Native Language Influence During Second Language Acquisition:
A Large-Scale Learner Corpus Analysis

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Abstract

Learners' interlanguage is affected by their native language (L1) during second language (L2) acquisition. Current literature focuses on narrow samples, necessitating a large-scale study of the topic. The present study uses a corpus of over 133,000 texts, composed by nearly 38,000 learners of English as foreign language, representing seven different L1s, and all L2 proficiency levels. The effects of the structural relationship between learners' L1 and the target L2 were examined. Overall, there was significant variation, as both structural similarities and differences could either facilitate acquisition, hinder it, or have no significant effect.

1. Introduction

Learners' interlanguage is affected by their native language (L1) during second language (L2) acquisition, and this crosslinguistic influence depends on the structural relationship between the two languages. L1 influence occurs primarily due to transfer of structures from the L1 to the L2. Transfer which facilitates acquisition is referred to as *positive*, and has been found to occur primarily in cases where structure is identical or similar for both languages. Conversely, transfer which hinders acquisition is referred to as *negative*, and has been found to occur primarily in cases where the languages are dissimilar (Benson, 2002; Ellis, 2008; Jarvis, 2015; Odlin, 1989, 2003; Ringbom, 1992; Tolentino & Tokowicz, 2011).

Previous studies on the subject focused on narrow samples, in terms of L1s examined and the range of participants' L2 proficiencies (e.g. Cebrian, 2000; Lemhöfer, Schriefers, & Hanique, 2010; Sönmez & Griffiths, 2015). This is exemplified by Darus and Ching (2009), who examined students of English as an L2, and who state that: "This study is limited to the written work of 70 essays of Form One Chinese students… Therefore, the study will not be able to give conclusive evidence regarding other Form One Chinese students from other proficiency levels." (p. 252).

A viable way to circumvent this issue are learner corpora, which are collections of texts produced by language learners (Ghadessy, Henry, & Roseberry, 2001; Granger & Leech, 2014; McEnery, Xiao, & Tono, 2006). These corpora already play a role in L1 transfer research, though many still focus on a narrow scope, similarly to studies using different samples (e.g. Borin & Prütz, 2004; Crompton, 2011; Laufer & Waldman, 2011). The present study provides a wider analysis of the topic, which includes the comparison of learners with varied linguistic backgrounds and abilities. It does this by using a large-scale learner corpus called the Education-First Cambridge Open Language Database (EFCAMDAT), which contains over 550,00 texts, produced by nearly 85,000 learners of English as a foreign language during their studies.

1.1. The corpus

The EFCAMDAT was developed at the Department of Theoretical and Applied Linguistics at the University of Cambridge, in a collaboration with Education First, an international education company (Geertzen, Alexopoulou, Baker, Jiang, & Korhonen, 2013). The database consists of essays on a variety of topics, composed by English learners at EF's online school. In the school, learners first undertake a placement test to determine their L2 proficiency level. The school spans 16 levels, which align with language proficiency standards such as the Common European Framework of Reference for languages (CEFR). Each level is composed of eight units; at the end of each unit, the learner writes an essay which is graded by a language teacher. A passing grade is required in order to proceed to the next unit. Teachers also provide feedback using standardized error tags, which cover concepts such as punctuation, grammar, and spelling.

2. Methodology

2.1. Sample

Since the EFCAMDAT only contains metadata about learners' nationality and English proficiency, learners' L1 was approximated based on their nationality, as in previous studies (Geertzen, Alexopoulou, & Korhonen, 2014; Jiang et al., 2014). Texts from the 10 best-represented nationalities were used, and of these, 3 nationalities where under 90% of the population speaks a single L1 were excluded: Chinese, Saudi Arabian, and Taiwanese (Lewis, Simons, & Fennig, 2015). The remaining L1s are listed in table 1.

Table 1. *L1s in sample*

Native language	Prevalence as L1	Number of texts	Number of learners
French	93%	8,376 (6.3%)	2,680 (7.1%)
German	90%	10,793 (8.1%)	3,312 (8.7%)
Italian	95%	7,928 (6.0%)	2,464 (6.5%)
Japanese	99%	4,038 (3.0%)	1,204 (3.2%)
Portuguese	95%	70,185 (52.7%)	19,286 (50.8%)
Russian	95%	16,148 (12.1%)	4,881 (12.8%)
Spanish	93%	15,632 (11.7%)	4,165 (11.0%)
Total	-	133,100	37,992

Prevalence per L1 was calculated per nationality. Nationality for Portuguese is Brazilian; nationality for Spanish is Mexican. Prevalence for French, German, and Italian from Special Eurobarometer 243, 2006; for Spanish from The World Factbook, 2015. Japanese, Portuguese, and Russian calculated from Lewis et al. (2015).

Of the 16 English proficiency levels in the database, texts from levels 1-15 were used; level 16 was excluded due to a limited number of texts. Table 2 contains the number of texts in each proficiency level, and the corresponding CEFR rankings.

Table 2. *L2 proficiency levels in sample*

Original levels	CEFR level	Number of texts
1-3	A1	65,424 (49.2%)
4-6	A2	39,637 (29.8%)
7-9	B1	19,335 (14.5%)
10-12	B2	6,992 (5.3%)
13-15	C1	1,712 (1.3%)

2.2. Structural similarity

The structural similarity between the different L1s and the target L2 was quantified based on relevant linguistic features for each error. The features and their respective values are extracted from the World Atlas of Language Structures (WALS), a database of structural properties of various languages, gathered by linguists from descriptive materials, (Biberauer, Holmberg, & Roberts, 2014; Dryer & Haspelmath, 2013). The value of each feature for each L1 was categorized as *similar* if the L1 had the same value for that feature as did English, as *different* if the L1 had a different value for that feature than English, and as *absent* if the feature existed in English, but not in the L1. For example, the type of indefinite articles in the language is a feature in the case of article errors. English has indefinite articles which are distinct from the lexeme for 'one'; Japanese has the same type of indefinite articles, while Portuguese, Spanish, German, French and Italian have a different type of indefinite article, and Russian does not have indefinite articles at all. The appendix contains some notes regarding the analysis of features in the study.

2.3. Error selection

The EFCAMDAT currently contains error annotations for ~36% of texts. Table 3 shows the 23 standardized error tags.

Table 3. *Error annotations in the EFCAMDAT*

Symbol	Error type	Symbol	Error type
x >> y	Change from x to y	PH	Phraseology
AG	Agreement	PL	Plural
AR	Article	PO	Possessive
CO	Combine sentences	PR	Preposition
C	Capitalization	PS	Part of speech
D	Delete	PU	Punctuation
EX	Expression of idiom	SI	Singular
HL	Highlight	SP	Spelling
I(x)	Insert x	VT	Verb tense
MW	Missing word	WC	Word choice
NS	New sentence	WO	Word order
NSW	No such word		

The convention was to use the most specific annotation possible; in the case of a plurality error, for example, this means using the 'plural' annotation in place of the 'agreement' annotation. However, no information is available regarding, for example, when an 'insert x' annotation would be used as opposed to a 'missing word' annotation (Geertzen et al., 2013). Furthermore, interrater and intrarater reliability rates for the error annotations are not available, although the annotation process itself is standardized.

The study examined errors which could be matched with a set of related linguistic features, whose values could be compared between the different L1s and English, the target L2. As such, 14 errors were excluded because they are not related to specific linguistic features (e.g. 'insert x' and 'missing word'). Preposition errors were excluded because features which relate to prepositions in the WALS are under the 'word order' category, and such errors were marked using the 'word order' error tag. In addition, the 'plural' and 'singular' error tags were consolidated into a single category ('plurality'), leaving a total of six errors in the final analysis:

i. *Article errors*- cases where the learner either did not use a necessary article, as in "I bought car", or used an incorrect article, as in "I have the great mom".
ii. *Plurality errors*- incorrect usage of plurality markings, such as "I bought a cars", or missing markings, such as "I bought two car".
iii. *Agreement errors*- cases such as "I walks a lot".
iv. *Word order errors*- cases such as "I a bird saw".
v. *Verb tense errors*- using incorrect verb tenses, as in "I will bought a car" or "I liked will buy cars".
vi. *Possessive errors*- incorrect or missing possessive markings, such as "My dad boat is white".

2.4. Data analysis

The analysis focused on learners' error patterns, and specifically on how many errors of each type they make per 100 words of writing, a frequently-used metric in second language acquisition (SLA) research (for examples of studies which utilize it, see Chandler, 2003; Kovac, 2011; Polio, 1997).

A weighted, multivariate analysis of variance (MANOVA) was used to check how learners' L1 affected the rate of errors per words. The weighing controlled for the difference in the number of texts for each L1, and for each L2 proficiency level. This was accomplished by assigning a weight to each text, which was equal to its proportion out of the total number of texts from that L1 at that proficiency level. In addition, in order to account for the large number of Portuguese texts in the sample, a random 25% sample of these texts was selected for the analysis, prior to the weighing. This was followed by weighted analyses of variance (ANOVAs), to determine the influence of L1 on each error type. Then, estimated marginal means, which were adjusted for the weighing, were calculated for the error rates for each L1. Pairwise comparisons between the L1s were performed, in order to determine the significance of the differences in error rates.

Error rates were plotted for each L1 across learners' L2 proficiency levels, after these levels were grouped by their corresponding CEFR ranking. In addition, Spearman's rho correlation coefficient (r_s) was calculated between the percent of L1 features which were similar, different, or absent in comparison with English for each error type, and the error rates for that error. All tests were two-tailed and Bonferroni-adjusted, and this adjustment accounts for the fact that in the full analysis of the data, error proportion out of total errors was examined as a second metric of error rates.

3. Results

The MANOVA showed a significant effect of learners' L1 on their L2 error rates overall ($F_{36,\ 327572}$ = 96.443, p < .001, Wilk's $\varLambda$ = .955).

3.1. Article errors

The ANOVA showed a significant effect of L1 on article errors per word ($F_{6,80455}$ = 425.501, p < .001, η^2 = 0.033). In addition, there was a correlation between article errors per word and the percent of features which were similar (r_s= -.136, p < .001), different (r_s = -.188, p < .001), or absent (r_s = .190, p < .001). The results of this analysis are summarized in table 4 and figure 1.

Table 4. *Article errors: rates and relevant features*

L1	Feature Values (%)			Errors per 100 words
	Similar	Different	Absent	Mean (SE)
French	50	50	0	0.534 (0.015)
German	50	50	0	0.384 (0.015)
Italian	50	50	0	0.543 (0.014)
Japanese	50	0	50	1.069 (0.014)
Portuguese	50	50	0	0.572 (0.015)
Russian	0	0	100	1.135 (0.015)
Spanish	50	50	0	0.448 (0.015)

All differences in errors per words were statistically significant (p<.05 following Bonferroni adjustment) except for French-Italian, French-Portuguese, German-Spanish and Italian-Portuguese.
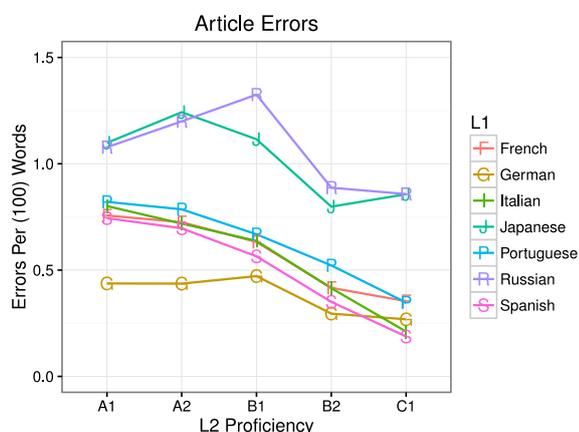

Figure 1. *Article errors rates*

3.2. Plurality errors

The ANOVA showed a significant effect of L1 on plurality errors per word ($F_{6,80455}$ = 78.379, p < .001, η^2 = 0.006). In addition, there was a correlation between plurality errors per word and the percent of features which were similar (r_s= -.036, p < .001) or different (r_s = .036, p < .001). The correlation with 'absent' features could not be calculated since there were no such features for plurality, meaning that similar/feature correlations had an equal but inverse effect, and the same was also true for possession and word order errors. The results of this analysis are summarized in table 5 and figure 2.

Table 5. *Plurality errors: rates and relevant features*

L1	Feature Values (%)			Errors per 100 words
	Similar	Different	Absent	Mean (SE)
French	75	25	0	0.340 (0.010)
German	75	25	0	0.174 (0.010)
Italian	100	0	0	0.299 (0.009)
Japanese	25	75	0	0.411 (0.009)
Portuguese	100	0	0	0.234 (0.010)
Russian	75	25	0	0.198 (0.010)
Spanish	75	25	0	0.223 (0.010)

All differences in errors per words were statistically significant (p<.05 following Bonferroni adjustment) except for French-Italian, German-Russian, Portuguese-Russian, Portuguese-Spanish, and Russian-Spanish.
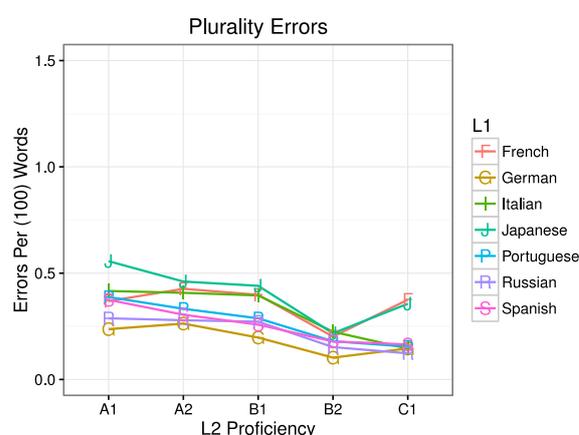

Figure 2. *Plurality errors rates*

3.3. Agreement errors

The ANOVA showed a significant effect of L1 on agreement errors per word ($F_{6,80455}$ = 11.88, p < .001, η^2 = 0.001). In addition, there was a correlation between agreement errors per word and the percent of features which were similar (r_s = .021, p < .001), different (r_s = -.024, p < .001), or absent (r_s = -.030, p < .001). The results of this analysis are summarized in table 6 and figure 3.

Table 6. *Agreement errors: rates and relevant features*

L1	Feature Values (%)			Errors per 100 words
	Similar	Different	Absent	Mean (SE)
French	59	35	6	0.181 (0.008)
German	59	41	0	0.140 (0.008)
Italian [a]	-	-	-	0.162 (0.007)
Japanese	21	50	29	0.144 (0.007)
Portuguese [a]	-	-	-	0.198 (0.008)
Russian	53	47	0	0.185 (0.008)
Spanish	53	47	0	0.208 (0.008)

[a] Portuguese and Italian were excluded from the analysis in this case due to missing feature values, as explained in the appendix.

All differences in errors per words were *not* statistically significant (p>.05 following Bonferroni adjustment), except for: French-German, French-Japanese, German-Portuguese, German-Russian, German-Spanish, Italian-Portuguese, Italian-Spanish, Japanese-Portuguese, Japanese-Russian, and Japanese-Spanish.
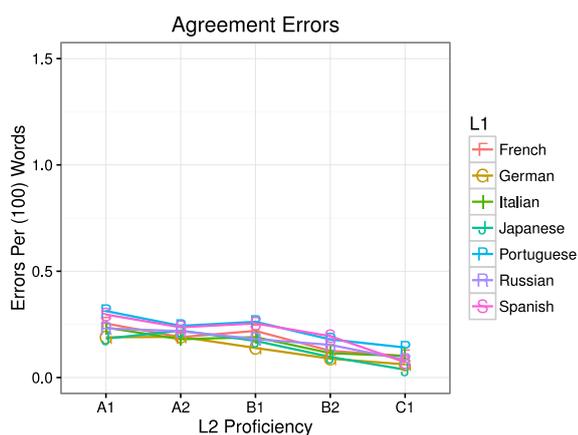
Figure 3. *Agreement errors rates*

3.4. Word order errors

The ANOVAs showed that there was a significant effect of L1 on word order errors per word ($F_{6,80455} = 19.443$, $p < .001$, $\eta^2 = 0.002$). In addition, there was a correlation between word order errors per word and the percent of features which were similar ($r_s = .032$, $p < .001$) or different ($r_s = -.032$, $p < .001$). The results of this analysis are summarized in table 7 and figure 4.

Table 7. *Word order errors: rates and relevant features*

L1	Feature Values (%)			Errors per 100 words
	Similar	Different	Absent	Mean (SE)
French	74	26	0	0.158 (0.010)
German	53	47	0	0.116 (0.009)
Italian	76	24	0	0.221 (0.009)
Japanese	28	72	0	0.111 (0.009)
Portuguese	73	27	0	0.126 (0.010)
Russian	94	6	0	0.115 (0.010)
Spanish	79	21	0	0.149 (0.009)

All differences in errors per words were not statistically significant ($p>.05$ following Bonferroni adjustment), except for the difference between Italian and the other L1s, as well as: French-German, French-Japanese, and French-Russian.
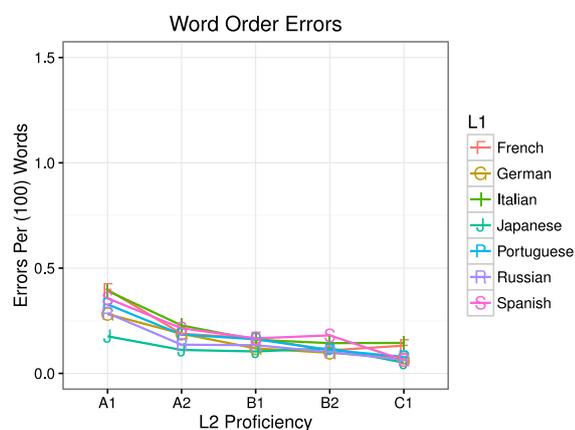

Figure 4. *Word order errors rates*

3.5. Verb tense errors

The ANOVAs showed a significant effect of L1 on verb tense errors per word ($F_{6,80455} = 15.903$, $p < .001$, $\eta^2 = 0.001$). There was no statistically significant correlation between verb tense errors per word, and the percent of L1 features which were similar, different, or absent. The results of this analysis are summarized in table 8 and figure 5.

Table 8. *Verb tense errors: rates and relevant features*

L1	Feature Values (%)			Errors per 100 words
	Similar	Different	Absent	Mean (SE)
French	50	50	0	0.414 (0.012)
German	100	0	0	0.352 (0.012)
Italian [a]	-	-	-	0.298 (0.011)
Japanese	67	0	33	0.38 (0.011)
Portuguese	75	0	25	0.431 (0.013)
Russian	50	33	17	0.327 (0.013)
Spanish	50	50	0	0.399 (0.012)

[a] Italian was excluded from the analysis in this case due to missing feature values, as explained in the appendix.
All differences in errors per words were statistically significant ($p<.05$ following Bonferroni adjustment) except for French-Japanese, French-Portuguese, French-Spanish, German-Japanese, German-Russian, German-Spanish, Italian-Russian, Japanese-Portuguese, Japanese-Spanish, and Portuguese-Spanish.
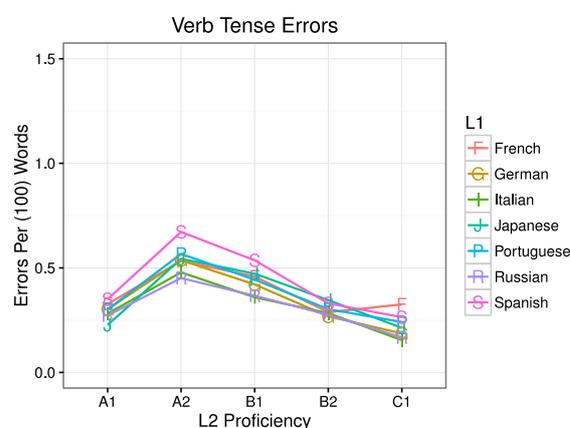

Figure 5. *Verb tense errors rates*
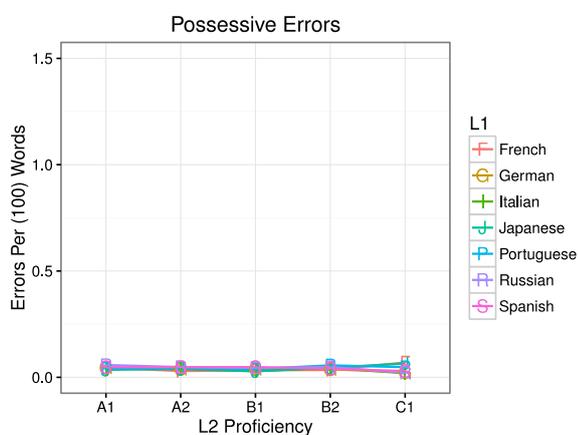
3.6. Possessive errors

The ANOVA showed a significant effect of L1 on possession errors per word ($F_{6,80455} = 17.348$, $p < .001$, $\eta^2 = 0.001$). There was no statistically significant correlation between possession errors per word, and the percent of L1 features which were similar or different. The results of this analysis are summarized in table 9 and figure 6.

Table 9. *Possessive errors: rates and relevant features*

L1	Feature Values (%)			Errors per 100 words
	Similar	Different	Absent	Mean (SE)
French	100	0	0	0.041 (0.003)
German	100	0	0	0.040 (0.003)
Italian [a]	-	-	-	0.037 (0.003)
Japanese	100	0	0	0.071 (0.003)
Portuguese [a]	-	-	-	0.036 (0.003)
Russian	83	17	0	0.047 (0.003)
Spanish	100	0	0	0.053 (0.003)

[a] Portuguese and Italian were excluded from the analysis in this case due to missing feature values, as explained in the appendix.

All differences in errors per words were not statistically significant (p>.05 following Bonferroni adjustment), except for the differences of each language with Japanese, as well as German-Spanish, Italian-Spanish, and Portuguese-Spanish.

Figure 6. *Possessive errors rates*

4. Discussion

This paper examined how learners' L1 affects them when learning English as a foreign language, and how this effect varies based on learners' L2 proficiency. The goal of the study was to expand on prior literature by looking at a large-scale learner corpus, which consists of texts produced by English learners from a wide range of linguistic backgrounds, in terms of their L1s and in terms of their L2 proficiency. The structural similarity between learners' L1 and English, the target L2, was assessed based on related feature values in the WALS. Learners' performance was gauged based on the error rates in their writing, as measured by the number of errors of a certain type that they make per the number of words in the text.

In the case of article errors, features which appear in the L2 and were absent from the L1 were associated with an increase in error rates. Consequently, speakers of Japanese, which has no indefinite articles, and speakers of Russian, which has no indefinite or definite articles, had the highest error rates, in comparison with the languages which did not have absent features. Interestingly, differences in error rates between speakers of different L1s increased slightly over time, so that the gap between Japanese/Russian speakers and speakers of other language became greater as learners' L2 proficiency improved. There was a similar pattern of error rates for plurality, though there were no absent features in this case. Instead, features which were different between the L1 and the L2 resulted in increased error rates, compared to features which were similar between the languages. However, the effect size here was smaller than for article errors, and differences between speakers of different L1s remained relatively consistent over time.

The error patterns were different than this for agreement and word order, where feature similarity had an inverse effect, so that similarity between the L1 and the L2 lead to increased error rates, while dissimilarity decreased them. In the case of agreement, where there were absent features, these features also lead to a decrease in error rates. The effect sizes here were slightly lower than for plurality. In agreement errors, differences in error rates between speakers of different L1s also remained consistent over time, as in plurality errors. However, in word order errors these differences grew smaller as learners' L2 proficiency improved.

Both verb tense and possession were largely unaffected by structural similarity. In the latter case, this could be attributed to the high level of feature homogeneity between the different L1s, as well as to their strong similarity to English, as nearly all of the L1s had feature values which were identical to English. It could also be attributed to the relative infrequency of possession marking in the language, in comparison with the other error types, which leads to lower rates of possession errors overall, and consequently to lower effect sizes in terms of L1 influence.

5. Conclusions

There was notable variability in the way learners' L1 affected them when acquiring different structures in English, as evident in the error patterns in learners' texts.

First, feature similarity between the L1 and the target L2 was found to either facilitate acquisition, as in the case of articles and plurality, hinder acquisition, as in the case of agreement and word order, or have no effect, as in the case of verb tense and possession, though in the case of possession this could potentially be attributed to a high degree of feature homogeneity.

In addition, there was also variability in terms of the effect size of L1 influence. This was especially notable in the case of article errors, where features which existed in the L2 but were absent from the L1 hindered acquisition, and where there was the largest effect size of L1 influence out of all the errors which were examined.

Finally, there was also variability in the way that learners' L1 affected them over time, or as their L2 proficiency improved. In the case of word order, differences between speakers of different L1s decreased slightly over time, which indicates that L1 influence had a smaller effect as learners' L2 proficiency increased, as expected. However, for all other errors, differences between speakers remained consistent over time, and surprisingly even increased in the case of article errors. This indicates that in some cases, and particularly when L1 influence has a strong effect, it continues to significantly affect learners even as they reach a high degree of proficiency in the L2.

Overall, the findings highlight the complexity of L1 influence during SLA, and show that there is no single pattern of L1 influence for all structures in the language. However, the study does provide insights regarding the nature of L1 influence during the acquisition of some prominent structures in English. Most importantly, the study shows that in some cases, L1 influence continues to play a role throughout acquisition, and not just during its initial stages.

6. Acknowledgments

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8. Appendix

Features in the sample: The following features were included (values available in the WALS; Dryer & Haspelmath, 2013):

i. Articles: definite articles; indefinite articles.

ii. Plurality: coding of nominal plurality; occurrence of nominal plurality; plurality in independent personal pronouns; the associative plural.

iii. Agreement: syncretism in verbal person/number marking; person marking on adpositions; alignment of verbal person marking; verbal person marking; third person zero of verbal person marking; order of person markers on the verb; number of genders.

iv. Word order: order of subject, object and verb; order of subject and verb; order of object and verb; order of object, oblique, and verb; order of adposition and noun phrase; order of genitive and noun; order of adjective and noun; order of demonstrative and noun; order of numeral and noun; order of relative clause and noun; postnominal relative clauses; order of degree word and adjective; position of interrogative phrases in content questions; order of adverbial subordinator and clause; relationship between the order of object and verb and the order of adposition and noun phrase; relationship between the order of object and verb and the order of relative clause and noun; relationship between the order of object and verb and the order of adjective and noun; position of negative word with respect to subject, object, and verb; position of negative words relative to beginning and end of clause and with respect to adjacency to verb.

v. Verb tense: exponence of tense-aspect-mood inflection; the past tense; the future tense; the perfect; position of tense-aspect affixes; suppletion according to tense and aspect.

vi. Possession: locus of marking in possessive noun phrases; position of pronominal possessive affixes; obligatory possessive inflection; number of possessive nouns; possessive classification; predicative possession.

Treatment of missing feature values: The WALS has some missing feature values. In the present study, when more than 30% of the values for related features for an error type were missing for a certain L1, then that L1 was excluded from the analysis in the case of that specific structure. There were five cases where this occurred: Portuguese in agreement (94.1% missing), Italian in agreement (47.1% missing), Portuguese in possessive (100% missing), Italian in possessive (83.3% missing), and Italian in verb tense (83.3% missing). When less than 30% of the values for related features for that error type were missing for a certain L1, then the missing features were excluded from the analysis, but the L1 itself remained. This occurred in 4.71% of cases.

Exclusion of word order features: Three features were excluded because their values were not related to aspects which are characterized as word order errors in the database ('minor morphological means of signaling negation', 'preverbal negative morphemes', 'postverbal negative morphemes'). The feature 'position of polar question particles' was excluded because there is no question particle in English (Dryer & Haspelmath, 2013). Five features were excluded because they had overlapping effects which are covered by the feature 'position of negative word with respect to subject, object, and verb'. These were: 'order of negative morpheme and verb', 'the position of negative morphemes in SVO languages', 'NegSVO order', 'SNegVO order', 'SVNegO order', 'SVONeg order'.