An OT Approach to Spanish and Thai Learners' Production of Past Tense Markers in L2 English

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Abstract

The present study investigates the production of the English past tense marker –ed by two qualitatively different groups of second language (L2) learners , namely, native speakers of Thai and Spanish. Several current models in L2 phonology are critically evaluated in order to explain variation in learners' production of functional morphemes. These models include the Organic Grammar Hypothesis (OGH), the Failed Functional Features Hypothesis (FFFH), the Prosodic Transfer Hypothesis (PTH), and the Phonological Reduction Hypothesis (PRH). The study argues that the Optimality Theoretic model provides a dynamic and predictive account of interlanguage variation. Before analyzing the variable productions of the learners, the phonological system of codas in Thai and Spanish is analyzed to determine the constraint rankings in the learners' L1s. The ranking of Thai is *COMPLEXCODA, *VOICED-CODA >> DEP-IO >> MAX-IO; in the case of Spanish, *COMPLEXCODA]WORD, *[d]CODA >> DEP-IO >> MAX-IO. According to these constraint rankings, two predictions were proposed: (1) high-ranked markedness constraints in the L1 grammars of Thai and Spanish lead learners to make errors when producing verbs marked with –ed, and (2) the strategy of deleting the second element of consonant clusters is preferred to inserting a vowel in learners' productions. The results show that most learners successfully produced VV-d and CV-d verbs but encountered difficulties with complex clusters. Furthermore, the learners tended to choose the strategy of deletion over epenthesis in the structures of consonant clusters. The current findings suggest that constraint re-ranking in learners' interlanguage grammars accounts for the variable productions of the morphological marker –ed. This analysis supports the ability of OT to explain both accuracy and variation in L2 morphological production.

Keywords: second language phonology, optimality theory (OT), morphological variability, past tense marker –ed, interlanguage constraint ranking

1. Introduction

Several studies have been conducted to examine the production of functional morphemes by L2ers (Vainikka & Young-Scholten, 1994, 1996, 2011, 2013; Tsimpli & Roussou, 1991; Hawkins & Chan, 1997; Lardiere, 1998, 2003; Prévost, 2003; Goad, White & Steele, 2003; Kahoul, 2014, and more recently Wang, McMillen & Shi, 2025; Gu & Zhang, 2025). All of these studies have shown that L2ers usually commit variable errors in producing L2 functional morphemes. While some learners may show acquisition of the underlying rules of grammar, surface variation in production of morphemes is typically present. The reasons behind those variable errors are analyzed from different syntactic and phonological perspectives. Nonetheless, an investigation of the production of the English past tense marker by L2ers using an OT theoretical framework has not received much attention in research of L2 phonology.

The current study targets speakers of Spanish and Thai whose L1 phonotactic and prosodic profiles are very different from English. The latter is an analytic, syllable-timed, tone language which limits coda complexity string. Spanish, inflectionally more complex but syllable-timed, is also typical in coda restriction, particularly on complex codas consisting of voiced stops like /d/. The phonology of English, while stress-timed, makes frequent use of complex coda in inflectionally marked forms like walked /wɔːkt/ or played /pleɪd/. The main question, then, is how L2 learners from various L1 background systems produce the English functional morpheme –ed, as well as whether prevailing theory in L2 phonology can explain adequately the variation observed in their interlanguage grammars.

To explore this question, the current study first evaluates five approaches proposed in an effort to explain variable morphological production: the Organic Grammar Hypothesis (OGH), the Failed Functional Features Hypothesis (FFFH), the Phonological Reduction Hypothesis (PRH), the Prosodic Transfer Hypothesis (PTH), and the Optimality Theory (OT). The Organic Grammar Hypothesis (Vainikka & Young-Scholten, 1994, 1996, 2011, 2013) views L2 development as an incremental building of syntactic structure, from lexical category onwards to complete functional grammar. The Failed Functional Features Hypothesis (Hawkins & Chan, 1997), in contrast, makes the assumption that adult L2 learners lack access to some given functional features especially when these features are not realized in the L1. The Phonological Reduction Hypothesis (Lardiere, 1998, 2003) attributes variability as an outcome of phonological or

phonetic constraints in L1 rather than a lack of syntactic features in L1. The Prosodic Transfer Hypothesis (Goad et al., 2003) aims at L1 prosodic structure as a constraint on morphological suffix realization in the L2. Whilst these models are insightful, they have shortcomings in both their ability to account for the systematic and variable nature of L2 morpheme production. Therefore, the current study assumes Optimality Theory (Prince & Smolensky, 2004) as a more complete and predictive theory. OT posits that all grammars are governed by universal constraints and that their rankings is language-specific. This way of ranking performs best in modeling interlanguage grammars, where constraint re-ranking can be a sign of differential target-like production among learners.

By adopting the framework of OT, the study aims to investigate whether it is possible to understand the production of L2ers through appealing to the notion of constraint re-rankings in interlanguage grammar throughout the stages of L2 acquisition (Hancin-Bhatt & Bhatt, 1997; Broselow, Chen & Wang, 1998; Hancin-Bhatt, 2000; Lombardi, 2003; Broselow, 2004). Consequently, I showed that the variable phonological productions of the English past tense marker in Thai and Spanish L2ers can be attributed to the different ranking of constraints in the interlanguage grammar. In particular, I found that the *COMPLEXCOD1 constraint is almost dominant in the interlanguage grammar of the subjects, which in turn prevents most of them from producing verbs ending in consonant clusters. Further, I demonstrated that by demoting the *VOICED-CODA and *[d]CODA constraints below the faithfulness constraint IDENT-IO in the interlanguage grammar, the subjects were able to produce verbs ending in /d/. Finally, I argued that the subjects' L1s constraints played a crucial role in the variable productions, while at the same time, the subjects attempted to produce outputs that were relatively close to the faithfulness of the target language.

The current study contributes to the field of phonology in second language acquisition in two ways. Firstly, it provides empirical evidence that the framework of Optimality Theory (OT) (Prince & Smolensky, 2004) can account for the variable phonological productions of the English past tense marker –ed by Thai and Spanish L2ers. The study proposes that the variable productions are attributed to the constant re-ranking of markedness and faithfulness constraints during the stages of L2 acquisition. Secondly, based on the data, it suggests the ranking constraints of Thai and Spanish-ESL interlanguage grammar.

The paper is organized as follows: section (2) introduces and briefly describes the previous accounts of functional morpheme production by L2ers. Section (3) elaborates on the status of coda in Thai and Spanish. Section (4) presents the results and analyzes the data through the framework of OT. Section (5) reintroduces the accounts mentioned in section (2) and evaluates them for viability against OT. The conclusion is presented in section (6).

2. Literature Review

The variability in the production of functional morphemes (especially in tense and agreement marking) by second language learners has consistently been observed and analyzed (Goad & White, 2006). This variable production is noticed in naturalistic and instructed learning settings, wherein second language learners often misuse or omit functional morphemes (White, 2003). While earlier studies attributed such misproduction of functional morphemes to factors such as native language transfer (Lado, 1957; Odlin, 1989) or cognitive effects (McDonald, 2006; Dekeyser, 2005), recent studies have analyzed the variability in L2 morphological production within different theoretical frameworks, including the Organic Grammar Hypothesis (OGH) (Vainikka & Young-Scholten, 1994, 1996, 2011, 2013), the Failed Functional Features Hypothesis (FFFH) (Hawkins & Chan, 1997), the Prosodic Transfer Hypothesis (PTH) (Goad et al., 2003), and the Phonological Reduction Hypothesis (PRH) (Lardiere, 1998, 2003). More recently, Optimality Theory (OT) has been used to account for the systematic structures observed in L2 Learners' production of morphological variability (Hancin-Bhatt, 2000; Rajab, 2019). The following section provides an overview of the different theoretical frameworks proposed to account for morphological variability in the production of L2 learners and argues that the framework of OT offers a more robust explanation in capturing the variable production of functional morphemes in L2 learners, particularly Spanish and Thai speakers.

2.1 The Organic Grammar Hypothesis (OGH)

Vainikka and Young-Scholten (1994, 1996, 2011, 2013) proposed the Organic Grammar Hypothesis (OGH) which argues that L2 learners create developmental stages within their interlanguage grammar. According to this approach, early L2 grammars begin with minimal syntactic structures that lack full developed syntactic features. In particular, L2 learners depend on the Verb Phrase (VP) from their L1 as they start to process and produce L2 structures. This starting point of the L1 VP is followed by more gradual complex syntactic structures that are shaped from exposure to L2 input. The gradual acquisition of L2 functional morphemes explains variability as L2 learners gradually produce new syntactic features. This process contrasts with perspectives that see the L2 production as full transfer of L1 grammar or those which propose constant interaction between L1 and L2 throughout the learning process.

Although the OGH accounts for the gradual acquisition of L2 functional morphemes by proposing the developmental process in the interlanguage grammar, it fails to refer to phonological or prosodic constraints which can affect the variable productions of functional morphemes. Additionally, with the idea of the Verb Phrase (VP) from the L1, the OGH does not account for the differences among learners from different L1s. Furthermore, this approach does not explain the variability among advanced L2 learners who produce inconsistent morpheme patters. Finally, the OGH does not account for the observed phenomenon of certain functional morphemes, like tense markers, being problematic to L2 learners although learners showing good understanding of tense distinctions in other contexts (Goad et al., 2003).

[1] All constraints are adopted from Kager (1999).

2.2 The Failed Functional Features Hypothesis (FFFH)

Hawkins and Chan (1997) propose the Failed Functional Features Hypothesis (FFFH) which explains why second language learners are unable to acquire and produce L2's verbal inflections (i.e. person, number and tense). The FFFH attributes the phenomenon of inability to acquire verbal inflections to the absence of corresponding syntactic features in L1. If the syntactic features are not present in L1 grammar, L2 learners will have difficulty in producing inflectional markings of the target language (e.g. the English past tense marking –ed). Based on what this hypothesis suggests, the productions of verbal inflections of L2 learners in general will vary according to the differences in syntactic features of L1. According to FFFH, German-speaking L2 learners, whose L1 grammar has the syntactic feature of (± past), were able to correctly produce English inflected past verbs (Hawkins & Liszka, 2003). In contrast, since the syntactic feature of (± past) is absent in the grammar of Chinese, L2 learners whose first language is Chinese produced English past tense verbs in their bare forms.

Although the FFFH, from one angle, accounts for the L2's errors in producing functional morphemes correctly, a criticism has been raised against this hypothesis for not explaining cases where high-proficiency speakers of Chinese showed good competence in producing past tense marking. Thus, instead of providing a deterministic prediction regarding the notion of L2's inability to produce functional morphemes, findings from empirical studies left room for variability among L2 learners in producing verbal inflections (Lardiere, 2003). Furthermore, Bayley (1991, 1996) attributed errors in producing functional morphemes by Chinese-speaking English learners to L1 phonological constraints rather than morphosyntactic. This attribution led Lardiere (2003) to propose the Phonological Reduction Hypothesis (PRH) that takes phonological constraints of L1 into consideration when explaining the consistent L2 failure of producing functional morphemes.

2.3 The Phonological Reduction Hypothesis (PRH)

Since the Failed Functional Features Hypothesis (FFFH) has some shortcomings, Lardiere (2003) proposed the Phonological Reduction Hypothesis (PRH) as a way of accounting for the errors made by L2ers when producing functional morphemes, such as English suffixes –ed and –s, especially when their L1 grammar lacks such morphemes. The core argument of the RPH is that the variable accuracy of L2ers in producing functional morphemes is a result of phonological or phonetic constraints in L1 rather than a lack of syntactic features in L1. The L1 phonological constraints lead to L2 production difficulties. This claim means that even if the L1 grammatical system acquires the functional features under consideration (e.g. Tense), the phonological or phonetic constraints of L1 lead to the reduction or omission of functional morphemes in L2 speech. Instead of attributing the omission of functional morphemes to competence-based factors (i.e. a lack of syntactic or grammatical knowledge), various performance-based factors, such as speech rate or articulatory constraints, contribute to the consistent L2 failure of producing functional morphemes. The empirical evidence for this hypothesis came from a production of an advanced Chinese-speaking L2 English learner who accurately perceived and understood tense features but often failed to produce English past tense markers (e.g. she said walk instead of walked) (Lardiere, 2003).

Although the RPH presents empirical evidence for explaining the omission of functional morphemes in L2 speech, it de-emphasized the effect of syntactic features that may be absent in L1. Furthermore, the absence of a formal predictive mechanism weakens the RPH as it does not provide a specific cross-linguistic framework for predicting the reduction or omission of functional morphemes in L2 speech. Finally, empirical evidence of one case study (i.e. the Chinese-speaking L2 English learner) can not be generalized to account for error occurrences universally, especially with various L1 backgrounds and proficiency levels.

2.4 The Prosodic Transfer Hypothesis (PTH)

Instead of focusing on the effect of the presence vs. absence of L1 syntactic features to account for variability in L2 production of functional morphemes, Goad et al. (2003) emphasized that the primary reason for this variability is due to the way morphology is prosodically represented in L1 grammar. What this means is that the greater the similarity between the native language and the target language regarding the prosodic structures, the lower the likelihood of variability in the L2 learners production of functional morphemes. Conversely, when the prosodic structure of L1 is represented differently than that of the target language, L2 learners are more likely to have difficulty in producing morphological markers.

Support for this hypothesis is provided by empirical evidence conducted by Goad et al. (2003) on L2 English learners from a Spanish and Chinese L1 backgrounds. These languages were chosen in their study because Spanish is classified as a syllable-timed language and Chinese as a tone language whereas English is a stressed-time language. Goad et al. (2003) predicted that these different L1 backgrounds of prosodic structures might have a role in the production of English inflectional morphemes, in particular third person singular -s and past tense -ed. The researchers found that both learner groups most commonly omitted these inflectional morphemes, particularly in difficult phonological environments, such as when the suffix –ed created a consonant cluster. The analysis of the data supported the Prosodic Transfer Hypothesis (PTH), under which learners transfer their L1's prosodic structure to their L2 productions and that this kind of transfer would presumably lead to constrain production of specific functional morphemes in English. In summary, such omissions were not necessarily a product of a lack of morphosyntactic knowledge, but a result of difficulties mapping these L2 morphemes on to L1s' available prosodic templates.

While the PTH contributes to the field of second language phonology by uncovering L1 prosody's influence on L2 functional productions, Prosodic Transfer Hypothesis (PTH) has been criticized on multiple grounds. Researchers argue that PTH underestimates the role of morphosyntactic representation in learners' interlanguage grammar by attributing variability largely to phonological constraints (Hawkins & Chan, 1997; Lardiere, 2003). Furthermore, Snape (2007) examined the production of articles by Japanese-speaking learners of English and

argued that the PTH cannot account for situations in which learners often omitted article morphemes even with the availability of L1 prosodic structures of articles. These inconsistent findings in producing functional morphemes suggests that other factors—e.g., knowledge of syntax, frequency of input, age of L2 acquisition—might have a determining role. Finally, PTH has a limited scope as it focuses solely on inflectional suffixes and cannot readily extend to other functional constituents like auxiliaries or modals (Ionin & Wexler, 2002). These criticisms entail a call for broader-based theories that capture the interaction between prosodic, syntactic, and processing variables in L2 growth.

2.5 Optimality Theory

Optimality Theory (OT) falls under the broader umbrella of generative grammar. This linguistic model first proposed by Prince and Smolensky (1993) and is based on the notion that the observed forms of language are the result of the best satisfaction of competing constraints. OT is different from other phonological analysis methods, which frequently employ rules rather than constraints. However, rule-based and constraint-based models can coexist alongside phonological representational models such as autosegmental phonology, prosodic phonology, and linear phonology. In OT, grammars of languages are seen as systems that offer mappings between inputs and outputs; typically, the underlying representations represent inputs whereas their surface representations refer to outputs (Prince and Smolensky,1993).

According to McCarthy (2008), the OT mechanism is an input-output relationship in which each input has a specific output. Two key elements that are active in any grammar, GEN (i.e. GENERATOR) and EVAL (i.e. EVALUATOR), operate this mechanism (Kager, 1999). These basic components set OT apart as a parallel input-output relation theory. A limitless number of potential candidates are functionally created by GEN, and these candidates are then evaluated by EVAL using a set of constraints. These constraints are assumed to be universal and that the ranking between them is language-specific (Kager, 1999). For instance, in languages that forbid onsetless syllables, ONS is ranked higher as an OT constraint that requires an onset, whereas the same constraint is ranked lower in languages that do not forbid them. Thus, EVAL selects a best candidate from among competing candidates.

Markedness and Faithfulness constraints are the two types of OT constraints (Prince & Smolensky 1993; McCarthy & Prince 1995; McCarthy, 2008; Kager, 1999); while faithfulness constraints make sure that the result is exactly corresponding to the input, markedness constraints are concerned with structural well-formedness. Every type is important to the theory in some way. Faithfulness constraints prevent every input from being realized as a completely unmarked form, while markedness constraints encourage changes from the underlying form.

2.5.1 Using Optimality Theory in Accounting for Functional Variation of Morphemes

Optimality Theory (OT) offers a constraint-based approach to explaining linguistic variation and thus is suited to studying L2 learners' production of functional morphemes. Diverging from previous theories that rely on hypotheses about deterministic rules or constraints, OT suggests production of language as a product of a system of ranked, violable constraints operating dynamically (Prince & Smolensky, 1993).

There have been a variety of investigations revealing the success of OT in accounting for L2 morphological variation. For example, Hancin-Bhatt (2000) applied OT to account for Thai ESL learners' production of coda consonants and identified the role of L1 prosodic constraints in shaping the production of English past tense marker. Similarly, Rajab (2019) applied an OT framework to test Saudi learners' production of regular past tense verbs and illustrated how constraint interaction could predict systematic variation patterns. OT provides a more dynamic framework for describing interlanguage variation by making possible reranking of constraints overtime. It is for this reason that learners exhibit different patterns of production based on proficiency levels, linguistic contexts, and phonological settings (McCarthy, 2008).

Both Spanish and Thai English learners exhibit specific challenges with morphology in the past tense because their first languages have distinct L1 phonological and morphosyntactic profiles. Spanish, a Romance language with a complex inflection system, lacks regular past tense coda clusters and therefore uses simplification procedures such as vowel epenthesis (Carlisle, 1998). Thai, a predominantly analytic language, has minimal inflectional morphology and consequently offers past tense marking as a novelty (Hancin-Bhatt, 2000). Applying the OT to the Spanish and Thai learners of English, predictions can be made regarding how interaction between constraints has effects on production of past tense marker and give a more fine-grained description than previously provided by theories.

This review has outlined competing theoretical perspectives on explaining variable productions of L2 morphemes and argued in favor of choosing OT as a preferable approach. By adopting the strengths of previous hypotheses while providing a formal account of variability prediction, OT provides an improved and evidence-based account of L2 morphological development. The next section focuses on the analysis of coda structures in Spanish and Thai.

3. Coda in Thai and Spanish

In this section, I briefly introduce the status of coda in Thai and Spanish. Since I am dealing with the addition of the inflectional suffix *–ed* to verb stems, it is vital to understand the L1s constraints regarding the coda condition and compare those to the ranking constraints of the interlanguage grammar.

Thai does not have past tense markers (Diller, 1988; Koenig & Muansuwan, 2005). In addition, consonant clusters and voiced consonants are forbidden in coda positions (Panlay, 1997; Rungruang, 2007). This suggests that the constraints *COMPLEXCOD and *VOICED-CODA are high-ranked in Thai. Lastly, since the adaptation of loanwords mirrors the phonotactic constraints of the borrowing

language, English loanwords that contain complex codas are repaired often by deleting one segment, ending up with simplex codas (Rungruang, 2007). This indicates that the constraint MAX-IO is ranked below DEP-IO. Given these basic principles about the status of coda in Thai, I can now provide the ranking constraints of Thai grammar given in (1):

(1) *COMPLEXCOD , *VOICED-CODA >> DEP-IO >> MAX-IO

In contrast, Spanish utilizes the morphological marker *–ó* to indicate past tense (Salaberry, 1999), but it does not allow complex coda words finally (Harris, 1983 as cited in Hancin-Bhatt & Bhatt, 1997) nor does it allow /d/ to surface in the coda position word-finally (Colina, 2009). Accordingly, the constraints *COMPLEX$^{COD}]_{WORD}$ and *[d]$_{CODA}$ are ranked high in Spanish. Moreover, the fact that loanwords that include complex codas are repaired in Spanish by deleting the second element of the cluster rather than inserting a vowel to break the clusters suggests that MAX-IO is dominated by DEP-IO (Colina, 2009; Shepherd, 2003). Given these facts about the coda condition in Spanish, I can suggest the following ranking of constraints given in (2):

(2) *COMPLEX$^{COD}]_{WORD}$, *[d]$_{CODA}$ >> DEP-IO >> MAX-IO

Based on the previous basic sketch of Thai and Spanish phonotactic coda constraints, I therefore suggest the following hypotheses:

Hypothesis 1: participants make variable errors in producing the English past tense marker –ed due to the high ranked constraints *COMPLEXCOD , *COMPLEX$^{COD}]_{WORD}$, *VOICED-CODA and *[d]$_{CODA}$.

Hypothesis 2: participants are more likely to delete the second element of the complex cluster than to insert a vowel.

4. Data Collection and Methodology

English has four allomorphs for the regular past tense verbs: 1) VV-d as in *played* [pl**eɪd**], 2) CV-d as in *started* [stɑːr**tɪd**], 3) C-t as in *talked* [tɑː**kt**], and 4) C-d as in *judged* [dʒɑː**gd**] (Kahoul, 2014).[1] Before presenting the variable productions of these allomorphs in section §4.3, the following sections provide an overview of the participants, methods of data collection and analysis.

4.1 Subjects

I obtained the productions of the English past tense marker –ed from five native speakers of Thai and five native speakers of Spanish. The Thai participants had been learning English for a period ranging from eight months to one year and had recently achieved a score of 5.0 in an IELTS test. Thus, I may assume that the proficiency level of the participants was intermediate. Their ages ranged from 18 to 25. The Spanish participants were from the same family, and had never received any formal instructions in English language after high school. However, they had been living in the United Kingdom for a year and a half, indicating ample exposure in naturalistic environments. Their ages ranged from 30 to 40. Similarly, I assume that their proficiency level is intermediate.

4.2 Production Task

I adopted Hancin-Bhatt's (2000) methodology where the target past tense verbs were inserted into 17 sentences. The selection of the sentences is based on different criteria; first, the phonological environment of the verb. In other words, the past tense verbs in the experiment was a mix between different phonological environments: VV-d, CV-d and C-cluster-d. Second, the sentences were syntactically structured to be simple and frequent for the purpose of meeting the proficiency levels of the learners. Finally, each sentence included two pairs: one of the sentences in the pairs is grammatically correct and the other is not. The subjects were then asked first to decide which sentence was correct and then to read only the grammatical sentence. It is important to note that the ungrammatical sentences did not contain errors in tense but they included errors in word order. All sentence pairs therefore included the target past tense verbs that contain final –ed with the purpose being to elicit the production of –ed markers. The purpose of adopting this methodology '[…] was to divert their attention from the pronunciation [the main goal of the study] and to elicit an additional measure of syntactic proficiency.' (Hancin-Bhatt, 2000: 219). Some of the sentence pairs are given below:

(3) (i) I *boiled* eggs.

Eggs *boiled* I.

ii) *Finished* I cleaning.

I *finished* cleaning.

4.3 Results

In this section, the results of both the Thai and Spanish speakers are introduced and analyzed using an OT interpretation. As proposed by Hancin-Bhatt (2000), the results of such a study need to focus on the generalizations of the productions and should attempt to overlook the errors made by individuals. This will enable me to interpret the results and suggest constraints that could account for the predominant errors.

The production of the past tense marker –ed was divided into three variants: VV-d, CV-d, and Complex cluster, as shown in tables (1) and (2). The first column refers to the results of the productions of VV-d verbs; the productions of CV-d verbs are reported in the second column; finally, the third column shows the results of Complex-cluster verbs.

[1]Throughout the study, these allomorphs will be categorized into three patterns and are labeled as follows: 1) VV-d verbs, 2) CV-d verbs, and 3) Complex-cluster verbs (C-t and C-d).

4.3.1 Thai Results

The results of Thai participants given in table (1) generally show a trend in errors that could be attributed to the dominance of the L1 constraints. For example, the majority of the participants could not produce Complex-cluster verbs due to the creation of complex codas in words like jogged. They repaired the cluster either by deleting one of the consonants (53% of participants) or by inserting a vowel between them (20%). However, the first column shows relatively fewer errors in producing VV-d, and half of the participants produced these verbs accurately. Moreover, the dominance of the complex coda constraint is supported by the fact that a majority of the participants had produced CV-d verbs accurately (70%) because there was no complex cluster. Although Thai does not allow the occurrence of voiced consonants in coda positions, most of the participants were able to produce final /d/ which indicates that they are progressing towards the faithfulness of the L2 forms.

Table 1. the variable productions of the English past tense marker -ed by Thai subjects

Subjects	**VV-d**	**CV-d**	**Complex cluster**
Speaker 1	C: 2 - Z: 2	C: 3 - Z: 1	C: 2 - D: 2 - E: 5
Speaker 2	C: 4 - Z: 0	C: 4 - Z: 0	C: 6 - D: 3 - E: 0
Speaker 3	C: 0 - Z: 4	C: 2 - Z: 2	C: 1 - D: 7 - E: 1
Speaker 4	C: 2 - Z: 2	C: 3 - Z: 1	C: 1 - D: 6 - E: 2
Speaker 5	C: 2 - Z: 2	C: 3 - Z: 1	C: 2 - D: 6 - E: 1
Overall	50%	70%	C: 27% - D: 53% - E: 20%

Zero (Z): the subject did not pronounce the past tense marker; **Correct (C)**: the subject pronounced the past tense marker correctly; **Epenthesis (E):** The subject inserted a vowel between the complex cluster; **Deletion (D)**: the last consonant of the complex cluster was deleted.

4.3.2 Thai Results Interpreted Using OT

The results show that *COMPLEXCOD is still dominant in the interlanguage grammar of the subjects, as 73% failed to produce Complex-cluster verbs accurately. However, the majority of the subjects pronounced final /d/ correctly which indicates that the *VOICED-CODA constraint is demoted below the faithfulness constraint IDENT-IO. Deleting the last consonant of the cluster is the predominant strategy adopted by the Thai subjects in Complex-cluster verbs, while inserting a vowel to break the cluster occurred less frequently. This indicates that the violation of DEP-IO is worse than MAX-IO. I can therefore generate the following ranking of constraints in the interlanguage grammar of Thai subjects:

(4) *COMPLEXCOD >> IDENT-IO >> >> DEP-IO >> MAX-IO >> *VOICED-CODA

Given the ranking constraints in (4), the following tableaux provide evaluations of the candidates' productions.

Tableau 1. Production of VV-d verbs by the Thai subjects

/pleɪd/	IDENT-IO	MAX-IO	*VOICED-CODA
a. pleɪt	*!		
b. pleɪ		*!	
→ c. pleɪd			*

Tableau 2. Production of CV-d verbs by the Thai subjects

/stɑːrtɪd/	IDENT-IO	MAX-IO	*VOICED-CODA
a. stɑːrtɪt	*!		
b. stɑːrt		*!	
→ c. stɑːrtɪd			*

In tableaux (1) and (2), candidates (As) are not optimized because of the violation of the high constraint IDENT-IO. Although candidates (Bs) delete /d/ to avoid the potential of having final voiced consonants, they incur a violation of the faithfulness constraint MAX-IO. On the other hand, the optimal candidates (Cs) are chosen because they violate the less serious constraint *VOICED-CODA.

Now consider the third tableau, which introduces the evaluation of the potential outputs of Complex-cluster verbs:

Tableau 3. Production of Complex-cluster verbs by the Thai subjects

/bɔɪld/	*COMPLEXCOD	IDENT-IO	DEP-IO	MAX-IO	*VOICED-CODA
a. bɔɪlt	*!	*			
b. bɔɪld	*!				*
→ c. bɔɪlid			*		*
→ d. bɔɪl				*	

When the constraint *COMPLEXCOD is in present, it dominates all other constraints. This makes clear that the losing candidates (a) and (b) are ruled out due to the violation of the highly top-ranked constraint *COMPLEXCOD, whereas the winning candidates (c) and (d) avoid the complex coda by violating the less harmful constraints DEP-IO and MAX-IO.

4.3.3 Spanish Results

Table (2) below shows that the Spanish subjects did better than the Thai subjects. The results produce no evidence that there was full transfer from Spanish. Instead, although Spanish does not allow /d/ to occupy coda positions, most of the tokens in VV-d and CV-d verbs are produced correctly, produced by 80% and 65% of participants, respectively. Moreover, in spite of the fact that complex codas are prohibited word-finally in Spanish, almost half of the tokens in Complex-cluster verbs are produced accurately (49%). The remaining unproduced tokens of Complex-cluster verbs are repaired mostly by deleting the second element of the clusters (33%). This is consistent with the fact that complex codas in loanwords are repaired by deletion in Spanish.

Table 2. the variable productions of the English past tense marker by the Spanish subjects

Subjects	**VV-d**	**CV-d**	**Complex cluster**
Speaker 1	C: 2 - Z: 2	C: 1 - Z: 3	C: 2 - D: 3 - E: 4
Speaker 2	C: 4 - Z: 0	C: 4 - Z: 0	C: 6 - D: 3 - E: 0
Speaker 3	C: 4 - Z: 0	C: 3 - Z: 1	C: 4 - D: 4 - E: 1
Speaker 4	C: 3 - Z: 1	C: 2 - Z: 2	C: 5 - D: 3 - E: 1
Speaker 5	C: 3 - Z: 1	C: 3 - Z: 1	C: 5 - D: 2 - E: 2
Overall	C: 80%	65%	C: 49% - D: 33% - E: 18%

Zero (Z): the subject did not pronounce the past tense marker; **Correct (C)**: the subject pronounced the past tense marker correctly; **Epenthesis (E):** The subject inserted a vowel between the complex cluster; **Deletion (D)**: the last consonant of the complex cluster was deleted.

4.3.4 Spanish Results Interpreted Using OT

In this section, I will posit that the constraint rankings in the interlanguage grammar of Spanish subjects are different from the L1 stated in section (3). I found that *COMPLEX^{COD}]$_{WORD}$ is ranked equally with the faithfulness constraints DEP-IO and MAX-IO. Moreover, the constraint *[d]$_{CODA}$ is ranked below all other constraints. This is shown in (5):

(5) IDENT-IO >> DEP-IO , *COMPLEX^{COD}]$_{WORD}$, MAX-IO >> *[d]$_{CODA}$

Tableaux (4) and (5) below are included to show that Spanish subjects have moved the high-ranked constraint *[d]$_{CODA}$ to occur below the faithfulness constraint IDENT-IO, which in turn enables the Spanish subjects to produce the optimal candidates (Cs), while the loser candidates (a), (b) and (d) violate the high-ranked constraints IDENT-IO. DEP-IO and MAX-IO, respectively.

Tableau 4. Production of VV-d verbs by Spanish subjects

/pleɪd/	IDENT-IO	DEP-IO	MAX-IO	*[d]$_{CODA}$
a. pleɪt	*!			
b. pleɪ			*!	
→ c. pleɪd				*
d. **pleɪdə**		*!		

Tableau 5. Production of CV-d verbs by Spanish subjects

/stɑːrtɪd/	IDENT-IO	MAX-IO	*[d]$_{CODA}$
a. stɑːrtɪt	*!		
b. stɑːrt		*!	
→ c. stɑːrtɪd			*

Now consider the following tableau, which shows that candidates (a) and (b) are ruled out because of the violation of the high constraints IDENT-IO and DEP-IO, respectively. Since it is assumed that Spanish subjects rank *COMPLEXCOD and MAX-IO equally in their interlanguage grammar, candidates (c) and (d) are possible winners.

Tableau 6. Production of Complex-cluster verbs by Spanish subjects

/bɔɪld/	IDENT-IO	DEP-IO	*COMPLEXCOD	MAX-IO	*[d]$_{CODA}$
a. bɔɪlt	*!		*		
b. bɔɪlid		*!			*
→ c. bɔɪl				*	
→ d. bɔɪld			*		*

The results presented in the current study provide partial support for, yet also contradict, my initial prediction. I found that the majority of the subjects could not produce Complex-cluster verbs faithfully. However, most of the subjects were better able to produce VV-d and CV-d verbs. The results support the second prediction, as most of the subjects deleted the second element of the clusters rather than inserting a vowel to break the cluster.

5. Discussion

The fact that the majority of the subjects produced VV-d and CV-d verbs faithfully but failed to produce Complex-cluster verbs casts doubt on the four hypotheses mentioned earlier (OGH, FFFH, PTH, and PRH). OGH argues that syntactic features are built gradually in L2 acquisition. In fact, assuming that the subjects have reached the syntactic level that enables them to produce the English past tense marker accounts for the productions of VV-d and CV-d but not the complex-cluster verbs, as most of the subjects produced the former accurately but

failed with the latter. This observation also applies to FFFH which proposes that absence of a syntactic feature in L1 would prevent L2ers from acquiring it. Nonetheless, although Thai does not have a past tense marker, the majority of the Thai subjects produced VV-d and CV-d verbs faithfully. In contrast, Spanish has a past tense marker *–ó*, but half of the Spanish subjects could not produce Complex-cluster verbs faithfully. PTH suggests that errors are due to different syllabification of suffixes in L1 and L2, and while this might account for the errors in Complex-cluster verbs, it does not account for the high rates of accuracy in producing VV-d and CV-d verbs. The last hypothesis, PRH, which attributes the errors to the reduction of cluster if L1 does not permit it, could account for the errors in the productions of Complex-cluster verbs but could not explain why most of the subjects were able to produce VV-d and CV-d verbs correctly.

In fact, OT is uniquely able to account for the variable productions of the subjects. This has been demonstrated by attributing the failure of productions in Complex-cluster verbs to the argument that the faithfulness constraints are dominated by the markedness constraint *COMPLEXCOD in the interlanguage grammar. By ranking the markedness constraints *VOICED-CODA and *$[d]_{CODA}$ below the faithfulness constraint IDENT-IO, the interlanguage grammar must also allow for the accurate productions of VV-d and CV-d verbs. This analysis aligns with the observation found by Hancin-Bhatt (2000) that Thai ESL learners faced difficulty in producing coda consonants. In particular, Hancin-Bhatt showed that whenever the Thai phonotactic constraints, especially **COMPLEXCODA** *and* **VOICED-CODA,** dominate the second language constraints within the interlanguage grammar, the Thai learners frequently deleted the final consonants in complex clusters.

6. Conclusion

The current study utilized Optimality Theory to account for the production of the English past tense marker –ed by L2 learners from Thai and Spanish-speaking language backgrounds. The findings confirmed that learners were successful almost entirely in producing past tense forms in phonologically restricted environments (i.e., VV-d and CV-d structures) but significantly failed in complex coda clusters, particularly those in final consonant cluster articulation such as /kt/ or /ld/. The findings also showed that participants preferred significantly consonant cluster deletion (second element deletion) rather than vowel insertion. Such a conclusion is consistent with the expectations under OT in that high-ranked markedness constraints dominate faithfulness constraints, particularly in initial stages in interlanguage development.

Although the Thai learners followed this tending of ranking in which markedness takes precedence over faithfulness (*COMPLEXCODA, VOICED-CODA >> MAX-IO), the Spanish learners were much less consistent. This indicates that in their interlanguage grammar, constraint rankings could be less fixed, such that various surface realizations can become optimal. Such variability is in agreement with the position of Broselow (2004) and Hancin-Bhatt (2008), which holds that interlanguage grammars are dynamic systems in which constraint re-ranking is responsible not only for systematicity but also for variation.

The significant limitation of this study is the relatively small sample size of the participants, which may limit the generalizability of the findings. Moreover, the study primarily relied on oral production data, without considering comprehension or morphological rule awareness in an organized way. Future research can explore these, as well as investigate the impact of speech rate and task type on realization of the–ed.

Moreover, subsequent research can adopt a longitudinal study in OT in order to capture the change in constraint rankings over time, and shed further light on the development of L2 morphophonology. Lastly, cross-linguistic studies involving learners of various L1s (e.g., Arabic, Korean) can also contribute to typological predictions of the universal interlanguage grammar constraints.

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Appendix

Production Task

The following sentences contain two pairs: one is grammatically correct and the other is not. Please decide which one is correct, then read only the grammatical one.

1- Who started their diet?
   Started their diet who?
2- Finished I cleaning.
   I finished cleaning.
3- I boiled eggs.
   Eggs boiled I.
4- He does played football.
   He played football.
5- This who apple baked pie?
   Who baked this apple pie?
6- I prepared this food.
   This prepared I food.
7- We added this file.
   We them added this file.
8- Jogged he in the park.
   He jogged in the park.
9- He died on Monday.
   He died in Monday.
10- I missed my class.
   I am missed my class.
11- Them waited for an hour.
   We waited them for an hour.
12- I cleaned the kitchen.
   Cleaned I the kitchen.
13- You paid 200 dollars?
   Paid you 200 dollars?
14- He stopped his car.
   He it stopped his car.
15- I studied English last year.
   I studied did English last year.
16- This changed we course.
   We changed this course.
17- We enjoyed the party
   We enjoyed it the party.