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# Locating the Source of Number Agreement Errors in Intermediate-to-Advanced Second Language Learners of English

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**Abstract**
This study explores the extent to which adult Second Language (L2) Learners of English are sensitive to Subject-Verb (S-V) agreement errors with thematic verbs and copulas. A group of intermediate-to-advanced Persian-English second language learners and a group of native English speakers (NSs) participated in an online Speeded Acceptability Judgment task. The results are as follows. Whereas NSs are sensitive to number agreement errors in both verb types, second language learners are not. For the latter group, the results reveal the following systematic errors. For agreement errors in thematic verbs, there is an omission-commission asymmetry; whereas L2 learners are not sensitive to omission errors, they are sensitive to commission errors in finite forms. For copulas, there is a singular-plural asymmetry, indicating higher error rates in **plural subject NP + is* configurations than in **singular subject NP+ are* ones. Yet, proficiency seems to be a strong predictor of L2 learners' sensitivity to agreement errors. The results support the Morphological Underspecification Hypothesis (McCarthy, 2007; 2008; 2012).

**keywords:** feature clash errors, omission-commission asymmetry, singular-plural asymmetry, subject-verb agreement, underspecification errors

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## Introduction

It has often been a common observation that Subject-Verb (S-V) agreement poses a protracted difficulty for adult Second Language Learners (L2ers). This has robustly been reported in both Second Language Acquisition (SLA) (Eubank & Grace, 1998; Prévost & White, 2000; Herschensohn, 2001) and L2 processing research (Chen, Shu, Liu, Zhao, & Li, 2007; Ojima et al. 2005; Jiang, 2004; McDonald, 2006; Sato & Felser, 2010). Importantly, growing evidence from the study of S-V agreement processing during L2 listening and reading has shown that L2ers' difficulty with agreement may not be a purely production-specific problem because they are also less sensitive to S-V agreement than native-speakers (NSs) are during L2 comprehension (e.g., Wakabayashi, 1997; McDonald, 2006; Chen et al., 2007; Jiang, 2004; Safaie, 2015; Sato & Felser, 2010), as in (1) and (2).

(1) The price of the car was/*were too high. (Chen, et al., 2007, p. 163)

(2) I hear that Tom goes/*go to the pub every night. (Wakabayashi, 1997, p. 160)

Two missing gaps are observable in L2 processing research on S-V agreement compared to SLA research. First, while the majority of the aforementioned SLA studies have focused on S-V agreement with both thematic verbs and copula *be* in a single study, in L2 processing, separate research has focused on one or the other, but not on both in a single study. For instance, L2 processing studies on agreement have only tested either copula *be* (e.g., Chen et al., 2007; Jiang, 2004; Tanner, et al., 2012) or thematic verbs (e.g., Armstrong et al., 2018; McDonald, 2006; Ojima et al., 2005; Sato & Felser, 2010; Wakabayashi, 1997) ignoring the potential effects of verb type differences on L2 processing of S-V agreement. Given that a fully-fledged L2 processing account of S-V agreement should ideally include the effect of both verb types, it is surprising that no L2 processing studies to date have been specifically designed to examine both verb types in a single study so that they can develop a comprehensive perspective regarding L2 processing of S-V agreement. Second, L2 processing research has not deemed the potential effect of markedness on L2 processing of S-V agreement. Under markedness theory, marked representations are more specified than unmarked ones which are underspecified. Therefore, unmarked representations should be processed with greater difficulty than marked ones. Ignoring the potential token frequency differences in the input and word-formation processes between copulas and thematic verbs, these two verb types are different in terms of markedness as will be discussed in detail later below. To the best of the researcher's knowledge, L2 processing research of S-V agreement has not been studied from this perspective.

To fill the missing gaps in L2 processing research, this study aims at exploring L2ers' variability in S-V agreement from the perspective of markedness theory using both verb types in a single study in Persian speakers of L2 English. To this end, both verb types (thematic verbs vs. copula *be* with their possible configurations when combined with both singular and plural subjects) are examined to see how L2ers treat them online in a Speeded Acceptability Judgment (SAJ) task when they are under added processing pressure.

The current study is significant because, first, it tests both verb types in a single study. This allows a unique way of exploring S-V agreement within a single participant. Second, this study tests Persian speakers of L2 English. Persian as the L1 of the L2ers is highly inflected for both verb types. Thus, studying Persian speakers is likely to rule out the possibility that the variability might be related to an absence of similar features in the L1 as reported in some studies (e.g., Hawkins &

Chan, 1997; Franceschina, 2005). This is because features like person and number agreement have already been acquired via the L2ers' L1 before the critical period is over. Third, this is the first study applying markedness theory to the L2 processing of S-V agreement.

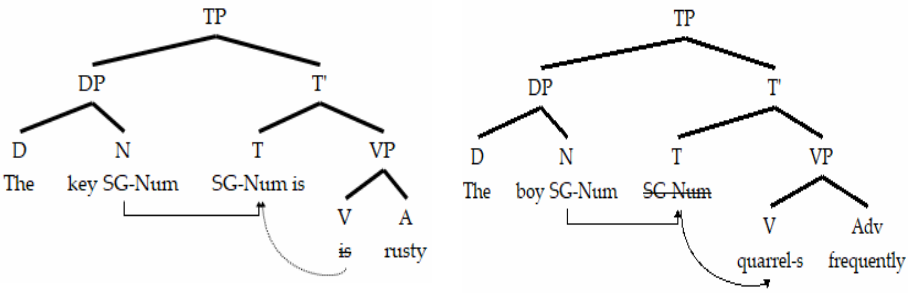
To apply the markedness theory, the present study tests the predictions of the Morphological Underspecification Hypothesis (MUH) (McCarthy, 2012; 2008) in the L2 processing of S-V agreement. As a point of departure, after presenting a minimalist account of S-V agreement, the theoretical framework of the MUH is discussed along with evidence from the L2 processing research supporting the MUH predictions.

## The Minimalist Account of S-V Agreement with Thematic Verbs and Copulas

Agreement is a computational process at the syntax-morphology interface. It is syntactic as it depends on lexical categories like N, V, etc. and involves MERGE and MOVE operations. It is morphological as it affects the forms of morphemes. Syntactically, for S-V agreement with both copulas and thematic verbs, successive applications of several MERGE operations lead to the formation of the basic skeleton in the syntactic component (Franck et al., 2006), as displayed in Figure 1 (in the tree diagrams, details are omitted for simplicity). Afterwards, the unvalued person and number features [u-Pers, u-Num] of T(ense) are valued by the already valued features of the subject phrase demonstrated with solid trace lines. Then, in the Phonetic Form (PF) component, HEAD MOVEMENT rules operate in different directions depending on the type of the verb to spell out their phonetic representations. Copulas raise to T position to receive their feature values from T. But thematic verbs stay *in situ* and are inflected via affix-hopping/lowering (Radford, 2009), as illustrated with curved trace lines for both verb types.

**Figure 1**

*Tree Diagram Displaying Raising Possibilities*




**a. Verb-raising** **b. Affix-lowering/hopping**

It should be pointed out in passing that several SLA researchers, (Ionin & Wexler, 2002; Prévost & White, 2000) suggest that, in the initial stages of learning L2 English, more efficient use of copulas than inflected thematic verbs is due to the different raising possibilities of these two verb types. That is, L2 beginners master suppletive *be* forms which raise to T but not 3rd person singular present tense affixal *–s* which lowers to T leading to a suppletive-affixal asymmetry (i.e., L2ers' easy mastery of S-V agreement with suppletive *be* forms than that with thematic verbs). If this argument is true, L2ers at the higher stages of learning should not have problems in S-V agreement with both verb types, because they should be beyond

this initial stage. However, these types of problems persist even for advanced L2ers as will be discussed later below.

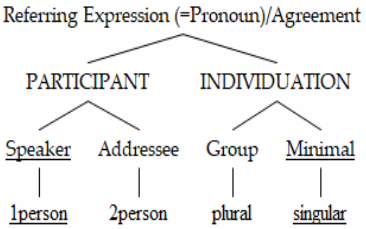
**Morphological Underspecification Hypothesis**

Using a recent theoretical framework in morphological theory, known as the Feature Geometric Hypothesis (Cowper, 2005; Harley, 1994; Harley & Ritter, 2002) McCarthy (2007; 2008; 2012) suggests the MUH to account for L2 variability in agreement features like *person*, *number, and finiteness*. For instance, the Feature Geometric Hypothesis posits that L1 acquirers pick up feature categories like person and number which are made up of feature values. These features gradually become hierarchically organised with privative values (as opposed to binary, e.g., [+plural], [−plural]) in the mental lexicon such that one member is marked or specified while the other is unmarked and thereby default or underspecified.

As illustrated in Figure 2 below, for Person/Number agreement, unmarked features (underlined forms) are realised as underspecified feature values, compared to more marked or specified features (not underlined). To contrast 1st and 2nd person, Addressee as the 2nd person is more marked than Speaker as the 1st person, i.e., 2nd person is marked relative to 1st person, which is unmarked. However, relative to 1st and 2nd person, 3rd person is assumed to be universally unmarked. That is why 3rd person is absent from the PARTICIPANT node. To contrast singular and plural number, INDIVIDUATION representing number, is an organising node encompassing its daughter nodes, namely Group ([plural]) which is marked, relative to the Minimal ([singular]) feature which is unmarked. Note that the marked or specified feature value is encoded by an additional node (i.e., the presence of Group and Addressee) while unmarked ones lack additional nodes (here they are underlined to demonstrate their absence from the mental lexicon).

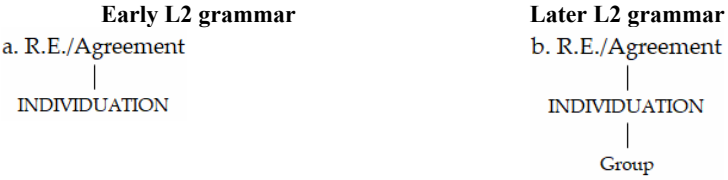
**Figure 2**

*The Feature Geometry for S-V Agreement (extracted from Harley & Ritter, 2002)*




It is postulated that marked feature values are learned later than unmarked ones because they consist of more nodes than unmarked ones. So for the developmental stages of number learning, following Harley and Ritter (2002) for the L1 grammar, McCarthy (2012, p. 34) further assumes that the early L2 grammar learns Individuation instantiating Singular in (3a) before the later L2 grammar learns Group representing plural in (3b) because Group has an additional node and more marked than Singular which is unmarked and absent from the mental lexicon.

(3)




Accordingly, under the MUH, McCarthy (2007; 2008; 2012) argues that L2 morphological errors involve a systematic substitution of unmarked (i.e., underspecified) forms as defaults across comprehension and production. For instance, McCarthy (2007) tested S-V number agreement in intermediate-to-advanced L1 English speakers of L2 Spanish (N=13) via a production task (interview). Following the Feature Geometric Hypothesis (Harley & Ritter, 2002), she found a singular-plural asymmetry in that advanced L2ers committed underspecification errors (92%) in (e.g., *Los italianos puede entender un poco "The Italians PL can 3SG understand a little (Spanish)") in which they selected singular verbs (i.e., unmarked/underspecified forms) preceded by plural subjects. This is in contrast to errors of feature clash which constituted only (8%) of L2ers' data (i.e., L2ers selected plural verbs (i.e., marked/specified forms) to substitute singular verbs preceded by the singular subjects, e.g., *he are). See more evidence for the MUH from L2ers of Spanish (López Prego & Gabriele, 2014; McCarthy, 2012) and German (Slabakova, 2009). As for the L2 processing of S-V agreement, to the best of the researcher's knowledge, there have been no studies testing the MUH. Thus, after discussing English verbs in terms of the Feature Geometric Hypothesis, evidence will be provided from the existing processing research on L2 English which seems to support the MUH.

**Feature Geometric Hypothesis: Thematic Verbs vs. Copulas of English**

Given the assumptions of the Feature Geometric Hypothesis, the marked-unmarked relations shown in Table 1 are applied to the verbs of English. In SUBJECT + COPULA BE (S-VC) dependencies, for person with participant as its feature category, non-3rd persons (participant) are marked but 3rd is universally unmarked. For number with individuation as its feature category, plural (Group) is marked but singular (Minimal) is universally unmarked. For FINITENESS in SUBJECT + THEMATIC VERB (S-VT) dependencies, following Cowper (2005), the non-finite form is unmarked relative to the finite form which is marked (for a detailed discussion of the range of markedness criteria, see Harley & Ritter, 2002).

**Table 1**

*Summary of Markedness Relations in Feature-Geometric Theory*

| Verb type | Feature category | Marked Feature value | Unmarked Feature value |
|---|---|---|---|
| Copula be | Person (PARTICIPANT) | Non-3rd (=1st or 2nd) | 3rd |
| | Number (INDIVIDUATION) | Plural (Group) | Singular (Minimal) |
| Thematic verb | FINITENESS | Finite | Nonfinite |

**Note:** This summary was taken from McCarthy, 2012, p. 33, but applied to verbs of English with some modifications.

Drawing on the Feature Geometric Hypothesis to explain L2 morphological variability, the MUH holds that "L2 errors are instances of underspecification, not

feature clash" (McCarthy, 2008, p. 467; 2012, p. 33). For concreteness, as illustrated in Table 2, for thematic verbs, errors of underspecification refer to omission errors where non-finite unmarked forms substitute finite marked forms, as in *She speak, in obligatory contexts. Feature clash occurs where an incorrectly marked form gets inserted, as in *They speaks, when such a form is not obligatory. For copulas, [singular] is universally unmarked compared to [plural] which is marked. This means that when the subject is singular and the copula be is plural [are] this is an instance of feature clash because the syntactic context changes from an unmarked form [singular subject] to a marked form of the verb [plural copula be]. In contrast, when the subject is plural and copula be is singular [is], this is an instance of underspecification because the syntactic context changes from a marked form to an unmarked form.

**Table 2**
*Error Types Based on Markedness Relations in Feature Geometric Theory*

| Verb type | Error type | Example | Predictions |
|---|---|---|---|
| Thematic verb | Underspecification Marked⇒ Unmarked | Finite ⇒ Nonfinite e.g.**She speak* | More errors with nonfinite underspecified forms (*speak*) |
| | Feature clash Unmarked⇒ Marked | Nonfinite ⇒Finite e.g.**They speaks* | Fewer errors with finite specified forms (*speaks*) |
| Copula *be* | Underspecification Marked⇒ Unmarked | Specified(Plural*NP*)⇒ Underspecified (Singular *is*) e.g. **The spoons is …* | More errors with underspecified forms (*is*) |
| | Feature clash Unmarked ⇒ Marked | Underspecified (Singular NP)⇒ Specified (Plural *are*)e.g. **The spoon are …* | Fewer errors with specified forms (*are*) |

## Evidence for the MUH from L2 Processing of English S-V Agreement

### *Thematic Verb*

According to the top part of Table 2, L2 processing studies using thematic verbs show that L2ers exhibit different patterns depending on their proficiency levels consistent with the predictions of the MUH. Whereas intermediate L2ers are not sensitive to either error type, advanced L2ers are sensitive to errors of feature clash but not to errors of underspecification. For instance, in an Event-Related Potentials (ERP) experiment, Ojima et al., (2005) investigated ERP responses to S-V agreement violations (e.g., *Turtles moves slowly vs. Turtles move slowly) in L1 Japanese L2ers of English who were either moderately (intermediate) or highly proficient (advanced). Like the NSs who were sensitive to errors of feature clash by showing a biphasic LAN-P600 pattern, the highly proficient L2ers were sensitive to them by showing a LAN (but no P600) typically associated with syntactic processing. In contrast, the moderately proficient L2ers were not sensitive by showing none of the ERP components. (see also Rossi et al., 2006) in which the NSs and the high proficiency learners (L1 Italian learners of L2 German & L1 German learners of L2 Italian) showed a LAN and a P600 effect in response to feature clashes in S-V agreement, and Armstrong et al.'s (2018) study, in which both NSs and intermediate-to-advanced Chinese L2ers of English, showed a P600 effect in response to errors of feature clash, as in The cookies taste/*tastes …).

Likewise, behavioural studies such as Wakabayashi (1997) and Sato & Felser (2010) showed that whereas advanced L2ers were not sensitive to errors of underspecification they were sensitive to those of feature clash in S-VT

dependencies. Studying L2ers' online sensitivity to S-V agreement, Wakabayashi (1997) focused on ungrammaticality caused by overuse (i.e., errors of feature clash) and omission of 3rd person singular present tense –s (errors of underspecification) by using a Self-Paced Reading (SPR) task. NSs and two groups of L2ers (advanced & intermediate Japanese L2ers of English) were tested. The results revealed that NSs were sensitive to both error types. As for L2ers, whereas the intermediate Japanese L2ers of English (JLE) were insensitive to both errors of commission/feature clash and omission/underspecification errors in number disagreement, the advanced JLEs were insensitive only to omission/ underspecification errors. Similarly, Sato and Felser (2010) investigated sensitivity to omission errors in S-V agreement vis-à-vis case violations (S-V agreement: *He frequently yawn vs. Accusative case: *He admires she) in intermediate-to-advanced L2ers of English from three typologically different L1 backgrounds (German, Japanese, Chinese) using a SAJ task. The results showed that all L2ers, independently of their L1s, were less sensitive to S-V agreement (i.e., an underspecified form like yawn) than case violations, see also McDonald, 2006, for similar findings. Summarising, in line with the MUH, for thematic verbs, these observations may suggest that morphological underspecification is more likely to be the source of variability in L2 processing of S-V agreement and proficiency seems to modulate it.

***Copula be***

According to the bottom part of Table 2, (except for Jiang's (2004) study) L2 processing studies on S-V agreement with copula be, show a singular-plural asymmetry; L2ers perform better in *singular subject NP + plural copula be configurations (errors of feature clash) than in *plural subject NP+ singular copula be ones (errors of underspecification).

Using an SPR task, Jiang (2004) examined S-V agreement in NSs and a group of Chinese intermediate L2ers. In his experiments 2 and 3, he tested S-V agreement violations in four conditions, as in The bridges to the island were about… (Subject PL + Attractor SG + Verb PL (PSP)) vs. *The bridge to the island were about… (Subject SG + Attractor SG + Verb PL (SSP)) and The bridge to the island was about… (Subject SG + Attractor SG + Verb SG (SSS)) vs. *The bridges to the island was about… (Subject PL + Attractor SG + Verb SG (PSS)). The results showed significant longer RTs at the verb and the following region for the NSs. As for the L2ers, while they also showed longer RTs at the same regions (even longer than the NSs) but their results were not significant. Note, however, that Jiang's study can be criticised for a couple of reasons. First, the comparison of PSP with SSP conditions resulted in slowdowns on the verb region for both NSs and L2ers but NSs showed only significant results in participant analysis but not item analysis. So, both groups almost converged because SSP is an instance of feature clash as the syntactic context changes from an unmarked singular subject NP to a marked plural copula be form. The comparison of SSS with PSS, however, resulted in a NS-L2er contrast. Perhaps this is because the PSS condition is an instance of underspecification error (because the syntactic context changes from a marked plural subject NP to an unmarked singular copula be form) and this kind of error is committed by the NSs, too.[1] Thus, L2ers almost performed better in SSP than in PSS showing a singular-

[1] According to the CORPUS OF CONTEMPORARY AMERICAN ENGLISH (COCA) database (Davies, 2008) configurations like *$Subject\ NP_{PL}$ + *is* (e.g., **The spoons is*), show a

plural asymmetry. Second, regarding the statistical analyses used, Jiang's study is questionable because although L1 group (NSs vs. Chinese) was an independent between-group factor, the data were analysed separately for each group. That is, by using a within-condition design, separate paired t-tests were used for each condition and each group. Consequently, it is not clear whether groups were different if a mixed design had been used.

However, in contrast to Jiang's study[1] which was claimed to show L2ers'reduced sensitivity to S-V agreement in S-VC dependencies, Tanner et al. (2012) found their native-like sensitivity. They used ERPs in a study of L2 agreement processing testing native speakers and advanced L1 Spanish L2ers of English. The critical ungrammatical items (*The key to the wooden cabinet are rusty (Subject SG + Attractor SG + Verb PL (SSP)) and (*The key to the wooden cabinets are rusty (Subject SG + Attractor PL + Verb PL (SPP)) had a singular subject and a plural verb which are instances of feature clash because the plural copula are is marked and thereby clashes with the [singular] feature of the subject, hence no processing difficulty for advanced L2ers (following McCarthy, 2007; 2008; 2012). Similarly, using eye tracking, Lim and Christianson (2015) found that both NSs and higher proficiency Korean-English L2ers were sensitive to agreement violations (The teachers who instructed the student were very strict (PSP) vs. *The teacher who instructed the student were very strict (SSP). Note that the ungrammatical critical items had singular subjects and plural copula verbs, hence these are instances of feature clash. Altogether, it can be concluded that in these studies a singular-plural asymmetry was observed; L2ers were better in singular subject NP + plural copula be configurations (errors of feature clash) than in plural subject NP+ singular copula be ones (errors of underspecification).

Summarising, the results of L2 processing studies of S-V agreement in thematic verbs and copulas can provide compelling evidence for the MUH, hence morphological underspecification is the culprit for variability in S-V agreement. Additionally, the L2 processing studies revealed the paramount role of L2ers' proficiency. Whereas moderate L2ers were not sensitive to either violation type, advanced L2ers were sensitive to marked feature values (i.e., errors of feature clash) but not to unmarked feature ones (i.e., errors of underspecification).

**This Study**

Building upon the MUH (McCarthy, 2007; 2008; 2012), the present study explores sensitivity to S-V agreement errors (underspecification & feature clash errors) in the intermediate-to-advanced L2ers and NSs of English using different verb types (copulas vs. thematic verbs). This was investigated by measuring the L2ers' reactions to errors (ungrammatical forms) in an online SAJ task. The focus is on errors because the existing research shows that L2ers might not have problems with correct forms of S-V agreement in grammatical items for which verbs are inflected accurately (Lardiere, 2007; McCarthy, 2012; 2008; Prévost & White,

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co-occurrence frequency of 0.06 (per million) words in the COCA corpus (1990-2012). Moreover, the British National Corpus shows a co-occurrence frequency of 0.20 (per million) for **Subject NP* $_{PL}$ + *is*.

[1] Chen et al. (2007) also tested Chinese L2ers using ERP components. However, as the researchers themselves pointed out, their study did not "examine the S-V agreement errors actually made by L2 learners" (p. 171), rather they studied agreement attraction for which NSs have been documented to show errors (see e.g., Pearlmutter, et al. 1999).

2000). Moreover, the SAJ task was used because processing pressure seems to be a potential factor giving rise to L2 variability (Ionin & Wexler, 2002; Prévost & White, 2000). According to the existing L2 processing research and the MUH discussed above, the following questions and predictions are explored:

Question 1: Are L2ers more sensitive to errors of feature clash than underspecification?

Prediction 1: According to the MUH, "L2 errors are instances of underspecification, not feature clash" (McCarthy, 2008, p. 467; 2012, p. 33) (cf. Table 2).

Question 2: Does proficiency modulate their sensitivity to these two error types?

Prediction 2: Proficiency is a key factor in their sensitivity to error types.

## Method

### *Instrument*

**Speeded Acceptability Judgment (SAJ) Task.** A SAJ task requires that participants react to the acceptability of stimuli as quickly and accurately as possible. Stimuli are broken into words or phrases and presented at a very high-speed rate. This task uses a Rapid Serial Visual Presentation (RSVP) mode which presents one word at a time for an exactly short period.

Insensitivity leads to higher error rates in ungrammatical items relative to sensitivity which results in lower error rates. (McElree & Griffith, 1995). This task is useful for studies exploring implicit processing (Schütze, 1996; Ellis, 2005). This is because the added time pressure in this task may make the effect of explicit knowledge or metalinguistic judgments less likely to influence L2 response behaviour. Additionally, an SAJ task is appropriate to see whether processing pressure is likely to cause L2 variability

### *Participants*

Thirty-two L1 Persian speakers of L2 English (19 males; 13 females; 1 left-handed) were recruited from among the Iranian student community at the University of Essex and Manchester. All participants had a normal or corrected-to-normal vision. All non-native participants were residents in the UK at the time of testing and, on average, had been exposed to British English for a mean of 2.39 in years. The bio-data and their mean proficiency scores as measured by the Oxford Placement Test (OPT) (Allan, 1992) are given in Table 3. The learner group scored above 65 which corresponds to the intermediate-to-advanced level on the OPT scale. This is the minimum requirement for L2ers' participation in this study.

**Table 3**

*L2ers' Bio-Data and OPT*

| | Mean | SD | Range |
|---|---|---|---|
| Age (years) | 27.28 | 3.5 | 22-34 |
| Age of onset<br>(Age of first exposure to English in years) | 11.28 | 2.29 | 6-17 |
| Length of residence (years) | 2.39 | 1.28 | 0.6-5 |
| OPT (total 100) | 79.18 | 7.47 | 65-93 |

**OPT**: Oxford Placement Test

This experiment was also administered to a control group of thirty-three NSs of English (mean age: 23.54, age range: 18-33, 21 female, 12 male) recruited from among the students of the University of Essex, who were paid a small fee for their participation.

***Materials***

In the SAJ task, participants made acceptability judgments for 106 sentences, each seven words long. Thirty-two were experimental items relevant for testing thematic verbs (N = 16) vs. copula *be* (N = 16), 16 for testing simple past tense verbs, and 58 were fillers. Out of 32 experimental items, 64 sets of 8 conditions, as in (4) and (5), were distributed in 4 lists based on a Latin Square design for each verb type totaling 128 experimental items.

Items for the thematic verb, as in (4), were made by the researcher and assessed by NSs to see if they were acceptable in English. They were twenty sentences, which were modified and reduced to 16 after NSs' recommendations. Items for the copula *be* condition, as in (5), were a modified version of Pearlmutter et al.'s (1999).[1]

| | | | |
|---|---|---|---|
| (4) | T-SSS G | The boy in the house quarrels frequently. | Thematic Verbs |
| | T-SSP U | * The boy in the house quarrel frequently. | |
| | T-PSP G | The boys in the house quarrel frequently. | |
| | T-PSS U | * The boys in the house quarrels frequently. | |
| (5) | C-SSS G | The slogan on the poster is expressive. | Copula *Be* |
| | C-SSP U | *The slogan on the poster are expressive. | |
| | C-PSP G | The slogans on the poster are expressive. | |
| | C-PSS U | *The slogans on the poster is expressive. | |

**T** = Thematic; **C** = Copula *be*; **S** = Singular; **P** = Plural; **G** = Grammatical; **U** = Ungrammatical

Each sentence consisted of a singular or a plural head NP (e.g., the boy/s) followed by a modifier PP consisting of a preposition (e.g., in) and a singular local NP (e.g., the house) which was the object of the preposition. The subject NP part of the sentence was followed by a simple present tense form of copula be or a thematic verb and an adjective or an adverb. The function of the PP modifier was to break the co-occurrence effect between adjacent subjects and verbs which might affect L2 processing of S-V agreement. For instance, according to the CORPUS OF CONTEMPORARY AMERICAN ENGLISH (COCA) database (Davies, 2008), regardless of pronoun + copula be configurations which really add more frequencies to the use of copulas, even the Subject NP SG + is configuration (e.g., the student is) alone shows a co-occurrence frequency of 12.23 (per million) words in English.

Experimental items appeared in eight different conditions that were created by manipulating grammaticality (grammatical vs. ungrammatical) and the number of the head noun (singular vs. plural), and verb type (Thematic verb vs. Copulas). Mismatching the head noun number and the verb number created ungrammatical versions. The 32 experimental items testing S-V agreement were arranged in four lists using a Latin Square Design such that each participant saw exactly one version of each item in only one condition. Past tense items and fillers each were arranged in two lists using a Latin Square Design. The experimental items (N = 32) with four lists were combined with two lists of the past tense condition (N = 16) and two lists of the fillers (N = 58) totaling 106 items. Subsequently, the order of the items was pseudo-randomised for each presentation list such that items of the same condition did not appear consecutively.

[1] The full list of experimental items is available upon request.

***Procedure***

The experiment was administered individually in a soundproof room. The participant groups (the NSs and the L2ers) were first asked to fill in a questionnaire providing their bio-data and a consent form of participation. After reading the instruction on the monitor, the participants were also given the chance to raise questions regarding the procedure, if necessary. The participants were required to judge the acceptability of the sentences presented to them on a 14-inch computer screen one word at a time. Each sentence trial started with a fixation cross displayed in the centre of the screen for 500ms. Afterwards, a sentence was presented in the centre of the computer screen in a word-by-word fashion at a rate of 400ms per word (Lago & Felser, 2018). By using the RSVP paradigm, the DMDX software (Forster & Forster, 2003) presented the words automatically replacing one another. All words appeared in white letters on a black background in Arial Font of 30 point. The participants were required to make acceptability judgments after reading the final word as quickly and as accurately as possible. They used a game-pad by pressing either 'Yes' or 'No' buttons to accept or reject the sentences. The game-pad was activated from the onset of the final word. Three breaks were offered throughout the experiment after each set of items. The experiment began with seven practice items giving no clues about its critical items. It took approximately 25-35 minutes. The L2ers were also given an OPT which almost took 50-60 minutes.

***Analysis***

For the statistical analysis, the data set was analysed using Generalised Linear Mixed Models (GLMMs) with a logistic link function and binomial variance (e.g., error rates = accurate vs. inaccurate) (Baayen, 2008; Jaeger, 2008). GLMMs were applied using R (R Development Core Team, 2017).

Following Barr, Levy, Scheepers, and Tily (2013), the initial full models consisted of all fixed factors and a maximal random structure. When any individual random variable reached a high correlation of +l or –l, it was removed from the maximal random structure. Fixed-effects were compared through contrasts between levels. Each level of a factor was contrasted to a specified reference level shown in **bold type** below. The initial full model consisted of Group (**NSs** vs. L2ers**)**, Grammaticality (**GRAMM** vs. UNGRAMM), Verb Type (**COP** vs. THEMA**),** and Head Noun (**SG** vs. PL**)**.

To avoid issues of collinearity, predictor variables were grand-mean centred. Models were first fitted to the full data set for both groups; any interaction terms were further explored by analysing data from each group separately. The model fitted to the data from the L2ers also tested whether proficiency was a significant predictor of their error rates.

For further analyses, basic decision trees were also used. Basic decision tree models are either regression tree models, appropriate to numeric response variables or conditional inference recursive classification/partitioning trees (henceforth, classification trees for short), appropriate to binary response variables. Classification trees are a simple non-parametric regression approach (drawn via ctree () function from party package in R) that partitions the data into subsets called nodes or partitions in a data-driven way (Hothorn, Hornik, & Zeileis, 2006). Their main characteristics are classifications. They make predictor variables split recursively into a set of nodes, based on the binary response values, e.g., errors (ACCURATE = 0 vs. INACCURATE = 1) in the current study. The partitions are made

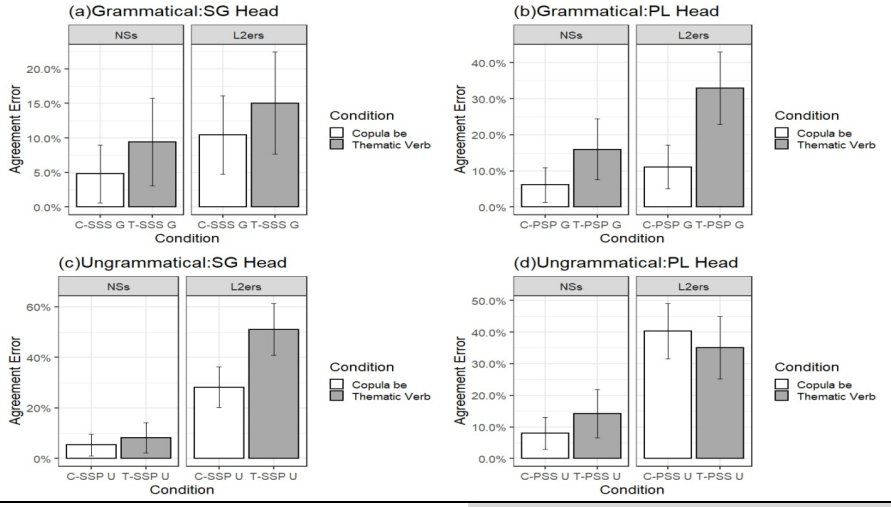
such that observations with similar error response values are grouped together. For each partition/node a constant value of error rates is predicted within that node. To partition the full data set, the algorithm starts with the root node at the top. The root node represents the full data set. The algorithm works through all predictors dividing the data into subsets where appropriate and then recursively looks into each of the subsets until further partitioning is not justified. The algorithm splits the input data into subsets that are increasingly homogeneous with the levels of the response variable. Classification trees provide more flexibility than linear regression models for modelling interactions (Blom & Baayen, 2012). Accordingly, following Blom and Baayen, (2012), along with the regression models, the current study also uses classification trees to supplement regression models in a data-driven way.

## Results

The results will be presented along with figures followed by tables. Tables list the estimated coefficients, the standard errors, Z-values along with their associated p-values for the fixed effects from the models. Figure 3 illustrates the descriptive bar graph for the mean percentage of S-V agreement errors.

**Figure 3**

*S-V Agreement with Copulas vs. Thematic Verb for both Groups (Error ars are 95% CI).*




| | | Copula *be* | | Thematic verb |
|---|---|---|---|---|
| GRAMM | C-SSS G | The slogan on the poster is expressive. | T-SSS G | The boy in the house quarrels frequently. |
| | C-PSP G | The slogans on the poster are expressive. | T-PSP G | The boys in the house quarrel frequently. |
| UNGRAMM | C-SSP U | *The slogan on the poster are expressive. | T-SSP U | *The boy in the house quarrel frequently. |
| | C-PSS U | *The slogans on the poster is expressive. | T-PSS U | *The boys in the house quarrels frequently. |

In Table 4, the coefficients for the main effects of Group, Grammaticality, and Verb Type were significant. These significant main effects indicate that the L2ers made more errors than the NSs, error rates increased in ungrammatical items relative to grammatical ones, and that error rates increased in thematic verbs compared to copulas.

The two-way interaction (Group× Grammaticality) indicates that, relative to the NSs, the L2ers displayed higher error rates in ungrammatical items than grammatical ones. However, this interaction is superseded by the four-way interaction (Group × Grammaticality × Head Noun × Verb Type) demonstrating between-verb type differences. The negative coefficient for this latter interaction reflects the fact that error rates slightly decrease in thematic verbs relative to copula be in the L2ers when the head noun is plural and the sentence is ungrammatical (cf. Panel d of Figure 3). This is in contrast to other combinations of head noun and verb type in which copula be is associated with low error rates (cf. panels a, b, & c).

**Table 4**

*Fixed-effects from generalised linear mixed model fit to data from NSs & L2ers.*

| Fixed Effects | Estimate | Std. Error | z value | Pr( > \|z\|) | |
|---|---|---|---|---|---|
| (Intercept) | -1.97488 | 0.13901 | -14.207 | < 2e-16 | *** |
| Group (L2ers) | 1.5879 | 0.18291 | 8.682 | < 2e-16 | *** |
| Grammaticality (Ungrammatical) | 0.52558 | 0.24648 | 2.132 | 0.03298 | * |
| Head Noun (PL) | 0.2782 | 0.21429 | 1.298 | 0.19421 | |
| Verb Type (THEMA) | 0.75172 | 0.25679 | 2.927 | 0.00342 | ** |
| Group (L2ers)×Grammaticality(Ungrammatical) | 1.56607 | 0.36748 | 4.262 | 2.03e-05 | *** |
| Group (L2ers)× Head Noun (PL) | -0.05052 | 0.36177 | -0.14 | 0.88893 | |
| Grammaticality (Ungrammatical) × Head Noun (PL) | -0.55496 | 0.47715 | -1.163 | 0.24479 | |
| Group (L2ers) × Verb Type (THEMA) | -0.25282 | 0.35648 | -0.709 | 0.47819 | |
| Grammaticality (Ungrammatical) × Verb Type (THEMA) | -0.48588 | 0.45854 | -1.06 | 0.28931 | |
| Head Noun (PL) ×Verb Type (THEMA) | 0.1474 | 0.44874 | 0.328 | 0.74254 | |
| Group (L2ers) ×Grammaticality (Ungrammatical) × Head Noun (PL) | -0.2522 | 0.73294 | -0.344 | 0.73078 | |
| Group (L2ers)× Grammaticality (Ungrammatical) × Verb Type (THEMA) | -0.45914 | 0.70735 | -0.649 | 0.51628 | |
| Group (L2ers)× Head Noun (PL) × Verb Type (THEMA) | -0.75603 | 0.70832 | -1.067 | 0.28581 | |
| Grammaticality (Ungrammatical) × Head Noun (PL) × Verb Type (THEMA) | -0.88689 | 0.99346 | -0.893 | 0.37201 | |
| Group (L2ers)× Grammaticality (Ungrammatical) × Head Noun (PL) × Verb Type (THEMA) | -3.13841 | 1.42522 | -2.202 | 0.02766 | * |

Formula in R: Error Rate ~ 1 + Group * Grammaticality * Head Noun * Verb Type + (1|Item) + (1+ Grammaticality * Head Noun * Verb Type |Participant)

The four-way interaction is split by Group for further analysis in Table 5 for NSs and L2ers separately. The analysis in Table 5 revealed that whereas the NSs showed no significant effects in any factors, the L2ers exhibited a different pattern. The negative coefficient for the significant main effect of proficiency shows that as proficiency increased the L2ers' error rates decreased, overall. The positive coefficient for the significant main effect of Grammaticality shows that the L2ers' error rates increased in ungrammatical items relative to grammatical ones indicating less sensitivity to ungrammatical verbs. The positive coefficient for the significant main effect of Verb Type shows that the L2ers' error rates increased in thematic verbs compared to copulas. The three-way interaction (Grammaticality × Verb Type × Head Noun) with the negative coefficient indicates that whereas errors were roughly higher in thematic verbs relative to copula be, in plural head ungrammatical sentences (panel d of Figure 3) errors were lower in thematic verbs compared to copula be. However, the significant four-way interaction (Proficiency × Grammaticality ×Verb Type× Head Noun) with the positive coefficient indicates that as proficiency increased error rates increased in thematic verbs relative to copula be in plural conditions with ungrammatical items (panel d). This means that proficiency has changed the effect of the three-way interaction such that higher proficiency L2ers detected copula be with lower error rates than thematic verbs in all four panels including panel d. In contrast, the less proficient L2ers were better in copula be than thematic verbs in all conditions except in panel d.

**Table 5**
*Fixed-Effects from Generalised Linear Mixed Model Fit to NSs & L2ers Data Separately*

| NSs (Grammatical vs. Ungrammatical) | | | | | |
|---|---|---|---|---|---|
| Fixed effects | Estimate | Std. Error | z value | Pr( > \|z\|) | |
| (Intercept) | -3.496 | 0.4167 | -8.39 | <2e-16 | *** |
| Grammaticality (Ungrammatical) | -0.3311 | 0.7579 | -0.437 | 0.662 | |
| Verb Type (THEMA) | 0.996 | 0.7139 | 1.395 | 0.163 | |
| Head Noun (PL) | 0.4941 | 0.7222 | 0.684 | 0.494 | |
| Grammaticality (Ungrammatical) × Verb Type (THEMA) | -0.1725 | 1.4875 | -0.116 | 0.908 | |
| Grammaticality (Ungrammatical) × Head Noun (PL) | 0.1567 | 1.4845 | 0.106 | 0.916 | |
| Verb Type (THEMA) × Head Noun (PL) | 0.7199 | 1.3468 | 0.535 | 0.593 | |
| Grammaticality (Ungrammatical) × Verb Type (THEMA) × Head Noun (PL) | -0.1382 | 2.9571 | -0.047 | 0.963 | |
| Formula in R: ErrorRate~1 + Grammaticality * Head Noun * Verb Type+(1 \|Item)+(1+ Head Noun * Grammaticality * Verb Type \|Participant) | | | | | |

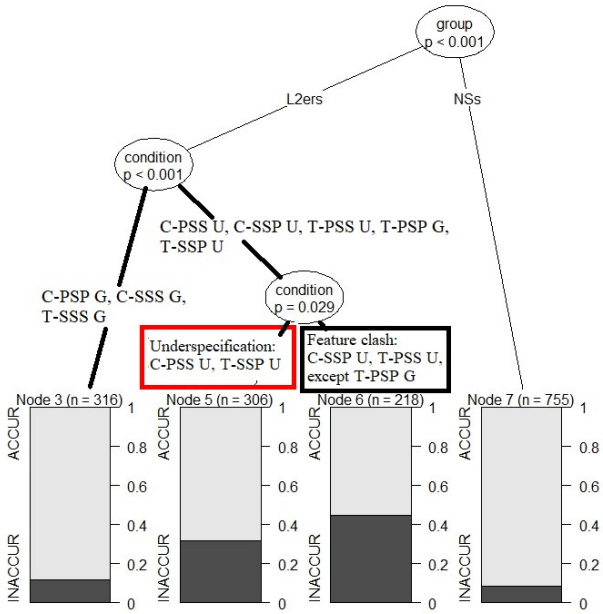
| L2ers (Grammatical vs. Ungrammatical) | | | | | |
|---|---|---|---|---|---|
| Fixed effects | Estimate | Std. Error | z value | Pr( > \|z\|) | |
| (Intercept) | -1.32106 | 0.137057 | -9.639 | < 2e-16 | *** |
| Proficiency | -0.06749 | 0.015507 | -4.352 | 1.35e-05 | *** |
| Grammaticality (Ungrammatical) | 1.474526 | 0.327932 | 4.496 | 6.91e-06 | *** |
| Verb Type (THEMA) | 0.725903 | 0.268478 | 2.704 | 0.0068 | ** |
| Head Noun (PL) | 0.168137 | 0.270602 | 0.621 | 0.5343 | |
| Proficiency × Grammaticality (Ungrammatical) | -0.05358 | 0.04052 | -1.322 | 0.1860 | |
| Proficiency × Verb Type (THEMA) | 0.005477 | 0.030582 | 0.179 | 0.8578 | |
| Grammaticality (Ungrammatical) × Verb Type (THEMA) | -0.76416 | 0.578925 | -1.32 | 0.1868 | |
| Proficiency × Head Noun (PL) | 0.040031 | 0.032385 | 1.236 | 0.2164 | |
| Grammaticality (Ungrammatical) × Head Noun (PL) | -0.4895 | 0.55575 | -0.881 | 0.3784 | |
| Verb Type (THEMA) × Head Noun (PL) | -0.1498 | 0.535856 | -0.28 | 0.7798 | |
| Proficiency × Grammaticality (Ungrammatical) × Verb Type (THEMA) | -0.04363 | 0.069573 | -0.627 | 0.5306 | |
| Proficiency ×Grammaticality (Ungrammatical) × Head Noun (PL) | -0.0441 | 0.068015 | -0.648 | 0.5167 | |
| Proficiency × Verb Type (THEMA) × Head Noun (PL) | 0.049604 | 0.065057 | 0.762 | 0.4457 | |
| Grammaticality (Ungrammatical) × Verb Type (THEMA) × Head Noun (PL) | -2.56741 | 1.149341 | -2.234 | 0.0255 | * |
| Proficiency × Grammaticality (Ungrammatical) × Verb Type (THEMA) × Head Noun (PL) | 0.280833 | 0.141751 | 1.981 | 0.0475 | * |
| Formula in R: ErrorRate~1 + Proficiency * Grammaticality * Head Noun * Verb Type+(1 \|Item)+(1+ Head Noun * Grammaticality * Verb Type \|Participant) | | | | | |

To locate the loci of S-V agreement errors in participant groups, in a data-driven way, a binary recursive partitioning (the classification tree in Figure 4) was run to see which pairs among the 8 conditions ("C-PSS U" "C-PSP G" "C-SSP U"

"C-SSS G" "T-PSS U" "T-PSP G" "T-SSP U" "T-SSS G") are difficult for L2ers. Figure 4 depicts interactions between Group and Condition. Starting at the top of the tree, which represents the full data set, we observe that a first partition was made based on Group. The NSs were different from the L2ers in that they showed no difficulty in any conditions (around less than 10% error). Within the L2ers' data, a second partition was made based on Condition. They reacted differentially to ungrammatical conditions (C-PSS U, C-SSP U, T-PSS U, T-SSP U), except for T-PSP G, and grammatical conditions (C-PSP G, C-SSS G & T-SSS G). They were less accurate in the former than in the latter. Within the ungrammatical conditions, a third partition was made: The L2ers performed worse in copula be (C-PSS U) and in thematic verbs (T-SSP U) (around less than 45%) than in copula be (C-SSP) and in thematic verbs (T-PSS U) (around less than 30%). T-PSP G seems to be an exception in the latter category.

**Figure 4**

*Classification Tree Predicting Error Rates in S-VA Agreement with Copulas and Thematic Verbs for both Groups*



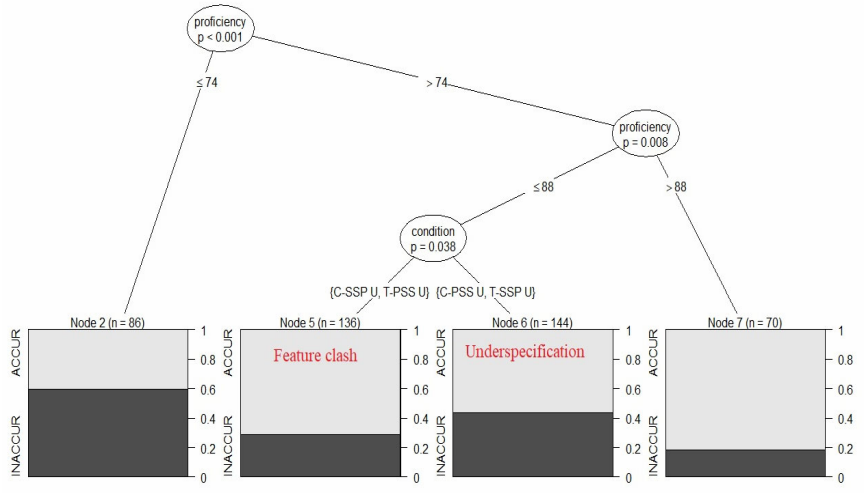

| | | Thematic verb | | Copula *be* |
|---|---|---|---|---|
| GRAMM | T-SSS G | The boy in the house quarrels frequently. | C-SSS G | The slogan on the poster is expressive. |
| | T-PSP G | The boys in the house quarrel frequently. | C-PSP G | The slogans on the poster are expressive. |
| UNGRAMM | T-SSP U | *The boy in the house quarrel frequently. | C-SSP U | *The slogan on the poster are expressive. |
| | T-PSS U | *The boys in the house quarrels frequently. | C-PSS U | *The slogans on the poster is expressive. |

The effect of proficiency is further investigated by running a binary recursive partitioning (the classification tree in Figure 5) to see how proficiency affects the *ungrammatical* conditions (agreement violations). Note that the binary recursive partitioning (Figure 4) showed that L2ers did not show difficulty in *grammatical* conditions.

As Figure 5 shows, the L2ers who scored below 74 (= intermediate L2ers) did not make a difference between conditions; they were generally worse in all conditions than those who scored above 74 (above-74 group). The above-74 group was further divided into two subgroups. Those who scored within the 74-88 range (= advanced L2ers) showed differential sensitivity to ungrammatical conditions, but those scored above 88 (= very advanced L2ers) did not show difficulty in these conditions (only around 10% errors). The 74-88 (advanced) group made worse judgment decisions in (C-PSS U) and (T-SSP U) (around less than 45%) than in C-SSP U and T-PSS U (around less than 30%).

**Figure 5**

*Classification Tree Predicting Error Rates in S-V Agreement with Copulas and Thematic Verbs for L2ers, Proficiency Effect*




| | | Thematic verb | | Copula *be* |
|---|---|---|---|---|
| UNGRAMM | T-SSP U | *The boy in the house quarrel frequently. | C-SSP U | *The slogan on the poster are expressive. |
| | T-PSS U | *The boys in the house quarrels frequently. | C-PSS U | *The slogans on the poster is expressive. |

## Summary

With two questions, this study explored L2ers' morphological sources of difficulty in S-V agreement with different verb types (copulas vs. thematic verbs) when participants were under processing pressure: 1. Are L2ers more sensitive to errors of feature clash than underspecification? 2. Does proficiency modulate their sensitivity to these error types? The results revealed that the NSs did not have any problems with S-V agreement in all configurations of both verb types. As for L2ers, there was a significant difference between L2 proficiency subgroups (intermediate,

advanced & very advanced) as exhibited in Table 6.

a. The *intermediate* L2ers were not sensitive to errors of underspecification nor errors of feature clash.

c. The *advanced* L2ers were sensitive to errors of feature clash but not to errors of underspecification.

d. The *very advanced* L2ers converged on the NSs in exhibiting a native-like performance; they were sensitive to both error types.

**Table 6**
*Effect of Proficiency on L2ers' Sensitivity to Errors.*

| | | Intermediate | Advanced | Very advanced |
|---|---|---|---|---|
| Sensitivity to error type | Feature clash | - | + | + |
| | Underspecification | - | - | + |
| Decreased sensitivity = - ; Increased sensitivity = + | | | | |

## Discussion

Due to the effect of proficiency on the L2ers' sensitivity to agreement errors, the detailed effect of proficiency is discussed in two sections: *intermediate vs. very advanced* and *advanced*.

### *Intermediate vs. Very Advanced L2ers*

The above proficiency levels, shown in Table 6, reveal two opposite ends in L2ers' sensitivity to S-V agreement; whereas the *intermediate* L2ers were not sensitive to either error type (underspecification & feature clash), the *very advanced* L2ers were sensitive to both. The intermediate L2ers' *in*sensitivity to both error types is consistent with L2 processing research (e.g., Ojima et al., 2005; Wakabayashi, 1997) in which intermediate L2ers were not sensitive to errors of feature clash. As for the very advanced L2ers, these observations are consistent with L2 processing research showing native-like performance in highly proficient L2ers (e.g., Armstrong et al., 2018; Rossi et al., 2006; Tanner et al., 2012).

### *Advanced L2ers*

The advanced L2ers demonstrated the omission-commission asymmetry in thematic verbs and the singular-plural asymmetry in copulas. This means that they were more sensitive to errors of feature clash than errors of underspecification in both verb types.

**Thematic Verbs: The Omission-Commission Asymmetry.** Consistent with the omission-commission asymmetry in thematic verbs, high proficiency L2ers were sensitive to errors of feature clash, as in **Turtles moves slowly*, observed in Ojima et al. (2005) and Armstrong, Bulkes, and Tanner (2018). Likewise, in Wakabayashi's (1997) study, L1 Japanese advanced L2ers of English showed sensitivity to the ungrammatical condition containing errors of feature clash (i.e., overuse condition), as in *The teacher thinks the students like/*likes discussions …*. In contrast, high proficiency L2ers were not sensitive to errors of underspecification in Sato and Felser's (2010) (**She seriously agree*) and Wakabayashi's (1997) studies. This may indicate that advanced proficiency L2ers' response pattern diverged from NSs' when thematic verbs were underspecified default forms.

The above observation is consistent with the prediction of the MUH regarding the omission-commission asymmetry. Likewise, the findings of the

current study support the predictions of the MUH that proficiency is a key factor in enhancing L2ers' ability to be sensitive to errors of feature clash. That is, L2ers at the advanced but not the intermediate levels are sensitive to errors of feature clash.

**Copula *be*: The Singular-Plural Asymmetry.** Several recent SLA studies showed such a singular-plural asymmetry in intermediate-to-advanced L2ers of L2 Spanish (McCarthy, 2007; 2008; 2012). Additionally, for L2 English several studies (Jiang, 2004; Lim & Christianson, 2015; Tanner et al., 2012) showed that L2ers did not have difficulty when critical items involved *plural marked are*. Thus, L2ers in the current study displayed the same singular-plural asymmetry, observed in the previous studies, despite the presence of intervening elements between subjects and verbs. The singular-plural asymmetry in L2ers' data is consistent with the MUH following the notion of unmarkedness in terms of the Feature Geometric Hypothesis.

In sum, while the intermediate L2ers were not sensitive to either error type, the very advanced L2ers performed at the near-native level. As for the advanced L2ers, they were more sensitive to errors of feature clash than to those of underspecification. As a conclusion, it may be maintained that even though L2ers are likely to have problems with errors of underspecification more than errors of feature clash, proficiency seems to be a key factor modulating L2ers' errors with S-V agreement.

***A Representational Deficit in Syntax or Morphology?***

The presence of the omission-commission and singular-plural asymmetries in thematic verbs and copulas respectively in L2ers' data may indicate a representational deficit in morphology but not syntax due to the following reasons. First, had the L2 variability been due to the different syntactic raising possibilities between these verb types (cf. Figure 1), it should have led to a suppletive-affixal asymmetry, but it did not. Second, since it is a representational difference between morphological features in geometric hypothesis's terms (Harley & Ritter, 2002) which accounts for the discrepancy in error rates for both verb types, this shows a representational deficit in morphology but not syntax. Specifically, since the underspecified forms have simpler morphological representations than specified ones, they are used as defaults irrespective of their syntactic raising possibilities. Third, as McCarthy (2008) correctly argued, SLA research shows that morphological deficits may not necessarily depend on syntactic ones. For instance, Lardiere (2007) showed that Patty, an L1 Chinese L2ers of L2 English, produces morphological errors (3rd person singular present tense –s and regular past tense –ed) after many years of immersion even though she has long since successfully acquired the corresponding syntactic features. Fourth, since in the reading-based task in this study which requires a bottom-up encoding, lexical forms are temporarily processed sooner than their corresponding abstract syntactic features, morphological effects must have been more influential than syntactic effects in comprehension compared to production tasks, hence this can be further evidence for a morphological deficit but not a syntactic one. Finally, even frequency may not account for the singular-plural asymmetry observed in S-V agreement with copulas because L2ers performed better in *singular subject NP + plural copula be configurations (errors of feature clash) than in *plural subject NP+ singular copula be ones (errors of underspecification). This performance profile is against the corpus data which demonstrate that "the token frequency of 'is' is much larger than that of 'are' in NSs' spoken English" (Safaie, 2015, p. 85). For instance, according to the

COCA database (Davies, 2008), the Subject NP $_{SG}$ + is configuration (e.g., the student is) demonstrates a co-occurrence frequency of 12.23 (per million) words in English. By contrast, the Subject NP $_{PL}$ + are configuration (e.g., the students are) shows a co-occurrence frequency of 0.18 (per million) words in the corpus. This shows that configurations with the singular copula be (i.e., Subject NP $_{SG}$ + is) are even more frequent in English than its plural form (i.e., Subject NP $_{PL}$ + are). Accordingly, had frequency impacted L2ers' performance profiles, L2ers should have exhibited stronger sensitivity to is (the higher frequency forms) than are (the lower frequency ones), but they did not. Similarly, Safaie (2020, 2021) also found anti-frequency effects in high proficiency L2ers' reactions to ungrammatical English regular past tense forms of high-frequency relative to low-frequency ones (i.e., L2ers performed better in detecting ungrammatical forms of low-frequency regular verbs than high-frequency ones).

***Proficiency Effect***

Proficiency led to the formation of three subgroups: *intermediate*, *advanced,* and *very advanced* L2ers who performed differently. Assuming that "L2 speakers' representations are, in some cases and particularly at lower proficiency levels, deficient" (McCarthy, 2008, p. 483) we may expect variability across proficiency levels. Here, I agree with McCarthy (2008) that the effect of different proficiency levels may show that some L2ers, presumably the intermediate ones in the current study may lack the dependent feature [plural] in their geometries, whereas others, presumably the higher-proficiency ones, may have it. Thus, before acquiring [plural], *intermediate* L2ers' geometries may not instantiate feature asymmetry. Accordingly, at this level, errors are bidirectional as neither singular nor plural is specified, hence errors of underspecification are expected in both directions. In contrast, since the *advanced* ones have already acquired the marked feature [plural], a feature asymmetry causes unidirectional errors (McCarthy, 2008). However, the *very advanced* group did not show difficulty in detecting either error type and behaved like NSs. That is because these L2ers have already acquired the feature asymmetries. But they must also have gained high control over using feature asymmetries as like as NSs, where needed. More specifically, since the GAJ task involved detection of the agreement violations the *very advanced* L2ers must have developed enough control over their feature asymmetries such that they do not allow errors of underspecification nor those of feature clash to occur.

**Conclusion and Pedagogical Implications**

This study demonstrated morphological properties of L2 errors in S-V agreement. These properties support the MUH which relates L2 variability to a representational deficit in morphology claiming that L2 errors involve systematic substitutions of unmarked forms as defaults in both comprehension and production. That is because L2 errors were driven by systematic variations in morphological markedness under the Feature Geometric Hypothesis (Harley & Ritter, 2002). This theory considers nonfinite thematic verbs and the third person singular form of copula *be* as unmarked or default (underspecified), hence L2ers' reduced sensitivity to errors of underspecification. However, finite thematic verbs and the third person plural form of copula *be* are considered as marked (specified), hence L2ers' increased sensitivity to errors of feature clash. Consequently, L2 variability is a deficit in morphological representations (but not syntactic ones) where unmarked

forms substitute marked forms. Moreover, proficiency plays a key role in developing morphological competence such that, compared to lower proficiency L2ers, higher proficiency ones become sensitive to both marked and unmarked forms.

The least implication for language learning is that L2ers may benefit from a morphologically-oriented approach to language learning more than syntactically-oriented approaches focusing on grammatical accuracy. That is because the syntactic aspect of S-V agreement like hierarchical feature checking is, perhaps, a part of universal principles governing human cognition which may not need to be the centre of instruction. More importantly, the different effects of proficiency levels on L2ers' sensitivity to S-V agreement errors may demonstrate a developmental pattern of language learning more or less similar to the L1 language acquisition pattern. This is because the results of this study along with the existing research were comparable with the developmental pattern of feature geometries in L1 acquisition.

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