1 induced nor phonological in nature and as such is best explained in terms of morphological complexity constraining the inflectional production.

In the agrammatic group, morpheme number prediction was confirmed under Inflection Correct. In the Inflection Present analysis, the difference between the successful production of the mono- and bi-morphemic words approached significance. The outcome of these analyses suggests, yet again, that in most cases the inflection was accessed but did not always surface as correct. The results are inconsistent with those obtained by Meth (1998). Although Meth did not concentrate on a mono- vs. bi-morphemic distinction, she reported on complex codas as significantly more difficult than simple codas and constraining the production of inflection. It is evident from our study that not all CCs are created equal. Those with inflectional functions assigned to them are particularly susceptible to omissions which fact underscores morphological nature of the inflectional deficit.

Morphological involvement in an inconsistent use of inflection is further strengthened by the morpheme type prediction stating that if morphology contributes to the inflectional inconsistency, the participants would use PLU, AGR, and POSS morphemes differently. In the second condition we included the hierarchy proposed by so-called morphemes studies, e.g., PLU>POSS>AGR. The hierarchy is only a description of what was observed in the previous research (for review see, Zobl and Liceras, 1994). In the current study, in order to detect morphological influence on the use

of inflection, we do not expect to see such strict sequence but rather any differences in the production of the three morphemes. Indeed, these three homophonous morphemes were produced with a different degree of success. Both analyses yielded the same pattern: of the three, POSS was by far the most challenging while the performance on PLU and AGR was comparable (contra Ionin & Wexler, 2001, who reported on significant difference in suppliance of PLU and AGR).

Ionin and Wexler investigated early stages of L2 acquisition in a group of Russian children learning English. The reported rates of omissions were 78% for AGR and 11% for PLU (which translates into 22% of accuracy for AGR and 89% for PLU). Previously, Zobl and Liceras (1994) proposed that morphemes emerge in a sequenced fashion. Under this view PLU is said to be acquired prior to AGR (and POSS). Ionin and Wexler's findings provide evidence for the ordered emergence of morphemes and pertain to the early stages of L2 acquisition. The lack of significant difference between PLU and AGR under both analysis types in our study may be related to the proficiency level of our participants and may indicate that the learners approached the end-state in the acquisition of PLU and AGR which appear to develop faster than POSS. The proposed sequence of morpheme emergence assumes early stages in L2 development and consequently significant differences in the acquisition between the three morphemes. We speculate that the more proficient the learners, the less significant the differences between the two morphemes, PLU and AGR. That is precisely the pattern observed in the present study. As a result, the difference between morphemes decreases as the acquisition proceeds.

Similar production of PLU and AGR would be expected under MSIH which stipulates that processing pressure would equally affect the production of various

inflectional morphemes. This remark is not consistent with a high variability in the production of all three homophonous morphemes detected here, PLU, AGR, and POSS. Our results only partially support the MSIH where all features cause the same degree of difficulty. Equal distribution of PLU and AGR is in line with White's (2008) formulation of the Missing Surface Inflection Hypothesis under which "there appears to be no principled reason why certain features should be harder to map or access than others." (p. 320).

The L2 results were replicated in the agrammatic group. Three phonologically indistinguishable morphemes attached either to homophones (e.g., *marks, marks, Mark's*) or partial homophones (e.g., *cuts, cats, Kate's*) were produced differently. The morpheme type prediction was confirmed under both types of the accuracy analysis. Like their healthy counterparts, agrammatic aphasics were equally accurate in the production of PLU and AGR but performed markedly lower on POSS. Knowing how the morphemes emerge in the L2, we state, following Goodglass (1973), that there is a universal hierarchy of grammatical morphemes which specifies the degree of difficulty agrammatics experience with these forms. The degree of difficulty experienced by impaired participants is undoubtedly connected to the severity of their impairment. Caplan (1987) writes: "the patient who produces largely correct verbal inflections in English is obviously only mildly agrammatics (…)" (p.285). Indeed, our participants were mildly to moderately impaired and this fact might be reflected in their ability to produce those morphemes which are "easier".

The issue of difficulty among the three morphemes brings us to POSS which was produced the least correctly and significantly differently from both its morphological

counterparts, PLU and AGR. Here, the interaction between word structure and the phonological shape clearly emphasizes the involvement of a morphological rule as a causing factor. Why, we ask, did the phonologically identical suffixes embedded in homophonous or semi-homophonous environments produce different results?

Research on aphasia thus far offers no satisfactory explanation. Under the regression hypothesis, POSS is prone to omission because it is acquired late (Jakobson, 1960). In her seminal paper, Kean (1979) turned to the structuralist approach to account for POSS's distinctiveness. In her view, aphasics show a preference for simple, base-generated, morpho-syntactic constructions such as PLU, T (and AGR). POSS is susceptible to omissions because it is in its entirety "predicted from the structure of the sentence".

In contrast, in Thompson et al.'s case study (2002) POSS was, along with the progressive morpheme, the best preserved and produced with the highest degree of success. The authors claim that what distinguishes POSS from PLU or AGR in English is its lack of a zero morpheme alternative. Consequently, their aphasic participant did not opt for a default POSS because it is not available. Thompson et al.'s conclusion is in opposition to Bernstein & Tortora, (2004) who examine the parallels between AGR and POSS and point that both have comparable paradigms including zero morphemes. Under this current syntactic framework, POSS is considered an inflectional head similar to the 3rd person singular *-s*. Like AGR, POSS (or the full DP final *-s*) has a symmetric singular-plural (*ø* plural, that is) distribution: *she eats* vs. *they eat* for AGR and *the kid's mother* vs. *the kids' mother*. Initially in the derivation, plural possessives are plural DPs (*the kids*) which are affixed with a zero plural possessive marker (*the kids' mother*). This

analysis allows for the parallels between overt and zero morphemes in the nominal and verbal domains and provides counterevidence for Thompson et al.'s explanation of the POSS suffix production.

Further, in Thompson et al.'s study productive data were gathered via narratives and written samples. It is reported that POSS was correctly produced in 17 of the 18 instances; this included both spoken narratives as well as written samples. The authors do not specify how many occurrences of the possessive morpheme were actually produced orally. For that reason we are unable to make any direct comparisons. Second, POSS is exemplified and possibly expressed in only one form; in all three examples illustrating the correct use of POSS, there was the same affixed noun e.g., *Cinderella' s house* (x2), *Cinderella's mother*. It invites the interpretation that what seems to be supplied correctly is the possessive form of the NP *Cinderella* rather than the possessive morpheme itself. Finally, the following question still remains to be addressed: Considering both populations, what is it about POSS that makes its production so different from the other homophonous morphemes?

A different syntactic approach undertakes a careful examination of the English Saxon Genitive (den Dikken, 1995, 1999, 2000). Here the argument oscillates around the following claim. Suppose that we aim to arrive at the following phrase: *John's mother*. On den Dikken's account, in the underlying structure of the English possessive construction, the first component, *the possessum* (*mother*), is the subject of the dative predicate containing the *possessor* (*John*). In the course of the derivation the inversion occurs. Consequently, the dative prepositional phrase inverts with its subject. As a by-product of inversion a *linker* is introduced. Although semantically empty, the linker

specifies the syntactic relations between the two nouns in the derivation. If it were not for the linker we would have a random sequence of two unrelated nouns, *John mother*. Next, in the spell-out this linker transforms into *'s*, the genitival possessive marker. The presented derivation is complex. What makes it complex are two concurrent mechanisms: the inversion and raising to the predicate (e.g., raising of the relator up to the linker). We speculate that the complexity of the POSS computation as well as the rarity of its derivation could translate into a higher degree of variability in the use of POSS in L2 acquisition and L1 attrition observed in the present study. In particular, inversion as a syntactic mechanism might make production of POSS more difficult than production of morphemes whose affixation is devoid of inversion, as in the case of PLU and AGR.

7.4.1. Are the Pseudo-Verbs a Morphological or Lexical Problem?

Against the third morphological prediction, morpheme status, both groups inflected the pseudo-verbs significantly worse than the real ones. At this point, we would like to emphasize that this last morphological prediction is qualitatively different from the previous two. While morpheme number and morpheme type conditions depicted specific instances of morphological rules, morpheme status illustrated the mechanism behind a morphological rule implementation. As a result, the nature of this condition also suggests a non-morphological interpretation. Even though, as shown in the grammaticality judgment task, the features (T and AGR) are represented in the grammar of the L2 learners as well as agrammatics, something constraints the consistent application of the rules and consequently affects the output.

In the agrammatic group, Inflection Present and Inflection Correct analyses yielded a significant difference between successful inflection of the existing verbs and the

pseudo-verbs. This is rather typical of agrammatic aphasics in general. Miceli et al. (2004), in a very thorough error analysis, demonstrated that all participants were less accurate on pseudo-words that on existing words. Non-fluent aphasics are known for their limited capacity of working memory (Caplan, 1987; Caspari, Parkinson, LaPointe, & Katz, 1998; Friedmann & Gvion, 2003). If this restricted ability of working memory coincides with lexical morphological complexity it may lead to unconscious resorting to either default forms or mis-selection of suffixes.

Also, in this condition, we hypothesized that everything else being constant (e.g., phonological shape of the verbs, identical prompt as well as the same morphological rule inflecting both verb types) no significant differences should be expected. However, pseudo-verbs, although created as close as possible to their real verb counterparts, (e.g., *roop* vs. *rake*), are new lexemes and as such are susceptible to a search cost. Search cost emerging under both analysis types might have influenced the affixation of the pseudo-verbs. In other words, the adult L2Ls and agrammatics paid the cost for the processing of unfamiliar lexical items. Scanning the lexicon and not finding the item is costly. Therefore, we propose that the processing of new items inhibited the application of inflectional rules and lowered the performance. Here the lexical processing rather than the morpho-syntax more adequately explains the performance patterns.

What are the factors that make building and re-building of the linguistic system difficult? When required to provide inflection, participants in linguistically challenging conditions, post-pubertal L2 acquisition and L1 attrition, were sensitive to morphological complexity. The accuracy analysis demonstrated that: 1. morphology is a much bigger contributor to the inflectional inconsistency than phonology and 2. members of both

groups struggle with on-line production of morphologically complex words. Our data, thus, provide support for the morphological nature of the inconsistent production of inflection.

Further, the findings are akin to the morphological processing problems (e.g., poor mapping) triggered by the morphological complexity. We agree with Libben (1990) that the morphological nature of the observed production patterns does not correspond to the lack of underlying morphological manifestations. Paraphrasing him, one could state that both groups did not lose morphology in production but rather lost the productive (on-line) ability to consistently use inflectional morphemes. Do these results mean that phonology is not a factor or that it is inactive with respect to inflection? We turn to the error analysis in order to address this question.

7.5. The Error Analysis or the Evidence for Phonological Assistance & Morphological Awareness

Even though in this controlled experiment the participants were not given the opportunity to make a wide range of possible responses, the repertoire of their errors is rather impressive. The errors made by the L2 learners reveal only a slight variation from the impaired speakers' non-target responses. Errors committed by both groups are easily divided according to a manner of segmental manipulation into: omissions, inflectional substitutions, non-inflectional (segmental) substitutions, and insertions. Omissions and inflectional substitutions were the most frequent. Of the two dominant error categories, omissions prevailed. All these error types have one characteristic in common; in all segments or sequences of segments (e.g., syllables or clusters) are variously manipulated: omitted, substituted or inserted.

A careful examination of the errors reveals that they can be divided along a different dimension, namely place of occurrence. Considering this error grouping, omissions, inflectional substitutions, and insertions influence the suffix and as such are suffix-based whereas segmental or non-inflectional substitutions occurring within a stem are stem-based errors. Unlike the suffix-based errors, where the inflection might be present but is never correct, 93% (L2Ls) and 79% (agrammatics) of the stem-based errors contained the inflection which was correctly produced 87% and 69% of the time, respectively. Responses characterized as stem-based errors demonstrate a very interesting adaptive technique, namely something within a stem (either a segment or a sequence of segments) needs to be simplified, reduced or substituted in order to preserve the inflection. Even though correct inflection is produced at the expense of the stem, the meaning encapsulated in the stem is not necessarily compromised e.g., [eksesayt] for "exercised", [sembelt] for "assembled", [kolets] or [koleks] for "collects" [resaykt] for "recycled", [obzers] for "observes", [egzams] for "examines", [peyns] for "paints", [fografs] for "photographs", [oderd] for "ordered. The subset of phonological errors, stem-based, is possibly a strategy used to maintain inflection and illustrates that phonology assists in the preservation of inflection.

However, more importantly this error type provides evidence for morphological awareness. What the participants in both groups were doing was very skillful. It seems as if they were weighing morphemes or distinguishing between stems and suffixes in order to assess what they could afford to do: the alteration of the stem or the omission of the suffix. In many instances both L2Ls and agrammatics were phonologically "sacrificing" the stems. While altering the stems they appeared to know how far they could go to

sacrifice the stem, but not to compromise the meaning and preserve the inflection. This compensatory technique illustrates phonological assistance in the preservation of inflection, but most importantly it provides more evidence for the morphological involvement.

We have observed that both domains in question interact with inflection, each in its own way. The accuracy analysis has shown that morphology, as understood in the present study, contributes to the inconsistent use of inflection. In the error analysis, on the other hand, a set of stem-based errors demonstrated that phonology contributes to the non-target production of the lexical items (e.g., certain changes within a stem) but not to the inflectional inconsistency. In other words, phonology tries to preserve the inflection.

Chapter Eight

Conclusion

In general, the results detailed in the present study argue against global impairment in developing and re-developing grammars. The findings obtained here are compatible with the non-impairment account of underlying interlanguage grammars. There is evidence for the presence of functional categories responsible for finiteness (correct occurrence of finite forms) but also the knowledge of features (production of verb agreement). At the same time there are default bare forms used in finite contexts. This indicates a discrepancy between what is underlyingly present in abstract representations and what surfaces overtly. We argue repeatedly that the fact that verbal inflection is not produced consistently does not mean that underlying grammars in both groups are impaired at the abstract level. When finite forms are used they are used correctly by members of both groups. This alone suggests that underlying featural equivalents are not only present but fully specified.

Morphology is not lost in L2A and aphasia but rather computational resources available in the L2 acquisition and the L1 attrition are not sufficient to process morphologically dense forms. Morphology, as defined here, contributes to the inconsistent use of inflection to a greater extent than phonology. Both domains, however, interact with inflection in the course of its production. Our data demonstrated that morphology, being the more vulnerable, contributed to the inconsistent use of inflection. Phonology added to the non-target shape of the lexical items but in many instances assisted in the preservation of inflection.

Further, similar profiles were detected in the L2Ls and agrammatic aphasics. The patterns of performance are systematic in both groups. In both, morphology is a contributing factor in the non-target production of inflection while phonology is used as an adaptive strategy in the preservation of inflectional morphemes. Despite the unquestionable differences between the two populations the core knowledge appears to be equivalent in language acquisition and language attrition.

Finally, in the current study, the focus was on speech production at its most vulnerable states: adult language acquisition where a grammar is being built and language attrition representing a grammar in the process of re-building. The general goal of linguistics is to gain insights on how a language as a system functions. We investigated these two different systems because together they provide an insightful view of a language in a dynamic but fragile state. Only by considering the systems in flux can we learn how the whole (intact) system operates because only when a system breaks down are we able to localize the vulnerable areas. The significance of the present study stems not only from the fact that we have investigated two fundamentally different systems in flux, but also from the observed commonalities between them. We conclude that any type of stress put on a system (e.g., post-pubertal language acquisition or post-stroke language attrition) similarly constrains the use of inflection.

Chapter Nine

Appendix

9.1. Stimuli

Sentences used to elicit morpheme number

T
1.
It is cloudy in London.
Another word for fog is _____ (**mist**).
Bob did not want to miss a train. But…
Yesterday he _____ (**missed)** an eleven-thirty train.

2.
I am interested in politics.
An agreement between two countries is called a _____ (**pact**).
Joe had to pack something.
Yesterday he _____ (**packed**) a bottle of olive oil.

3.
I often go to parties.
A person who is invited to a party is called a _____ (**guest**).
Mary wanted to guess an answer.
Yesterday she _____(**guessed**) an answer to a difficult question.

4.
They did not ban smoking on the streets but…
Yesterday they _____(**banned**) all smoking in restaurants.
I enjoy going to concerts.
A group of people playing music professionally is called a _____ (**band**).

5.
Betty learned how to tie shoes.
Yesterday she _____ (**tied**) a shoelace all by herself.
I like to watch the ocean waves.
A big ocean wave coming every few hours is called a _____ (**tide**).

6.
I remember what happened a long time ago.
The period of time before the present is called the _____ (**past**).
John wanted to pass an exam.
Yesterday he _____ (**passed**) a very difficult exam in math.

AGR

1.

Number eight is my lucky number but…
Number _____ (**six**) always brings Peter good luck.
Usually bad boys kick girls but…
Sometimes a bad girl _____ (**kicks**) a boy in the schoolyard.

2.

The postman wants to knock quietly. But…
Every day he _____ (**knocks**) on the door very loudly.
My favorite color is red.
The red object on the table is called a _____ (**box**).

3.

Thomas likes to stare at something
Every day he _____ (**stares**) at the picture in his room.
There are many people working in a hospital.
A woman who cares for sick people in a hospital is a _____ (**nurse**).

4.

My sister always remembers to lock the apartment.
Every day she _____ (**locks**) our front door.
I like going to the zoo.
The animal in the picture is called a _____ (**fox**).

5.

Joseph does not want to snore. But…
Every night he _____ (**snores**) a lot in his bedroom.
I like large animals.
The animal in the picture is called a _____ (**horse**).

6.

I always buy fresh flowers.
The red flower in the store window is called a _____ (**rose**).
Strong winds blow in Florida.
Every year s strong wind _____ (**blows**) at about 100 miles per hour.

7.

The flowers need water.
An open container used to hold flowers is called a _____(**vase)**.
Billy doesn't like to play with his friends.
Every day he ____(**plays**) alone in his room.

Sentences used to elicit morpheme type

1.
Many professors mark the exams at home but...
Prof. Einstein always _____ (**marks**) exams in his office.
He never gets a good mark in math but…
His _____ (**marks**) on English tests are always very good.
Both Mary and Mark have very nice aunts but only…
_____ (**Mark's)** aunt works at the office.

2.
The hand-brake does not always work but…
The two foot-_____ (**brakes**) always work.
Some children never break their toys but…
This child always _____(**breaks**) a lot of toys.
Both Mister Brown and Miss Drake have new umbrellas but only…
Miss _____(**Drake's**) umbrella is green.

3.
John has a white cat and a black cat.
The _____ (**cats**) always play together.
Peter likes to cut bread.
Every morning he _____(**cuts**) a loaf of bread into slices.
Both Bob and Kate grow apples, but only…
Only **_____** (**Kate's**) apples are sweet and delicious.

4.
My Grandma likes to pet animals.
Every afternoon she _____ (**pets**) a dog in front of the house.
Mary had only one pet, a dog, but yesterday she bought a new pet, a cat.
Now she has two _____ (**pets**) at home
Both John and Pat have new apartments, but…
Only _____ (**Pat's**) apartment has two big windows.

5.
Tom likes to sail. Every month,
Every month he _____(**sails**) away to sea on his boat.
There is only one big sale in the stores in winter but…
There are many _____ (**sales**) in the stores in spring.
Both John and Gail have allergies, but…
Only _____ (**Gail's**) allergy makes her very sleepy.

Sentences used to elicit stem status

Pseudo-Verbs

T
1.
Susan wanted to blick.
Yesterday she _____(**blicked**) across a desert. (to blick = to ride a camel)
2.
The girl had to mank.
Yesterday she _____(**manked**) at the circus. (to mank = to jump on the trampoline)
3.
The boy wanted to bup.
Yesterday he _____(**buped**) in the park. (to bup = to ride a monocycle)
4.
Laura wanted to yick.
Yesterday she _____(**yicked**) in front of her house. (to yick = to jump very high)
5.
Betty wanted to roop outside, but…
Yesterday she _____ (**roped**) at home (to roop = to stand on one leg).
6.
Dorothy wanted to tane in the garden, but…
Yesterday she _____(**taned**) on the street. (to tane = to do a cartwheel)

AGR
1.
The girl likes to neek.
Every day she _____(**neeks**) outside her house. (to neek = to jump a rope)
2.
My brother likes to fabe.
Every day he _____(**fabes**) at 8 o'clock in the morning. (to fabe = to stand on one's hands)
3.
My neighbor likes to gorp a lot.
Every day he _____(**gorps**) in the yard. (to gorp = to exercise)
4.
Sara likes to pim a lot.
Every week she _____(**pims**) after work. (to pim = to do yoga)
5.
My friend likes to sike.
Every day he _____(**sikes**) after dinner. (to sike = to drive a horse carriage)
6.
The dog wants to zent.
Every morning he _____(**zents**) in the garden. (to zent = to bury a bone)

Real Verbs

AGR

1.
My Grandmother likes to walk a lot.
Every day she _____(**walks**) alone in the park.
2.
Lucy likes to pick different fruits.
Every day she _____(**picks**) apples in her garden.
3.
My brother likes to write.
Every day he _____ (**writes**) e-mails at work.
4.
Margaret does not drink milk but…
Every day she _____(**drinks**) eight glasses of water.
5.
My dog does not bark during the day but…
Every night he _____(**barks**) at the moon.
6.
John likes to sleep late.
Every day he _____(**sleeps**) until 10 in the morning.

T

1.
Mary wanted to cook for her children.
Yesterday she _____ (**cooked**) a delicious dinner.
2.
Peter had to rake his garden.
Yesterday he _____ (**raked**) a lot of leaves.
3.
Betty did not want to work late but…
Yesterday she _____ (**worked**) until eleven thirty.
4.
Mr. Brown wanted to talk about his family.
Yesterday he _____ (**talked**) about his daughter.
5.
The green car did not stop at all, but…
Yesterday the yellow car _____ (**stopped**) at a red light.
6.
The woman wanted to bake something.
Yesterday she _____(**baked**) a birthday cake for her husband.

Sentences used to elicit stem length

AGR

1.

Jessica likes to count her balloons.
Every day she _____(**counts**) orange balloons in her room (12)
Jessica wants to collect balloons.
Every day she_____ (**collects**) orange balloons in her room (13)
Jessica likes to decorate balloons.
Every day she _____ (**decorates**) orange balloons in her room (14)

2.

Mary wants to help people.
Every day she _____(**helps**) Adam after work. (10)
Mary likes to visit friends.
Every day she _____(**visits**) Adam after work. (11)
Mary wants to photograph well.
Every day she _____(**photographs**) Adam after work. (12)

3.

The man likes to paint walls.
Every day he _____(**paints**) our master bedroom. (11)
The man likes to vacuum.
Every day he _____(**vacuums**) our master bedroom. (12)
The man likes to remodel houses.
Every day he _____(**remodels**) our master bedroom. (13)

4.

My brother likes to fly.
Every day he _____(**flies**) around the world. (9)
My brother has to travel a lot.
Every day he _____(**travels**) around the world. (10)
My brother likes to navigate.
Every day he _____(**navigates**) around the world. (11)

5.

Peter likes to speak many languages.
He _____ (**speaks**) Arabic very well. (8)
Peter wants to translate many languages.
He _____ (**translates**) Arabic very well. (9)
Peter wants to understand many languages.
He _____ (**understands**) Arabic very well. (10)

6.
Doctor Brown has to see new patients.
Every day he _____(**sees**) a new patient at the hospital. (14)
Doctor Brown wants to observe new patients.
Every day he _____(**observes**) a new patient at the hospital. (15)
Doctor Brown has to examine new patients.
Every day he _____(**examines**) a new patient at the hospital. (16)

T
1.

The student wanted to kick bottles.
Yesterday he_____ (**kicked**) an empty plastic bottle. (12)
The student wanted to open a bottle.
Yesterday he _____ (**opened**) an empty plastic bottle. (13)
The student wanted to recycle bottles.
Yesterday he _____ (**recycled**) an empty plastic bottle. (14)

2.
The man wanted to wash his clothes.
Yesterday he _____ (**washed**) a dark green sports jacket. (11)
The man wanted to iron his clothes.
Yesterday he _____ (**ironed**) a dark green sports jacket. (12)
The man did not want to discolor his clothes.
Yesterday he _____ (**discolored**) a dark green sports jacket. (13)

3.
The girl wanted to close something.
Yesterday she _____ (**closed**) a green box on the table. (12)
The girl wanted to open something.
Yesterday she _____ (**opened**) a green box on the table. (13)
The girl wanted to uncover something.
Yesterday she _____ (**uncovered**) a green box on the table. (14)

4.
This sick man had to cough.
Yesterday he _____ (**coughed**) a lot in his bedroom. (11)
This sick man had to shiver.
Yesterday he _____ (**shivered**) a lot in his bedroom. (12)
This sick man wanted to exercise.
Yesterday he _____ (**exercised**) a lot in his bedroom. (13)

5.
Richard wanted to smash something.
Yesterday he _____ (**smashed**) a blue motorcycle. (11)
Richard wanted to repair something.
Yesterday he _____ (**repaired**) a blue motorcycle. (12)
Richard wanted to assemble something.
Yesterday he_____ (**assembled**) a blue motorcycle (13)

6.
The boy did not want to burn his food, but…
Yesterday he _____ (**burned**) a pizza pie. (9)
The boy wanted to order something to eat.
Yesterday he _____ (**ordered**) a pizza pie. (10)
The boy had to deliver something to eat.
Yesterday he _____ (**delivered**) a pizza pie. (11)

Sentences used to elicit suffix syllabicity

T
1.
The party does not usually start until 8 o'clock, but…
Yesterday the party _____ (**started**) at 4 in the afternoon.
2.
The woman wanted to taste some food.
Yesterday she _____ (**tasted**) a delicious salad.
3.
John wanted to paint something.
Yesterday he _____ (**painted**) a beautiful picture.
4.
Richard had to rest after work.
Yesterday he _____ (**rested**) at home.
5.
The boss wanted to shout at somebody.
Yesterday he _____ (**shouted**) at the new worker.
6.
The gardener wanted to plant flowers.
Yesterday he _____ (**planted**) a beautiful red rose.

AGR
1.
George likes to watch TV.
Every night he _____(**watches**) an interesting movie.
2.
Robert likes to use his tools.
Every day he _____(**uses**) a hammer and a wrench.

3.
This woman likes to wash her windows.
Every day she _____(**washes**) a big kitchen window.
4.
Our cat likes to catch mice.
Every week he _____(**catches**) a lot of mice in the basement.
5.
Rebecca likes to dance.
Every day she _____(**dances)** around the house.
6.
Aunt Liz wants to fix everything.
Every month she_____ (**fixes**) our TV set.
.

Sentences used to elicit sonority type

AGR
1.
Catherine likes to study math.
Every day she _____(**studies**) algebra at school.
2.
The postman has to carry lots of mail
Every week he _____(**carries**) a lot of letters.
3.
This mother likes to worry about her children.
Every day she _____(**worries)** about their health.
4.
Debby has to copy documents at work.
Every day she _____(**copies**) a lot of documents in her office.
5.
Every princess wants to marry a nice person.
In this story, the princess always _____(**marries**) a handsome prince.
6.
Mary likes to free mice.
Every week she _____(**frees**) a mouse from the trap.

T
1.
The students needed to study.
Yesterday they _____(**studied**) all night for the test.
2.
The tourist did not want to carry his luggage but…
Yesterday he _____ (**carried)** a heavy suitcase.

3.
The secretary had to copy a lot of documents.
Last week she _____ (**copied**) a very important document.
4.
Grandma did not want to worry but…
Every day she _____ (**worried**) about the weather.
5.
Lucy wanted to marry Allen in September but…
She _____ (**married**) Allen in *January.*
6.
My brother wanted to free a bird. Yesterday…
Every day he _____(**freed**) a blue bird from the cage.

9.2. **Task Demonstration**

Morpheme Number Sample

Bi-Morpheme

"They did not ban smoking on the streets but…"

Yesterday they _____ (**banned**) all smoking in restaurants.

Mono-Morpheme

"I enjoy going to concerts."

A group of people playing music professionally is called a _____ (**band**).

Morpheme Type Sample

POSS

"Both Bob and Kate grow apples, but only…"

Only _____ (**Kate's**) apples are sweet and delicious.

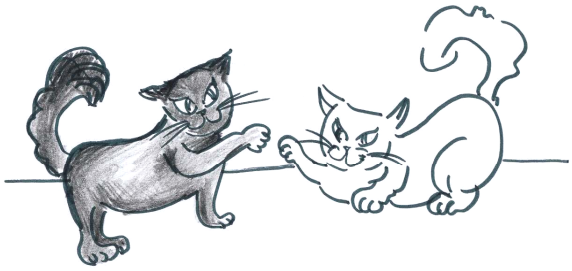
AGR

"Peter likes to cut bread."

Every morning he _____ (**cuts**) a loaf of bread into slices.

PLU

“John has a white cat and a black cat”.



The (**cats**) _____ always play together.

Stem Status Sample

Pseudo-Verbs

T

“The boy wanted to bup.”

Yesterday he _____ (**buped**) in the park.

AGR

“My friend likes to sike.”

Every day he _____ (**sikes**) after dinner.

Real Verbs

T

“Mary wanted to cook for her children.”

Yesterday she _____ (**cooked**) a delicious dinner.

AGR

“Lucy likes to pick different fruits”.

Every day she _____ (**picks**) apples in her garden.

Syllable Number Sample

AGR
Mono-Syllabic Stem

“Mary wants to help people.”

Every day she _____ (**helps**) Adam after work.

Bi-Syllabic Stem

"Mary likes to visit friends."

Every day she _____ (**visits**) Adam after work.

Tri-Syllabic Stem

"Mary wants to photograph well."

Every day she _____ (**photographs**) Adam after work.

Suffix Syllabicity Sample

T

"The gardener wanted to plant flowers."

Yesterday he _____ (**planted**) a beautiful red rose.

AGR

"Rebecca likes to dance."

Every day she _____ (**dances)** around the house.

Sonority Type Sample

T

"The tourist did not want to carry his luggage but…"

Yesterday he _____ (**carried)** a heavy suitcase.

AGR

"Debby has to copy documents at work."

Every day she _____ (**copies**) a lot of documents in her office.

9.3. Total Correct Analysis

9.3.1. L2 Learners

9.3.1.1. Morphological Predictions

In the morpheme number condition, as predicted, mono-morphemic homophones (95%) were produced significantly better than bi-morphemic ones (65%) ($F(1,29)= 60.921$; $p<.001$). There was a main effect of the morpheme type ($F(2,58) =63.387$, $p<.001$). There was a significant difference ($p<.001$) between PLU (74%) and POSS (18%) as well as AGR (72%) and POSS (18%) ($p<.001$), while the difference between PLU and AGR was not significant ($p=.721$). The third morphological prediction, stem status, was not confirmed because there was a significant difference in production of pseudo- (48%) and existing verbs (64%) ($F(1,29)=14.479$, $p=.001$).

9.3.1.2. Phonological Predictions

There was a main effect of the syllable number ($F(2,58) =14.540$, $p<.001$). Within this condition, the significant difference was observed between mono- (67%) and bi-syllabic stems (54%) ($p=.002$) and also between mono- (67%) and tri-syllabic (49%) ($p<.001$). The difference in the performance on bi- and tri-syllabic stems was not significant ($p=.113$). Further, suffix syllabicity prediction was not confirmed. Not only were the syllabic (38%) and non-syllabic suffixes (67%) produced significantly differently ($F(1,29)=41.385$, $p<.001$) but also the difference was not in the predicted direction. Finally, the difference between the two sonorous segments, vowels (51%) and stops (54%) did not even approach significance ($F(1,29) =.575$, $p=.454$).

9.3.2. Agrammatic Aphasics

9.3.2.1. Morphological Predictions

As predicted, mono- (95%) and bi-morphemic homophones (63%) were produced significantly differently ($F(1,6)=31.937$, $p=.001$). Next, there was a main effect of the morpheme type ($F(2,12) =6.187$, $p=.014$). Within this condition, there was a significant difference between PLU (69%) and POSS (26%) ($p=.032$), and between AGR (63%) and POSS ($p=. 007$). PLU and AGR, however, were not produced significantly differently ($p=.703$). Finally, consistent with our prediction, there was no significant difference in the production of pseudo- (34%) and existing verbs (51%). Although the mean values would suggest otherwise, significant difference was not observed ($F(1,6) = 2.019$, $p=.205$) and, thus, prediction confirmed.

9.3.2.2. Phonological Predictions

There was no main effect of the syllable number ($F(2,12) =1.395$, $p=.285$). However, within this condition, the only significant difference ($p=.042$) was between mono-syllabic (58%) and tri-syllabic verbs (46%). Further, contrary to the suffix syllabicity prediction, syllabic (52%) and non-syllabic suffixes (58%) were not produced significantly differently ($F(1,6) =.446$, $p=.529$). Finally, verbs ending in a vowel (45%) were not easier to inflect than those ending in a consonant (51%). Consequently, the difference between the two sonorous segments did not approach significance ($F(1,6) =1.198$, $p=.316$) and the prediction was not confirmed.

9.4. Questionnaire

L2-……

1. First Name- Last Name-

2. Age-

3. Profession-

4. Current Occupation -

5. Age began learning English -

Where (institution)-

6. Years of English in birth country -

7. Other languages spoken –

(Circle one) near native fluency fluent intermediate basic knowledge

8. Education

(Circle one) high school diploma community college 4-year college

9. How long have you been in the US?-

9.5. Grammaticality Judgment Task

Read the following sentences very carefully. Underline the word **Correct** if you think the sentence is correct. Underline the word **Incorrect** if you think the sentence is incorrect. In incorrect sentences, please, identify the error according to the example.

Example. I have two ~~apple~~. **apples** Correct Incorrect

Sentence	Correct Label	Incorrect Label
1. She always go to school by bus.	Correct	Incorrect
2. I am go to school now.	Correct	Incorrect
3. Yesterday he played a guitar.	Correct	Incorrect
4. I often to work walk.	Correct	Incorrect
5. Laura lives on Church Street.	Correct	Incorrect
6. I have a pen new.	Correct	Incorrect
7. She kissed a boy yesterday.	Correct	Incorrect
8. I the piano play very well.	Correct	Incorrect
9. His brother hates school.	Correct	Incorrect
10. The exercise were very easy.	Correct	Incorrect
11. I taked a bus to work yesterday.	Correct	Incorrect
12. You often listen to the music.	Correct	Incorrect
13. They wash their car yesterday.	Correct	Incorrect
14. On the table is the key.	Correct	Incorrect
15. They eated at home yesterday.	Correct	Incorrect
16. Betty cleaned her house yesterday.	Correct	Incorrect
17. I every day listen to the radio.	Correct	Incorrect

18. We finished our work at 5.	Correct	Incorrect
19. She call her mother last night.	Correct	Incorrect
20. I like chocolate white.	Correct	Incorrect
21. She gived me a nice present last year.	Correct	Incorrect
22. He standing now.	Correct	Incorrect
23. This is my book English.	Correct	Incorrect
24. The mother kiss a child every morning.	Correct	Incorrect
25. He opened a window.	Correct	Incorrect
26. Mary brush her teeth two hours ago.	Correct	Incorrect
27. I speak French very well.	Correct	Incorrect
28. We moved to New York two weeks ago.	Correct	Incorrect
29. She is studying now English.	Correct	Incorrect
30. Helen always travel by car.	Correct	Incorrect
31. He comed home very late last night.	Correct	Incorrect
32. I very good feel.	Correct	Incorrect
33. The student opened a book.	Correct	Incorrect
34. He learn English last year.	Correct	Incorrect
35. Dorothy drink a lot of coffee every day.	Correct	Incorrect
36. He waited for me last night.	Correct	Incorrect
37. My father smokes a lot.	Correct	Incorrect
38. She goed there yesterday.	Correct	Incorrect
39. My sister is a dancer also.	Correct	Incorrect
40. I now am eating my dinner.	Correct	Incorrect

41. The girl stay home yesterday.	Correct	Incorrect
42. He prepared a dinner last night.	Correct	Incorrect
43. He come here twice a week.	Correct	Incorrect
44. My mother always understands me.	Correct	Incorrect
45. She has a lot of work.	Correct	Incorrect
46. I am an American.	Correct	Incorrect
47. She calls me twice a day.	Correct	Incorrect
48. They want to eat ice cream.	Correct	Incorrect
49. Her sister called me last week.	Correct	Incorrect
50. Peter is ten year old.	Correct	Incorrect
51. I go to the movies every Thursday.	Correct	Incorrect
52. My baby cried a lot last night.	Correct	Incorrect
53. John writed a letter last week.	Correct	Incorrect
54. He always waits for me.	Correct	Incorrect
55. Listen to me.	Correct	Incorrect
56. We move to Chicago in 2005.	Correct	Incorrect
57. They walk to work every day.	Correct	Incorrect
58. He always arrive on time.	Correct	Incorrect
59. Where he is going?	Correct	Incorrect
60. He looked for work last month.	Correct	Incorrect

9.6. Tables

Table1: Sentence Category by Group in Grammaticality Judgment (Accuracy %)

Sentence Type	L2 Learners	Agrammatics
1. Correct Sentence (overall) **(Correct Ss with T & AGR)**	90%	85%
2. Incorrect Sentence (overall) **(Incorrect Ss with T& AGR)**	81%	51%
3. Overgeneralization (overall) **(Ss with T overgeneralizations)**	75%	77%
4. AGR (total correct) **(All Ss with AGR which were assessed correctly, correct & incorrect)**	77%	62%
5. Correct AGR **(Only Ss in which AGR was correct)**	92%	91%
6. Incorrect AGR **(Only Ss in which AGR was incorrect)**	70%	37%
7. T (total correct) **(All Ss with T which were assessed correctly, correct & incorrect)**	89%	80%
8. Correct T **(Only Ss in which T was correct)**	93%	86%
9. Incorrect T **(Only Ss in which T was incorrect)**	83%	51%

Table 2: Summary of Predictions by Analysis Types in the Experimental Groups

Analysis	Prediction	L2 Learners	Agrammatics
Inflection Present	**Morphological**		
	Morpheme Number	confirmed	not confirmed
	Morpheme Type	confirmed	confirmed
	Stem Status	not confirmed	not confirmed
	Phonological		
	Syllable Number	confirmed	not confirmed
	Suffix Syllabicity	not confirmed	not confirmed
	Sonority Type	not confirmed	not confirmed
Inflection Correct	**Morphological**		
	Morpheme Number	confirmed	confirmed
	Morpheme Type	confirmed	confirmed
	Stem Status	not confirmed	not confirmed
	Phonological		
	Syllable Number	confirmed	not confirmed
	Suffix Syllabicity	not confirmed	not confirmed
	Sonority Type	not confirmed	not confirmed

Table 3: Mean Values of Variables by Analysis Types in Both Experimental Groups

Analysis	Prediction	L2 Learners	Agrammatics
Inflection Present	**Morphological**		
	Morpheme Number Mono- vs. Bi-Morphemic	97% - 81%	95% - 84%
	Morpheme Type PLU vs. AGR. vs. POSS	80% - 79% - 18%	69% - 74% - 26%
	Stem Status Real vs. Pseudo-Verbs	85% - 69%	83% - 54%
	Phonological		
	Syllable Number Mono vs.Bi vs.Tri-Syllabic	81% - 79% - 69%	83% - 73% - 74%
	Suffix Syllabicity Syllabic vs. Non-Syllabic	54% - 81%	80% - 83%
	Sonority Type Vowels vs. Stops	66% - 76%	69% - 73%
Inflection Correct	**Morphological**		
	Morpheme Number Mono- vs. Bi-Morphemic	97% - 73%	95% - 66%
	Morpheme Type PLU vs. AGR. vs. POSS	78% - 76% - 18%	69% - 63% - 26%
	Stem Status Real vs. Pseudo-Verbs	70% - 60%	51% - 35%
	Phonological		
	Syllable Number Mono vs.Bi vs.Tri-Syllabic	76% - 69% - 61%	61% - 57% - 52%
	Suffix Syllabicity Syllabic vs. Non-Syllabic	43% - 76%	56% - 61%
	Sonority Type Vowels vs. Stops	57% - 69%	45% - 57%

Table 4: Overview of the p- and f-values in the two groups

Analysis	Prediction	L2 Learners	Agrammatics
Inflection Present	**Morphological**		
	Morpheme Number Mono- vs. Bi-Morphemic	p<.001 F(1,29)=23.018	p=.056 F(1,6)=5.588
	Morpheme Type PLU vs. AGR. vs. POSS	p<.001 F(2,58)=94.331	p=.005 F(2,12)=8.538
	Stem Status Real vs. Pseudo-Verbs	p=.008 F(1,29)=8.072	p=.016 F(1,6)=10.989
	Phonological		
	Syllable Number Mono vs.Bi vs.Tri-Syllabic	p<.001 F(2,58)=9.065	p=.308 F(2,12)=1.301
	Suffix Syllabicity Syllabic vs. Non-Syllabic	p<.001 F(1,29)=44.946	p=.626 F(1,6)=.264
	Sonority Type Vowels vs. Stops	p=.008 F(1,29)=8.055	p=.631 F(1,6)=.256
Inflection Correct	**Morphological**		
	Morpheme Number Mono- vs. Bi-Morphemic	p<.001 F(1,29)=36.674	p=.002 F(1,6)=26.189
	Morpheme Type PLU vs. AGR. vs. POSS	p<.001 F(2,58)=77.561	p=.014 F(2,12)=6.187
	Stem Status Real vs. Pseudo-Verbs	p=.014 F(1,29)=6.877	p=.050 F(1,6)=6.004
	Phonological		
	Syllable Number Mono vs.Bi vs.Tri-Syllabic	p<.001 F(2,58)=10.504	p=.474 F(2,12)=.795
	Suffix Syllabicity Syllabic vs. Non-Syllabic	p<.001 F(1,29)=59.730	p=.496 F(1,6)=.526
	Sonority Type Vowels vs. Stops	p=.002 F(1,29)=11.652	p=.058 F(1,6)=5.453

Table 5: Error Category Type by Group (Total %)

Error Type	L2 Learners	Agrammatics
Deletion	60	46
Substitution	15	37
Non-Inflectional Substitution	6	10
Insertion	12	2
Simplification	7	5

Table 6: Place-of-Occurrence Errors vs. Successful Use of Inflection (L2Ls)

Error Type	Total N	Inflection Present	Inflection Correct	Inflection Absent
Suffix -based	1249	21%	0%	79%
Stem-based	159	93%	87%	7%

Table 7: Place-of-Occurrence Errors vs. Successful Use of Inflection (AAs)

Error Type	Total N	Inflection Present	Inflection Correct	Inflection Absent
Suffix -based	359	40%	0%	60%
Stem-based	50	76%	69%	24%

Table 8: Agrammatic Patients - Profiles

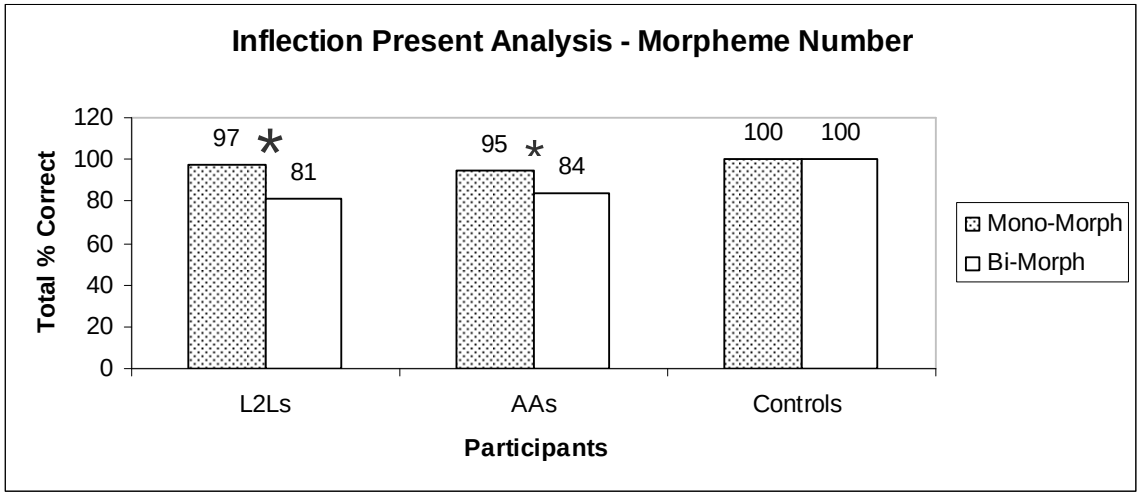
Participant	HM	BK	AM	IS	JG	SD	FD
Gender	M	F	M	M	M	F	F
Age at Onset	60	57	35	44	56	62	50
# of Years Post-Onset	10	2	7	7	5	2	10
Aphasia Type	Broca's	Broca's	Broca's/ Transcortical Motor	Broca's	Broca's	Broca's	Broca's/ Transcortical Motor
Right Sided Hemiplegia	No	Yes	Yes	Yes	Yes	No	No
Dysarthia	No	No	No	No	No	No	No
Apraxia	No	No	No	No	No	No	No
Handedness	Right	Right	Right	Left	Right	Right	Right
Profession	History Professor	Librarian	Computer Programmer	Project Manager	Computer Programmer	Legal Secretary	1ST Grade Teacher
Education	M.A.	B.A.	B.A.	M.B.A.	M.A.	Associate Degree	B.A.

9.7. Charts

1. Morphological Predictions

1.1 Morpheme Number

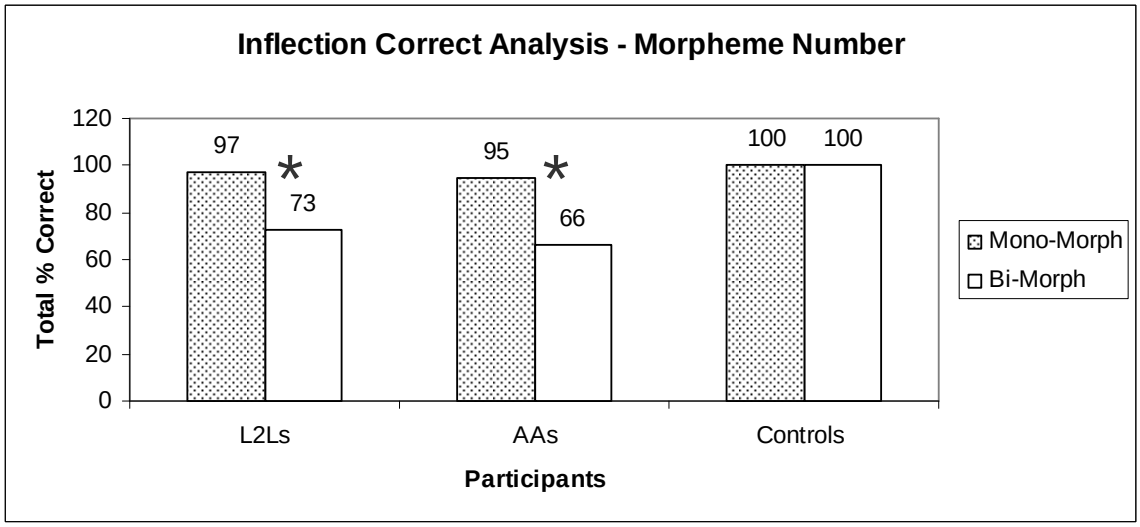
1.1.1. Inflection Present



p<.001 p=.056

Mono-Morph > Bi-Morph

1.1.2. Inflection Correct

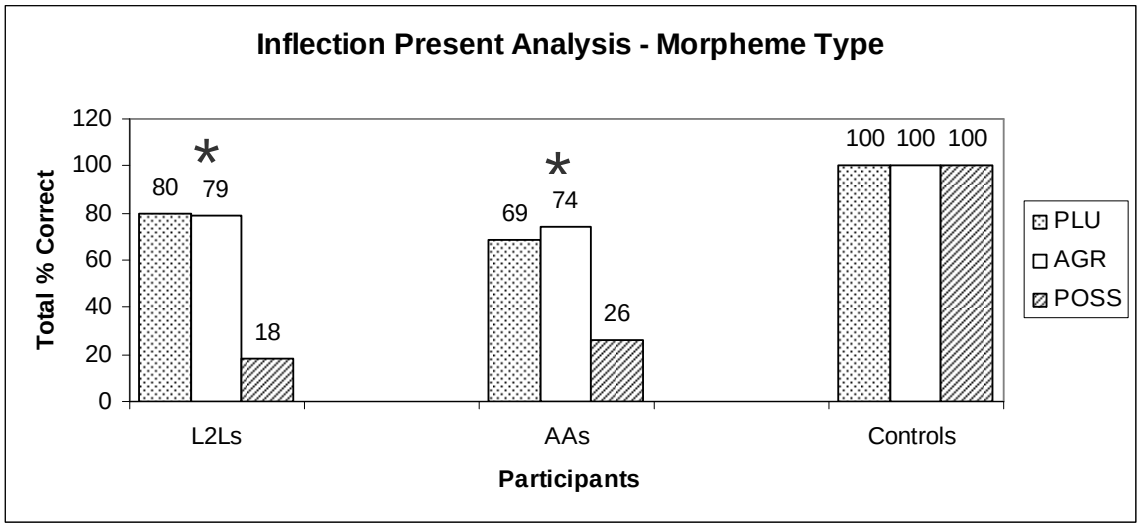


p<.001 p=.002

Mono-Morph > Bi-Morph

1.2. Morpheme Type

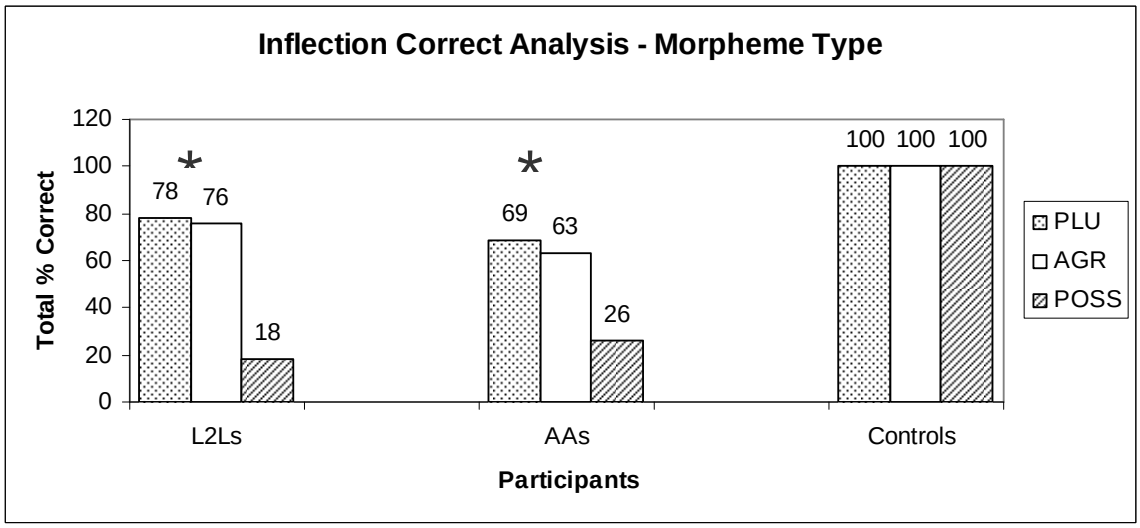
1.2.1. Inflection Present



p<.001 p=.005

PLUR > POSS > AGR

1.2.2. Inflection Correct

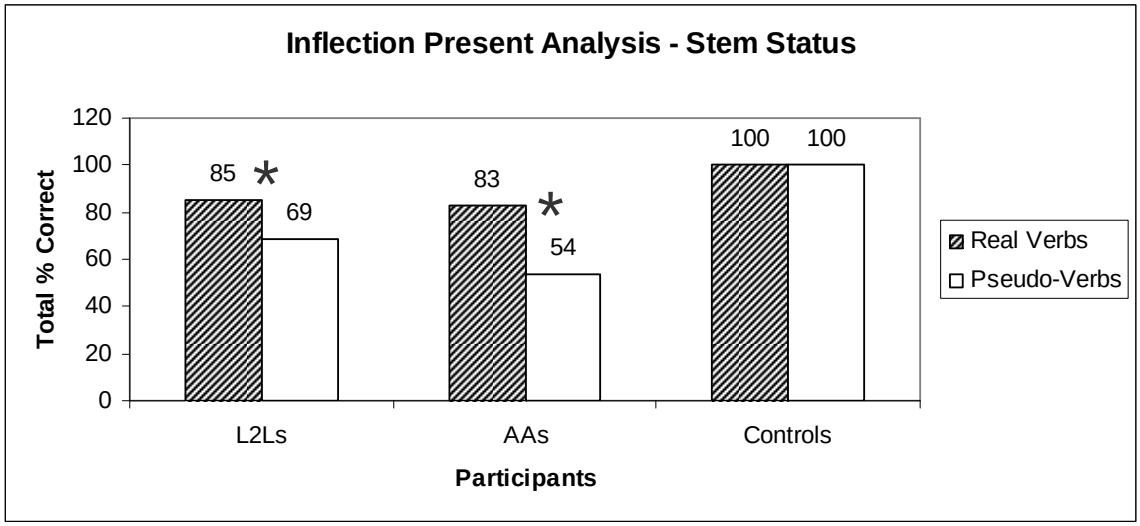


p<.001 p=.014

PLUR > POSS > AGR

1.3. Stem Status

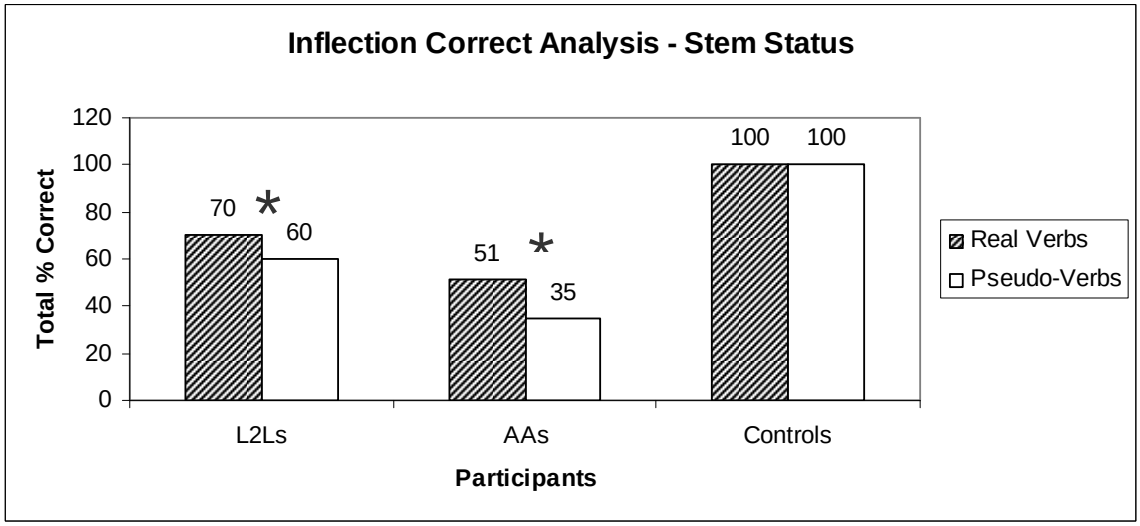
1.3.1. Inflection Present



p=.008 p=.016

Real Verbs ≈ Pseudo Verbs

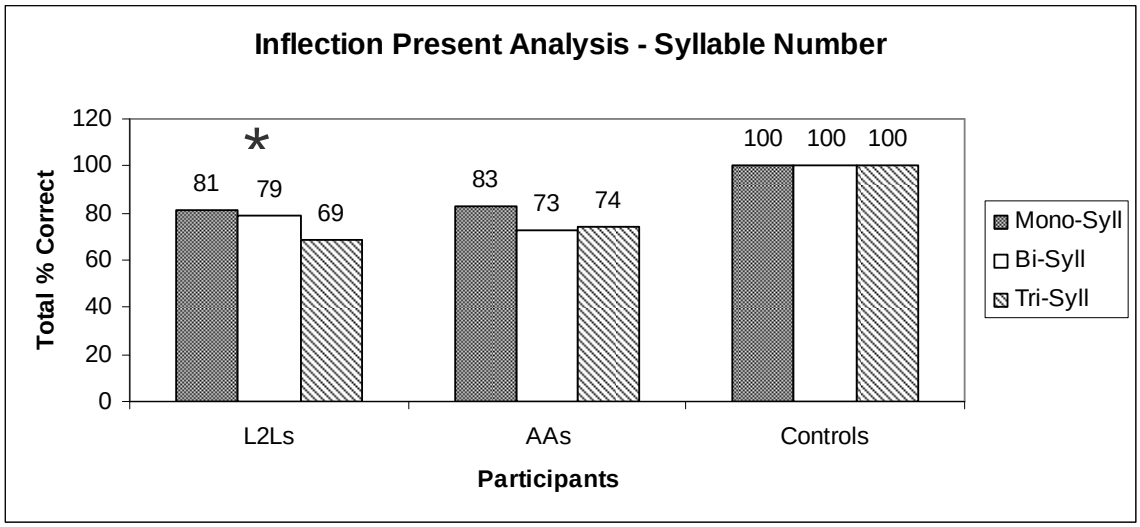
1.3.2. Inflection Correct



p=.014 p=.050

Real Verbs ≈ Pseudo Verbs

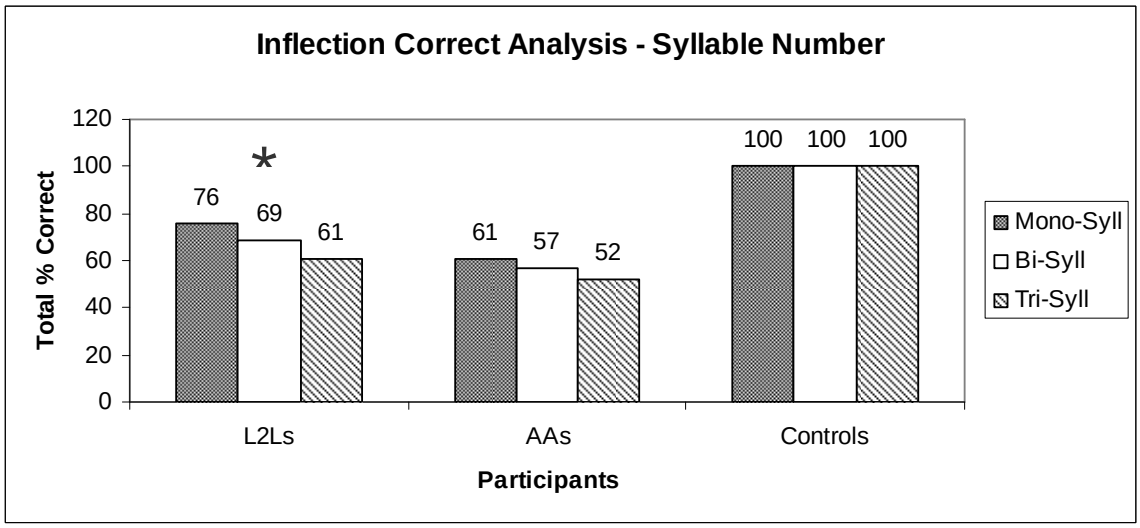
2. Phonological Predictions
2.1. Syllable Number
2.1.1. Inflection Present



p<.001 p=.308

Mono-syllabic > Bi-syllabic > Tri-syllabic

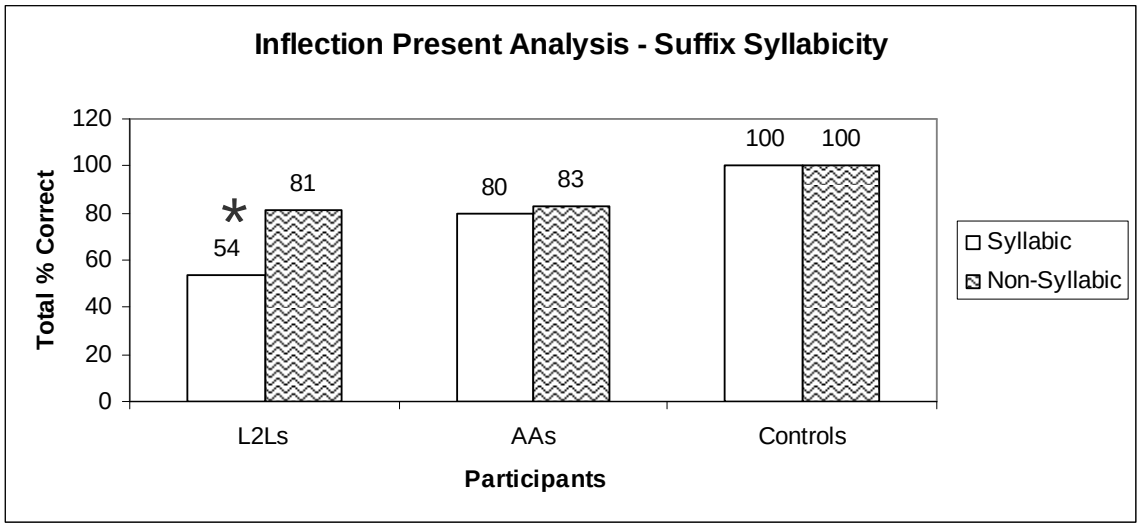
2.1.2. Inflection Correct



p<.001 p=.474

Mono-syllabic > Bi-syllabic > Tri-syllabic

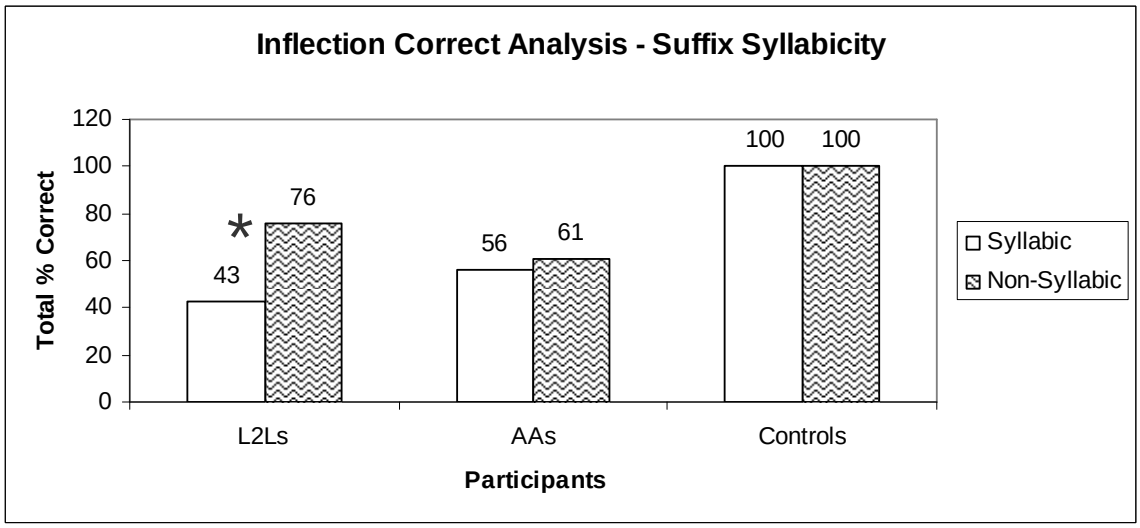
2.2. Suffix Syllabicity
2.2.1. Inflection Present



p<.001 p=.626

Syllabic > Non-Syllabic

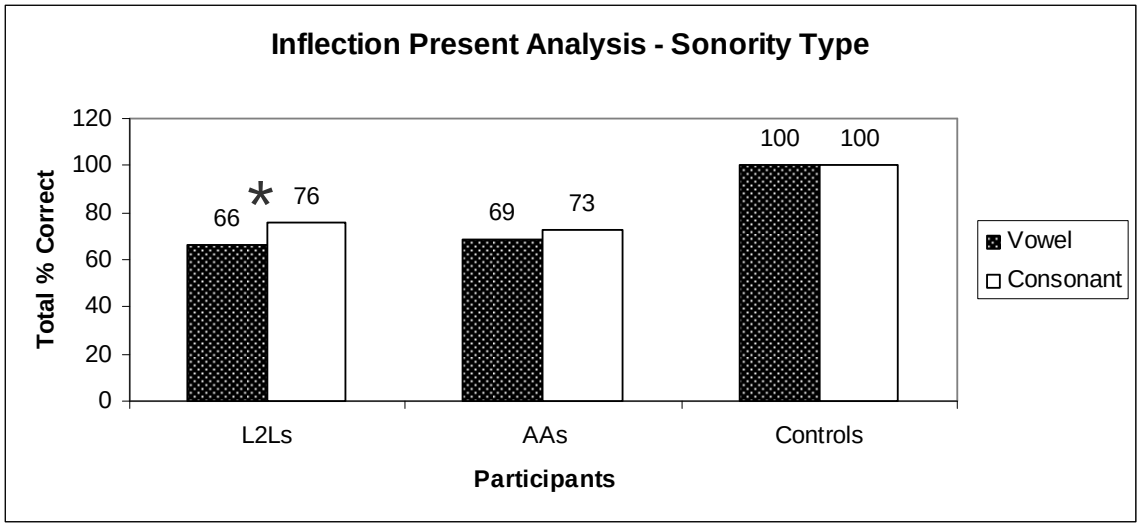
2.2.2. Inflection Correct



p<.001 p=.496

Syllabic > Non-Syllabic

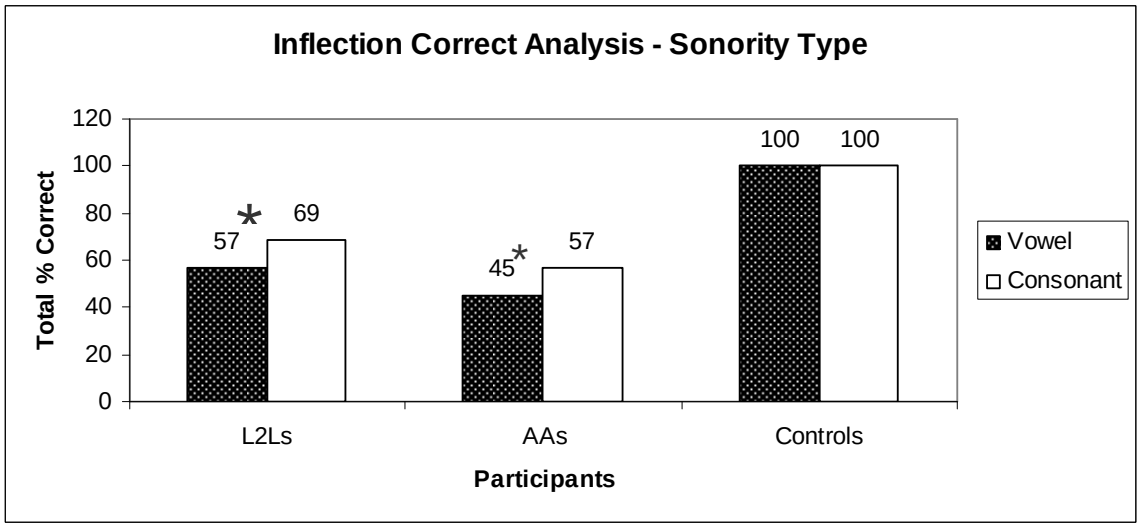
2.3. Sonority Type
2.3.1. Inflection Present



p=.008 p=.631

… #V + C > … #C + C

2.3.2. Inflection Correct



p=.002 p=.058

… #V + C > … #C + C

Chapter Ten

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