Full title

The role of L1 phonology in L2 morphological production:

L2 English past tense production by L1 Spanish, Mandarin, and Japanese Speakers

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L1 phonology effects on L2 morphology
Abstract

This study addresses the issue of L2 acquisition in adult learners by considering L1 phonological influence as part of the explanation for the ubiquitous problem of L2 functional morphology production. We compare the predictions of Representational Deficit Approaches and Full Access Approaches in the acquisition of English simple past tense by looking at morphology production by L1 speakers of Spanish, Mandarin, and Japanese. Common to these L1s are similar phonological restrictions on complex coda formation, typically found in simple past forms. Differences arise in L1 syntax; while Spanish and Japanese have syntactic past, Mandarin does not. Results show that having syntactic past in the L1 is not the only or main factor in target-like performance. Results also show that in some tasks, native speakers of Mandarin perform in a native-like way or like the other L2 groups, which questions the RDA position that adults are unable to acquire new syntactic features.

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1. Introduction

In the past two decades or so, generative second language (L2) acquisition studies have addressed the perennial problem of variable L2 functional morphology production as part of a more general, larger query, namely whether it is possible for adult L2 learners (L2ers) to acquire new target-like syntactic representation (see e.g., Prévost & White 2000 Franceschina 2002, 2005; Hawkins & Liszka 2003; McCarthy 2008; Slabakova 2008; Lardiere 2009). This means that variability in target L2 morphological production is understood by some as an indication of target deviancy in related syntactic representation (but see Rothman 2007, for discussion). Most recently, this issue has taken the form of examining the status of a number of uninterpretable parameterized syntactic features in L2 grammars (e.g., the syntactic features for number, tense, wh-movement). Among such features, the feature for past tense ([upast]) has received considerable attention particularly in the case of native Mandarin Chinese learners (henceforth, Mandarin) of L2 English. Different, sometimes mutually exclusive, proposals have been offered to account for the observed fact that suppliance of English past tense morphology proves difficult for this group (e.g., Hawkins & Chan 1997 for morphosyntactic deficits, Lardiere 1998 for syntax-morphology mapping difficulties, Davidson 2005, 2006a, 2006b for L1 phonotactic constraints, Goad, White & Steele 2003; Goad & White 2006 for prosodic constraints, Solt et al. 2004 for perception, Hopp 2009; Martohardjono, Valian & Klein 2011; Bonner 2013 for input factors and processing pressure). Indeed, it is intriguing that past tense morphology is so challenging for L2 speakers given that it is highly frequent during speech and in written texts, involves overt morphology (except in a few cases, e.g., ‘cut’-’cut’), and is explicitly taught in ESL classrooms from the elementary levels.

Assuming L1 transfer, exploring other explanations seems warranted. Mandarin not only lacks a syntactic feature for past tense, but also has phonological restrictions on complex
coda formation that are incompatible with many English past tense allomorphic forms. The possibility of L1 phonological transfer accounting better for the patterns of past tense omission by Mandarin speakers is a reasonable one to entertain.

Herein, we explore the possibility that the trend of variable L2 English past morpheme production by Mandarin speakers at high levels of L2 proficiency is best explained by L1 phonological influence as opposed to a syntactic deficit. This possibility was examined explicitly in Goad & White (2006). The present methodology attempts to test the latent predictions of Goad & White’s claims across other L2 groups. If they are on the right track, then any learner group acquiring English as an L2 whose L1 has similar phonological constraints on complex coda formation should pattern like Mandarin natives, irrespective of whether or not their L1 instantiates a syntactic feature for past available for transfer. The present study investigates the interlanguage (IL) of Mandarin native speakers and compares their performance against two other L2 English groups (L1 Japanese and L1 Spanish). As will be seen, comparison with these two groups is crucial to support any claims that a syntactic deficit approach over an L1 phonological transfer account for the data is privileged, precisely because all three languages share similar phonological restrictions on complex coda formation, despite the fact that Japanese and Spanish have the uninterpretable past [upast] feature available for transfer. If the L1 phonology is deterministic in L2 morphological suppliance, then the Japanese, Mandarin, and Spanish speakers, examined under the same methodology, should evidence similar difficulties in English past tense suppliance, specifically when the allomorph at play would be phonologically illegal in all three L1s. To our knowledge, Spanish has never been investigated in conjunction with these two languages to tease apart L1 phonological influence from L2 syntactic deficits.

The rest of this article is set up as follows. In section 2, we review relevant research into generative L2 acquisition of past tense morphology and contextualize the present study of the L2 acquisition of English past tense morphology by highly proficient adult native
speakers of Spanish, Mandarin, and Japanese. In section 3, for each L1 and English, we present analyses of the syntactic representation of pastness, as well as the morphological and prosodic representations and phonotactic constraints involved in simple past constructions. Using these analyses as a point of departure, we detail the learning task for each L1 group, and the predictions that fall out of RDAs versus FAAs for the different groups. In section 4, we describe the methodology we have implemented, which include three performance tasks that require written or oral past morphology suppliance. In sections 5 and 6, we report on our written and oral data, respectively. As will be seen, these results cannot be easily accommodated by RDAs, since the Mandarin and Spanish groups perform similarly across the three tasks. These findings are unexpected given that Spanish instantiates a syntactic feature for past, while Mandarin does not. Additionally, Japanese and Spanish speakers perform differently, which is also unexpected given that both instantiate a syntactic feature for past. As such, we posit that the results can be more easily accommodated by the PTH because syntactic differences in the L2ers’ native language are not supposed to be reflected in performance at high levels of proficiency. Section 7 addresses our findings as they relate to the hypotheses we have tested, and considers other factors that may help account for the data.

2. Previous generative acquisition research

Two generative approaches to adult L2 acquisition of morphosyntax are tested against one another herein: Representational Deficit Accounts (RDAs), and Full Access Approaches (FAAs). In this section, we outline these accounts, review the most relevant studies that have tested these approaches against one another, and contextualize the present study that follows the same line of reasoning from a unique angle.

Representational Deficit Accounts (RDAs¹) state that (some) differences at the level of syntactic representation between the L1 and the L2 are inevitable. In its most current

¹ We operationalize a group of theories under the macro-label Representational Deficient approaches (RDA) that claim syntactic features not instantiated in the L1 grammar and thus not available for transfer are unacquirable by second language learners in adulthood, such as Failed Functional features (Hawkins & Chan
instantiation, it is maintained that adult L2ers lose the ability to acquire new L2 syntactic (uninterpretable) features from the universal inventory, whereas semantically interpretable features remain accessible (Hawkins & Hattori 2006; Tsimpli & Dimitrakopoulou 2007). Such approaches, however, acknowledge the possibility of L2 learning which can correspond to what would seem to be surface reflexes of new syntactic feature acquisition, e.g., rote learning of morphological paradigms and their application via instruction, as well as unconscious compensatory learning strategies such as extensions of their L1 to accommodate the L2 input.

If on the right track, one consequence of an RDA predicts the impossibility of new uninterpretable features to be acquired in adulthood at the underlying level of representation. Yet, if one takes seriously that L2 learning in the truest sense of the word obtains as pointed out by Hawkins and others, then RDAs do not necessarily predict wildly different L2 performance for domains where surface learning could mask distinctions in underlying representation, for example, in the case of overt morphological production. Rather, RDAs expect predictable L2 variability/optionality in performance because other non-syntactic factors can help adult L2ers perform in ways that resemble the target language, such as the effect of explicit instruction and frequency effects. This prediction is particularly true of several irregular past tense forms, which tend to be frequent in the input and are more salient in the input that regular forms (e.g., ‘be’ vs. ‘was’). Therefore, RDAs would not propose a complete lack of knowledge because L2ers would have access to other non-syntactic resources.

The second generative SLA perspective discussed here is couched within Full Access Approaches (FAAs), which claim that adults have access to the full set of Universal Grammar (UG) features as in L1 acquisition (e.g., Schwartz & Sprouse 1996; Schwartz

1997) and the Interpretability Hypothesis (Tsimpli & Dimitrakopoulou, 2007). Despite differences between them, they make the same predictions as it relates to our study and thus can be treated as a single group.
FAAs propose that the noted difficulty in L2 functional morphology does not result from inevitable target-deviant syntactic representations, and that native-like syntactic representations are indeed attainable, especially at the advanced L2 level. However, they argue that the complexities inherent to the task of overtly expressing functional morphology can result in variability/optionality for a number of non-mutually exclusive reasons (Slabakova 2008; Lardiere 2009). Importantly, these approaches must attempt to account for the same observable optionality/variability of L2 functional morphology production in ways that offer a tenable and testable alternative to RDAs’ claims.

Knowledge and production of L2 English past tense has featured prominently in the debate between these two positions for L2 morphosyntax. In the remainder of this section, we review the most relevant of these studies, which will also serve to contextualize the present study that follows the same line of reasoning from a unique angle.

Hawkins & Liszka (2003) tested advanced L1 speakers of German, Japanese, and Mandarin for marking of L2 English thematic verbs for simple past tense. Statistical analysis of data from a sentence completion task revealed no difference among the L2er groups ($\chi^2 = 4.94, df = 2, p < .05$) when comparing regular and irregular verbs, and thus the authors conclude that morphological knowledge of past inflection was alike for all L2 groups. However, data from elicited spontaneous production tasks evidenced a significant difference between groups for both regular ($\chi^2 = 30.49, df = 2, p < .01$) and irregular verbs ($\chi^2 = 8.13, df = 2, p < .05$).

Arguably, this difference was due to the Mandarin informants since their mean scores were markedly lower, which the authors attribute to the fact that Mandarin does not instantiate a syntactic feature for past tense, unlike German and Japanese. The researchers also explored the possibility that L1 phonotactic transfer might have been responsible for low suppliance of past verb morphology (as argued, e.g., in Lardiere 1998a, 1998b, 2000). They compared the

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2 The details of the uninterpretable feature [npast] are provided in section 3.1.
performance of Mandarin and Japanese subjects on consonant clusters since both languages impose restrictions on them in ways relevant to past tense production of certain English past allomorphs. However, Mandarin speakers showed a markedly higher retention of consonant clusters on monomorphemes (82%) than simple past forms (63%), which suggests that the presence of a consonant cluster is not the determining factor in lower suppliance of past tense morphology. However, these data also suggest that consonant clusters can be a challenge by themselves, judging by the performance on monomorphemes. At the same time, the fact that the Japanese speakers show a high retention rate of consonant clusters in monomorphemic words (96%) seems to indicate that although both Mandarin and Japanese disallow consonant clusters, somehow Japanese speakers are better able to retain them, which might be responsible for their higher performance on simple past forms (92%).

Lardiere (1997, 1998a, 1998b, 2000, 2007) has analyzed longitudinal data from a native speaker of Chinese (Hokkien and Mandarin), known as Patty, who is reported to supply past tense morphology in obligatory contexts in a fairly stable manner (34.78%, 34.85%, and 33.82% at three different times over a period of nine years). The author has argued that Patty’s command of verb morphology underrepresents her syntactic knowledge, and that syntactic knowledge and its morphophonological reflexes need to be understood separately (Lardiere 2000:120). It is posited that L1 phonological transfer may account for this discrepancy, since consonant clusters are disallowed in Mandarin and Hokkien. Indeed, Patty’s written data show at least twice as many instances of suppliance of past tense marking in obligatory contexts than in her oral spontaneous production (Lardiere 2007), again suggesting that non-syntactic factors can be influential in morphology suppliance. A similar point is also made in Hawkins & Liszka (2003), although they warn that command of verb morphology may overrepresent L2ers’ actual knowledge. We take this to mean that studies that attempt to gather knowledge of the morphosyntactic feature for past need to consider
non-syntactic factors as well. Goad et al. (2003) tested 12 L1 Mandarin L2ers of English who had resided in Canada between six months and five years. They propose that interlanguage performance is constrained by phonological transfer effects, which can result in either across-the-board deletion of morphophonological material or variable suppliance. In their analysis, which we adopt in the current study, functional morphology is prosodified differently in both Mandarin and English, which is in part responsible for variable suppliance of the past –ed morpheme for Mandarin natives. While in English the past morpheme is adjoined to the verb stem, in Mandarin, functional morphemes (such as the aspectual perfective marker -lɘ), are in a position internal to the PWd, as shown in (1) (examples from Duanmu 2000:81, as cited in Goad & White 2006:248, 251). Therefore, the learning task for Mandarin speakers consists of not only retrieving the syntactic [upast] feature from the universal inventory, but also prosodifying functional morphology in a new way.

(1) a. English simple past allomorph  b. Mandarin aspect allomorph

Goad et al. (2003) suggest that adjunction of the –ed past marker in English is possible due to the violation of two of four constraints on prosodic domination proposed by Selkirk (1997). The first is EXHAUSTIVITY (EXHAUST), which militates against a constituent immediately dominating another constituent that is more than one level below it in the prosodic hierarchy. In this case, the English prosodic structure violates EXHAUST(PWd/ σ), which militates against a PWd linking directly to a σ. The second violated constraint is NONRECURSIVITY (NONREC), which militates against a constituent
dominating another constituent of the same prosodic level (in this case, a PWd dominating a PWd). As seen in Figure 1a, EXHAUST and NONREC are simultaneously violated in English forms that are inflected for simple past tense, since an external PWd directly dominates the internal PWd, while also linking directly to the external σ.³

In their study, Goad et al. (2003) propose the Prosodic Transfer Hypothesis (PTH), which predicts that a L1 prosodic structure that is not part of the L2 grammar cannot be acquired via access to universals. While their data support the hypothesis that transfer of L1 structures is the only possibility for suppliance, Goad & White (2004) determined that such a position was too strong. According to the instantiation of the PTH as detailed in Goad & White (2006), adult L2 learners have partial access to Universal Grammar for prosodic phonology in that there is full transfer of the L1 grammar to the L2, but not full access to universals not instantiated in the L1. Learners must therefore rely on L1 structures transferred to the L2 to construct English past tense prosodic structure; construction of L2 structures that cannot be built from existing L1 structures is predicted to be impossible. English learners are predicted to prosodify inflection adjoined to the PWd in the L2 if their L1 grammar allows the structures necessary for adjunction (recall that these include a PWd dominating a PWd and a PWd directly dominating a σ). L2 prosodic structure construction is thought to be possible if a) it can be built through combining L1 licensing relations or b) if it involves L1 structures being licensed in new positions (p. 247). As Goad & White (2006) state, most languages evidence compounding and permit direct domination of a syllable by a PWd, and therefore “learners from many L1s lacking adjunction should be in a position to build the structure required for English-type inflection” (264).

³ While Goad and colleagues discuss acquisition of L2 prosodic structure within an Optimality Theoretic framework consisting of constraint rankings and violations, for the purpose of this paper, we limit our discussion of the requirements for construction of new prosodic structure to the two pieces of structure needed for adjunction: a PWd linking directly to a dominating a PWd and σ.
Importantly, both of the structures necessary for PWd adjunction occur in Mandarin. First, a PWd can link directly to a $\sigma$ in a three-syllable construction in which the right-most syllable is undominated by a foot in order to comply with foot binarity. Second, a PWd can dominate a PWd in the case of compounding.\(^4\) However, these licensing relations do not occur in a single structure, which is a requirement of adjunction. As such, Mandarin inflectional morphology is thought to be part of the host’s PWd (what Selkirk calls an ‘internal clitic’). While adjunction is therefore not possible in Mandarin and thus condition b of Minimal Adaptation is not met, L1 Mandarin speakers are in a position to build English prosodic structure (although not inevitably so) because their L1 grammar includes the two structures necessary for adjunction (Goad & White 2006). That is, condition a of Minimal Adaptation is met.

Goad et al.’s (2003) results showed a lower rate of suppliance for regular verbs (57%) than for irregular verbs (78%), a finding consistent with data from Hawkins & Liszka (2003) as well as Lardiere (1998a, 1998b, 2000, 2007). These findings are in line with the predictions of the PTH, given that pseudo-inflected forms involve organization of the past tense morpheme inside the PWd of its host. That is, the learners are better at producing a form whose prosodic structure mirrors their L1 structure than they are at producing the adjoined form that is not part of their L1.

In a later study (Goad & White 2006), the authors analyzed data from 10 L1 Mandarin speakers and nine native controls.\(^5\) Participants were required to choose (in 12 seconds) one of two written sentences as a possible continuation to a prompt, as in the following example (from Goad & White 2006:252):

(2) Last night after dinner…

\(^4\) See Goad et al. (2003) for details of these violations.

\(^5\) Goad and White (2006) also investigated perfective morphology in this study, which is not discussed here.
The L1 Mandarin speakers selected the correct tense 83% of the time, in comparison with the English natives’ 98% accuracy. A two-way repeated measures ANOVA revealed a significant main effect for group ($f(1, 17) = 17.134, p<.001$). However, in spite of the differences between the two groups, the authors argue that Mandarin speakers do indeed represent $[\text{upast}]$ in their IL since they correctly chose past tense 83% of the time, well above chance.

Further analysis compared the “clicked” correct responses, thought to represent comprehension, and the oral responses to further examine how oral production of a target could be affected by phonological factors. The rate of selection of past forms in the first part of the experiment was compared with the rate of past tense suppliance in the recorded oral responses. In addition to examining the production of regular versus irregular forms, production of long-stemmed (VXC-final) versus short-stemmed (VX-final) regular forms was compared. Stem length is of interest when investigating prosodic transfer for two reasons. The first is because learners could treat short- and long-stemmed regulars differently, evidencing higher rates of suppliance for short-stemmed forms. This could be a possibility if learners were to treat short-stemmed forms like pseudo-inflected forms, essentially working around adjunction with the short-stemmed forms by constructing a PWd-internal representation of inflection (as in Mandarin). While an English rhyme can contain a maximum of two positions PWd-internally, a third position can occur PWd-finally. Pseudo-inflected forms such as ‘kept’ [kep-t]$_{PWd}$ are an example of this exception and are prosodified without adjunction. Similarly, in a short-stemmed form such as [pIk-t]$_{PWd}$, in comparison with a long-stemmed VXC-final form such as [[help]$_{PWd}$ t]$_{PWd}$, the addition of the past-tense allomorph does not exceed the maximum three-position rhyme and inflection could occur within the PWd. The second motive for investigating stem length is the articulatory difficulty
that comes with a three-consonant coda cluster and implications for L1 and L2 phonotactic constraints.

There were no statistically significant differences found between regular and irregular forms, or between short- and long-stemmed forms, with rates of suppliance ranging from 87% (short-stemmed regulars) to 94% (ablaut). The authors present evidence of stem reduction in the long-stemmed forms, which could suggest prosodification within a single PWd across the board. However, a phonetic analysis of learner productions indicated otherwise; stem-final consonants in the regular and pseudo-inflected forms were treated differently. Thus, similarly to Goad et al. (2003), the authors argue against RDHs. However, while Goad et al. (2003) concluded that learners would have only their L1 prosodic structure as recourse in L2 acquisition, Goad & White indicate that learners will be able to build adjunction structure not available in the L1 when a minimal adaptation condition is met.

The studies mentioned here differ not only in the type of data and the number of participants (see Table 1), but also in the results obtained. This is especially true for regular verbs, where suppliance rate goes from very high (87% in Goad et al. 2003) to very low (45.7% in Lardiere 2007). Therefore, further examination of group performance is warranted, especially for regular verbs, since they show greater variation even at advanced stages of acquisition.

Table 1. Comparison of L1 Mandarin performance across four studies

<table>
<thead>
<tr>
<th></th>
<th>Regular verbs</th>
<th>Irregular verbs</th>
<th>Number of subjects</th>
<th>Type of data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hawkins &amp; Liszka</td>
<td>62.5%</td>
<td>84.2%</td>
<td>2</td>
<td>Oral (spontaneous)</td>
</tr>
<tr>
<td>(2003)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goad, White &amp; Steele</td>
<td>57%</td>
<td>78%</td>
<td>12</td>
<td>Oral (picture description)</td>
</tr>
<tr>
<td>(2003)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lardiere (2007)</td>
<td>5.9%</td>
<td>45.7%</td>
<td>1</td>
<td>Oral (spontaneous)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Longitudinal (9 years)</td>
</tr>
<tr>
<td>Goad &amp; White (2006)</td>
<td>87%</td>
<td>94%</td>
<td>10</td>
<td>Oral sentence recitation (completion)</td>
</tr>
</tbody>
</table>
3. Past tense in English, Mandarin, Spanish, and Japanese

3.1. English

Our focus here is on the mental representation of the past tense in English. More specifically, given our empirical populations, we are interested in what the syntactic featural representation of pastness is in the IL of English as a second language by various groups of L2ers and the extent to which this IL representation is delimited by the uninterpretable features available from the L1 in this domain. The IL morphophonological surface forms as well as the mapping mechanism that connect the underlying representation to the morphological spell out are also of concern for us. Of course, pastness can be expressed in English through adverbials or the historical present, but for ease of exposition we focus here on the functional morpheme represented henceforth as –ed, which also has an abstract phonological representation. As is well known, -ed affixation can manifest as non-syllabic [t] or [d], or syllabic [ɪd], depending on the last segment of the verbal stem. In order to convey the idea that an event or state has taken place prior to the moment of speaking, English encodes this in the realization of the morpheme –ed adjoined to a lexical verb (e.g., walk-walked), although some verbs will undergo suppletion (e.g., go-went), vowel change (e.g., run-ran) or both vowel change and affixation (e.g., buy-bought) (Lobeck 2000).

We assume that simple past morphology marking results from a series of procedures that go from a syntactic representation to a phonological manifestation. Specifically, we follow Adger’s (2003:166-171) analysis. The essence of his proposal is that \( v \) enters the syntactic derivation with an unspecified uninterpretable tense feature, \([u\text{Infl}:]\). \( T \) hosts an interpretable [past] feature, which values the uninterpretable unvalued feature on \( v \), \( v[u\text{Infl}:] \) ➔ \( v[u\text{Infl}: \text{past}] \). The tense features on \( T \) and \( v \) match, and the uninterpretable feature on \( v \) is checked through c-command and is, therefore, deleted: \( v[u\text{Infl}: \text{past}] \).
Up to this point, all operations are strictly syntactic. The checked v[u
Inf : past] feature is spelled out as it interfaces with morphology, rendering it subject to the pronunciation rule that specifies that the affix –ed (for regular verbs) be added to the stem, resulting in the morphological representation: stem+ed. Adger describes this interface rule as in (3):⁶

(3) Pronounce v[u

As is easily observed, regular -ed affixation often times produces two-consonant codas, e.g., ‘sinned’ [sɪnd], ‘fooled’ [fuːld], ‘missed’ [mɪst], and even three-consonant codas, e.g., ‘worked’ [wɜːrkt]. Therefore, oral production of regular past tense English forms minimally involves instantiation of the [upast] feature and, following Goad et al.’s (2003) analysis, attachment of the –ed morpheme to the verb stem, and in the case of pseudo inflected forms, the past morpheme must be internal to the PWd of its host. As will be discussed in more detail in sections 3.2, 3.3 and 3.4, Mandarin natives need to retrieve the [upast] feature from the universal inventory, while native speakers of Spanish and Japanese can transfer it directly from their L1. Regarding prosodification of the past morpheme, both Japanese and Spanish natives will need to organize it in a position outside of the PWd.

3.2. Mandarin

Mandarin does not have overt morphology for expressing simple past tense (Li 1990), and pastness is mainly indicated through the use of temporal adverbs, and/or is calculated by the context. Therefore, the interpretation of a sentence without sufficient context or a time adverbial is ambiguous (example from Hawkins & Liszka 2003:26):

(4) Zhangsan kan dianying

Zhangsan see-INF movie

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⁶ For irregular cases such as ‘eat’-‘ate’, Adger proposes a special rule, expressed as: Pronounce ‘eat’ as ‘ate’ when it is adjacent to v[u
Inf : past], and in this case, do not pronounce v[u
‘Zhangsan is seeing/saw a movie’

Since Mandarin does not select the parameterized feature [u\text{past}] from the universal inventory (see Goad et al. 2003; Hawkins & Liszka 2003), Mandarin natives’ acquisition task involves retrieving such feature as well as the prosodification mechanism to adjoin the –\text{ed} morpheme to the verb host. In the case of pseudoinflected verbs, we find that, similar to Spanish and Japanese, Mandarin disallows consonant clusters in the rhyme and even single consonants in the rhyme are very limited. Indeed, as described in Duanmu (2007), a syllabic description of Mandarin lists only two possible consonants in the rhyme, /ŋ/ (as in /tuŋ/ ‘winter’), and /n/ (as in /tan/ ‘egg’). Therefore, L1 syllable transfer is of little help for native speakers of Mandarin because the alternative of treating regular past forms as pseudo-inflected forms is contingent on overcoming another set of L1 phonotactic constraints.

3.3. Spanish

Spanish expresses past tense through obligatory functional morphology on the verb and therefore is assumed to instantiate the uninterpretable [u\text{past}] feature like English. However, the Spanish affixation paradigm is much richer than in English, especially since grammatical aspect is differentiated through separate morphemes for preterit and imperfect. Another relevant point of comparison with English is the position that the past morpheme occupies with respect to the PWd (the lexical verb). In order to propose a position for the past morpheme in Spanish either inside or outside of the PWd, we examine its relationship with stress assignment. The logic is that if the morpheme is visible to stress assignment, we can take this to mean that it is inside the (lower) PWd. If, on the contrary, the morpheme’s presence does not affect stress assignment, we take this to mean that it is outside of the lower PWd. Such an approach is in line with Goad, White & Bruhn de Garavito (2011), who argue that the Spanish plural morpheme –s is PWd-joined because it is invisible to stress assignment. Here, we start with the common assumption that Spanish verb morphological
structure includes the following morphemes: prefix (if any), stem, theme vowel (TV), Tense/Aspect/Mood (TAM), and Person/Number (PN) (Harris 1987; Núñez Cedeño & Morales Front 1999; Alers-Valentín 2000, among others). Since the tense morpheme is conflated with aspect and mood into a single complex morphological unit (TAM), we explore the position that TAM occupies in the prosodic structure of the verb. For example, in the first person plural past form of *manejar* ‘drive’, stress falls on the syllable *já* in the sequence *manejábamos* ‘we drove’ (see (5)). This is the case for other regular verbs, in which stress is invariably assigned before the TAM morpheme. Following Harris (1987), we assume that the syllable following the TAM morpheme (which hosts PN) is extrametrical and is thus organized into a higher PWd. Stress is then assigned to the word-rightmost left-dominant binary foot (a trochaic foot), which suggests that the TAM morpheme is PWd-internal in order to ensure that the foot is binary.

(5) 

```
     PWd
     |
     PWd
     |
     Foot     Foot
     ┌──┐      ┌──┐
     σ   σ    σ   σ    σ
     ma  ne  ja  ba  mos
     TAM    PN
```

As established, knowledge of English past involves instantiation of the syntactic feature *\[\text{u}^{\text{past}}\]*, and a morphological structure that renders stem+*ed*. Up to this point, the acquisition task for a Spanish speaker is straightforward, as the difference between English and Spanish relies only on the specified past allomorph. However, the acquisition task is challenging
when one considers the interface of the morphological representation with phonology. As previously stated, English simple past forms involve PWd adjunction of the -ed morpheme, and since the tense marker in Spanish is inside the PWd, native speakers of Spanish will need to rearrange the L1-transferred prosodic structure to match that of the English simple past forms.

Recall that learners are predicted to prosodify inflection adjoined to the PWd in the L2 if their L1 a) can be built through combining L1 licensing relations or b) it involves L1 structures being licensed in new positions (Goad & White 2006:247). Spanish, Mandarin, and Japanese are in fact all in such a position. However, Spanish speakers will have an arguably easier task at hand, because PWd adjunction is an available prosodic structure in the Spanish verb system that can be adapted for use in the English IL; the conflated PN morpheme is adjoined to the PWd.\(^7\) That is, Spanish meets Goad and White’s Minimal Adaptation condition of an L1 structure being licensed in a new position. However, just because the structure is available does not guarantee it will be used. This study also explores the possibility that L2ers circumvent PWd-adjunction by treating regular simple past forms as if they were pseudo-inflected forms or monomorphemes. Therefore, we examine the restrictions that Spanish imposes on consonants in the rhyme in word-final position, which are limited to the following coronal consonants:

\[(6)\]  a. liquids [l] [ɾ]: e.g. sal [sal] ‘salt’, mar [mar] ‘sea’  
  b. obstruents [ʎ] [s] [θ]\(^8\) e.g. red [reθ] ‘net’, más [mas] ‘more’  
  c. nasal [n]: e.g. pan [pan] ‘bread’

Coda consonant clusters are mostly produced in careful speech and borrowings (see Colina 2006:191; Piñeros 2008:109), and only the consonant /s/ can be the second element in

\(^7\) PWd-adjunction is also found in nonverbal constituents, e.g., the prefix in- is directly linked to the PWd, e.g., in-estabilidad ‘instability’ (see Peperkamp 1997:91). Likewise, PWd-σ linking also occurs with three-syllable words in Spanish, which are numerous.

\(^8\) The voiceless interdental fricative is specific to Peninsular Spanish.
a consonant cluster. Furthermore, in casual speech, such clusters are usually reduced by deleting the second consonant, e.g., *biceps* as ['bi.sep], all of which suggests that complex codas (such as the ones found in several simple past forms, e.g. ‘packed’) will be reduced at least in the initial stages of English L2 acquisition.

Given the syntactic and phonological configuration of Spanish, the following predictions can be made thus far. RDAs predict target-like syntactic representation and use because Spanish natives are initially and subsequently aided by L1 transfer. The PTH also predicts target-like syntactic representation via transfer, but problems in performance might arise in oral production throughout development because past morphology in Spanish is prosodified within the PWd. However, the PTH does not rule out the possibility that some (if not all) advanced speakers might perform in a native-like manner with past morphology if they are able to accommodate existing prosodic structures (i.e., PWd-PWd and PWd-σ domination from their L1 into their L2 IL. Indeed, one limitation of the PTH is that in studies such as this, predictions cannot be easily falsified, given that Spanish natives are in a position to attain target-like production but are not inevitably so. On the other hand, with the data set in this study, it is much easier to falsify hypotheses associated with RDAs: L2 speakers either have the uninterpretable feature or not.

### 3.4. Japanese

Japanese expresses past tense through the allomorph –*ta* or –*da* added to the verb, as described in Kuroda (1979), Vance (1987), and Tsujimura (2007), e.g., /kaku/ ‘write’ and /kagu/ ‘sniff’ are the nonpast forms and their past forms are /kaita/ ‘wrote’ and /kaida/ ‘sniffed’, respectively. Marking the verb with the simple past allomorph is obligatory in past contexts, and so we follow Hawkins & Liszka’s (2003) assumption that Japanese has instantiated the syntactic feature [upast]. As in English, the instantiation of the [upast] feature results in the formation of a morphological rule that creates stem+*ta*. In terms of the prosodic
structure of the –ta/-da allomorph with respect to the verb, we propose that it is located internally to the PWd, as explained below.

3.4.1. Position of the –ta/-da allomorph in the Japanese verb

In order to examine the position of the past morpheme, it is first necessary to briefly mention the mora and pitch accent in Japanese. The mora is considered to be the appropriate level of prosodic analysis in Japanese since it constitutes a recognizable and intuitive level of prosodic organization for native speakers. Moras are also thought to regulate speech rhythm and have structural implications for the PWd.9 A commonly assumed typology of language rhythmic types classifies Japanese as a mora-timed rhythm (see Vance 2008:122). Accent in Japanese involves pitch and verbs are said to be either accented or unaccented. Within accented verbs, we attempt to establish the position of the –ta/-da morpheme with respect to the verb stem by examining whether its presence is visible to pitch accent assignment (similarly to what we have explored for Spanish in the previous section). Thus, if the past morpheme -ta/da is visible to pitch accent assignment, this suggests that it is inside of the PWd. If the morpheme is not visible to pitch assignment, we assume that it is outside (adjoined to) the PWd. An examination of past forms should therefore reveal whether the vowel in -ta/da is relevant for accent assignment. This seems to be the case since accent is invariably assigned to the third moraic element from right to left (pitch accent is placed before the downward arrow) in the following past forms: /ma\textsuperscript{e}z\textsuperscript{e}ru/ ‘mix’, /ma\textsuperscript{i}z\textsuperscript{e}ta/ ‘mixed’, and /aru\textsuperscript{i}ku/ ‘walk’, /aru\textsuperscript{i}ita/ ‘walked’ (examples from Vance 2008:168). This also holds in passive and causative past forms, as can be seen in (7) (adapted from Vance 2008:169):

\[
\begin{array}{ll}
(7) & \text{Dictionary form} \quad \text{Past} \quad \text{Passive nonpast} \\
\hline
/t\text{a}\text{\textsuperscript{be}z\textsuperscript{e}}\text{ru}/ & /\text{t}\text{a}\text{\textsuperscript{be}}\text{\textsuperscript{\textit{beta}}}/ & /\text{t}\text{a}\text{\textsuperscript{be}r\textsuperscript{a}}\text{\textsuperscript{\textit{ru}}}/
\end{array}
\]

9 Moras are thought to be equal in duration. However, as pointed out in Vance (2008:117-122), experimental efforts to demonstrate this have not been successful, and results from different studies are contradictory.
As can be seen, in all past forms pitch accent is invariably placed in the third mora to the left and therefore we assume that Japanese past morphology is internal to the PWd because its presence has implications for accent assignment.\footnote{A reviewer, however, suggests that the Japanese past morpheme is adjoined to the PWd, positing that “Compounded verbs can appear with tense in Japanese (unlike in Mandarin). If these compounds involve two PWds organized into a higher PWd ([[…]PWd […]PWd]PWd), then tense would need to be outside: [[[[…]PWd […]PWd]PWd]PWd -ta]PWd. The implication for this study is that Japanese natives would be in a better position to produce past tense forms than native speakers of Spanish, which is very important for testing the predictions of the PTH, but not as important for the predictions of RDAs.}

For the Japanese native, then, English simple past acquisition involves L1 transfer of \[upast\], acquisition of the morphological rule stem+\textit{ed}, and PWd adjunction of the English regular past–\textit{ed} allomorph, which the reader will recall requires allowance of PWd-\(\sigma\) and PWd-PWd structures. This is indeed possible, as pointed out in Ito & Mester (2003). In Japanese word clippings, syllables are linked directly to the PWd, skipping the foot. As seen in (8), the clipped borrowing results in a PWd formed by a bimoraic foot followed by a light syllable directly linked to the PWd.\footnote{If the second syllable were heavy (i.e., two moras), it would form a bimoraic foot.}

\begin{equation}
\begin{array}{c}
\text{PWd} \\
\text{Foot} \\
\sigma \\
\sigma \\
\mu \\
\mu \\
\mu \\
a \\
ni \\
\text{me (esyonN) ‘animation’}
\end{array}
\end{equation}
PWd-PWd domination also takes place in Japanese through certain compounds. Ito & Mester (2007) discuss prosodic adjunction in Japanese compounds and propose a typology that distinguishes between word compounds and phrasal compounds. Among Japanese three-element compounds, they analyze two types of word compounds: left branching and right-branching. In the structures they propose, a left-branching compound such as *hoken-Gaisha bÁnare* ‘movement away from insurance companies’ is represented in (9) (example from Ito & Mester 2007:103).

(9)  
```
     PWd
    /   \  
   PWd   PWd
   /     \  
  PWd   PWd
```

*hoken-gaisha*  *bÁnare*

This compound illustrates that structures of the type PWd-PWd are common in Japanese.

Likewise, a right branching compound such as *genkin fÚri-komi* ‘cash transfer’ also shows this type of structure as shown in (10) (example from Ito & Mester 2007:103).

(10)  
```
     PWd
    /   \  
   PWd   PWd
   /     \  
  PWd   PWd
```

*genkin*  *fÚri-komi*

Therefore, Japanese speakers are in a position to build the required prosodic structure for *–ed* inflection because there are two Japanese structures that can be combined to form it.

---

12 In Ito & Mester’s analysis, the number of moras of the second member of the compound determines whether a compound is a word compound or phrasal compound. If the second member of the compound has more than four moras, it becomes a phrasal compound. Otherwise, it is a word compound (see Ito & Mester 2007:104).
As mentioned, this study also explores whether L2ers circumvent PWd-adjunction by treating regular simple past forms as if they were pseudo-inflected forms or monomorphemes. Thus, it becomes necessary to examine the inventory of Japanese syllable types in order to determine what constraints Japanese has against consonants in the rhyme. As described in Ota (1999:24), Japanese has heavy restrictions on the presence of consonants in rhyme position. Indeed, the only consonants allowed in the rhyme are nasal consonants, either placeless, e.g., /hoN/, or homorganic in place with the onset of the following syllable, e.g., [kam.pa] ‘campaign’, [heŋ.ka] ‘change’, and the first part of a geminate, e.g., [kap.pa] ‘cucumber’, [kis.sa] ‘tea house’). Importantly, no complex codas are ever allowed and only a placeless nasal is allowed in word final position.

Since Japanese disallows consonant clusters in the rhyme, this means that L1 syllable transfer is of little help for both regular simple past forms and pseudo-inflected forms. Indeed, as is usually observed, English borrowings in Japanese are fixed to conform to L1 phonotactic constraints. The phonological acquisition task for native speakers of Japanese thus involves building the prosodic structure for regular past forms and/or allowing consonant clusters for pseudo-inflected forms.

3.5. Interim summary: Predictions and hypotheses

As discussed in detail above, Mandarin, Spanish, and Japanese disallow coda clusters (in similar ways) and have the necessary elements of prosodic structure for adjunction in their grammars, only Mandarin lacks the uninterpretable [u]past feature, and therefore a comparison of past suppliance among these groups should shed light on the role that lacking [u]past alone may have on past morphology suppliance. Thus, RDAs predict that Mandarin natives will consistently perform below native speaker level, differently (i.e., worse) than Spanish and Japanese natives. It is also predicted that there will be no observable differences between oral and written responses, provided they are appropriately comparable. On the other
hand, the PTH (and other FA approaches), predicts that such oral-written asymmetry among these groups may simply not take place. Instead, all three groups are predicted to perform in a native-like fashion when they produce past forms in writing. The PTH suggests that a great deal of variation might occur when responses are orally produced, however, irrespective of whether the L1 can provide the underlying syntactic feature relevant for the L2 category, since prosodic structure for simple past in each language is not created via adjunction.

4. The Study

4.1. Subject population

The experiment had four groups: a native English control group (n = 15), and three groups of L2ers whose native languages were Mandarin (n = 15), Spanish (n = 13), and Japanese (n = 11). All participants were recruited in academic settings in different areas of the United States, and were first exposed to daily interaction with English native speakers at around or after age 18. Exposure to naturalistic input was deemed important to establish that the participants had had enough evidence that past tense morphology is overtly manifested in lexical verbs. Each participant had been living in the US for a minimum of one year four months up to 25 years, and none was proficient in a third (or subsequent) language. A similar protocol as the one in Hawkins & Liszka (2003) was used to determine proficiency in English. That is, subjects were selected on the combined score obtained in the multiple-choice grammar test and the multiple-choice vocabulary test of the Michigan Placement test, and only participants whose scores on both measures fell around or above 75% accuracy were selected.13 Table 2 shows the L2ers’ profiles for Age of arrival (AoA), length of residence

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13 Hawkins & Liszka used Nation’s (1990) vocabulary test at the 10,000 word level. However, the Grammar and Vocabulary section of the Michigan Placement test was deemed more appropriate, since the learners had been exposed primarily to American English. The cutoff in their study was 80%, but we chose 75% was an appropriate cutoff because most scores clustered between 75% and 85%. Additionally, a closer examination of the combined proficiency scores and the performance on past tense suppliance did not suggest any correlation between higher proficiency scores and higher performance. For example, in all L2er groups,
(LoR), and combined proficiency score (Prof). Within each language group, each row represents a participant. All scores have been organized according to proficiency scores, with the highest scores at the top of the table and the lowest scores at the bottom. The Spanish group had the highest proficiency score \((M = 86.76, SD = 6.45)\), followed by the Japanese group \((M = 83, SD = 7.5)\), and the Mandarin group \((M = 79.4, SD = 4.2)\). A univariate ANOVA indicated a significant difference in mean proficiency score among groups \((F(2,39) = 5.193; p = .01)\). Bonferroni post-hoc tests revealed that the Mandarin group had significantly lower scores than the Spanish group \((p = .008)\), but no other group differences were significant.

Table 2. L2ers’ length of residence and proficiency score

<table>
<thead>
<tr>
<th>AoA</th>
<th>LoR</th>
<th>Prof</th>
<th>AoA</th>
<th>LoR</th>
<th>Prof</th>
<th>AoA</th>
<th>LoR</th>
<th>Prof</th>
</tr>
</thead>
<tbody>
<tr>
<td>26</td>
<td>24</td>
<td>98</td>
<td>27</td>
<td>5;4</td>
<td>98</td>
<td>25</td>
<td>1;4</td>
<td>87</td>
</tr>
<tr>
<td>27</td>
<td>13</td>
<td>92</td>
<td>24</td>
<td>4;9</td>
<td>93</td>
<td>22</td>
<td>1;6</td>
<td>86</td>
</tr>
<tr>
<td>28</td>
<td>21</td>
<td>90</td>
<td>24</td>
<td>17</td>
<td>93</td>
<td>24</td>
<td>1;4</td>
<td>85</td>
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<tr>
<td>27</td>
<td>11</td>
<td>85</td>
<td>25</td>
<td>8</td>
<td>91</td>
<td>22</td>
<td>3;4</td>
<td>82</td>
</tr>
<tr>
<td>19</td>
<td>11</td>
<td>84</td>
<td>32</td>
<td>10</td>
<td>91</td>
<td>17</td>
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<td>89</td>
<td>26</td>
<td>6;6</td>
<td>81</td>
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<td>77</td>
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<td>2;4</td>
<td>84</td>
<td>22</td>
<td>2;6</td>
<td>77</td>
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<td>77</td>
</tr>
<tr>
<td>19</td>
<td>9</td>
<td>76</td>
<td>36</td>
<td>4</td>
<td>82</td>
<td>29</td>
<td>1;7</td>
<td>76</td>
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<td>1;4</td>
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<td>42</td>
<td>8;4</td>
<td>79</td>
<td>23</td>
<td>1;4</td>
<td>76</td>
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<td></td>
<td></td>
<td></td>
<td>30</td>
<td>4;6</td>
<td>79</td>
<td>25</td>
<td>9</td>
<td>75</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>25</td>
<td>6</td>
<td>77</td>
<td>23</td>
<td>2;6</td>
<td>75</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26</td>
<td>1;4</td>
<td>74</td>
</tr>
</tbody>
</table>

The control group was composed of native speakers of American English \((n = 15)\) studying at different universities in the US. Their combined proficiency scores ranged between 80% and 100% \((M = 95.07, SD = 5.75)\), and their age range was between 18 and 31 \((M = 21.06, SD = 3.17)\).

Some participants with proficiency scores between 75% and 80% outperformed participants with proficiency scores of 90% or higher.
4.2. The tasks

Three tasks were carried out: two sentence completion tasks and a picture description task. While the sentence completion tests provide a controlled measure of use of functional morphology, the picture description task aimed at obtaining a more natural sample of past tense morphology use. All oral responses were recorded using a headset connected to a computer (using PRAAT software, Boersma & Weenink 2014, and were broadly transcribed by two trained native speakers of English.

4.2.1. Sentence completion tasks

Each participant completed two sentence completion tasks. In the first (Task A), they read 82 short contexts (each controlled to be 20-25 syllables long) in which one word was missing, and they were asked to write the missing word to complete the sentence.14 In the second sentence completion task (Task B), they read aloud 82 short contexts (20-25 syllables long) and were asked to utter the missing word out loud.15 These two sentence completion tasks had the same design and therefore provide highly comparable data: the same targets, number of sentences, and 16 distracters. The tasks were also completed under the same conditions: participants were told that there was no time limit and that they could change their answers if they wanted. The only difference in the design was the context in which the targets were embedded in order to avoid priming effects. The contexts consisted of one or two sentences taken from corpora so that they would resemble the kind of input that L2ers are typically exposed to and minimally adapted to control the environment. For example, for the target ‘filled’, two contexts were generated:

---

14 Targets were placed at the right edge of the sentence, and were either in final position or right before a word with a vocalic onset in order to facilitate data coding.

15 One reviewer inquired as to why only one word in each set could fit in each blank. The task was designed in this manner to ensure that participants would all choose the same answer and therefore the data would be comparable across participants and tasks.
(11)  a. Johnny had a terrible headache, so he _______ a glass with water and took two aspirins.       [fill  write  type]

b. In 1950, all computers in existence were huge. Each one _______ a whole room!

To control for task effects, approximately half of the participants in each group provided oral responses to Task A, and written responses to Task B, while the other half provided written responses to Task A, and oral responses to Task B.

4.2.1.1. Targets: Simple past forms and monomorphemes

A total of 27 simple past forms were included in tasks A and B. Of these, 15 were regular simple past forms with a complex coda, six with a singleton coda, and six were irregular (pseudo-inflected) forms. Fifteen monomorphemes that were similar in phonological shape to regular simple past forms were included as well (e.g., ‘past’, see Table 3). This was in order to obtain an indication of whether phonological constraints affected consonant clusters across the board in the IL. This is particularly relevant given that Mandarin, Spanish, and Japanese disallow consonant clusters often seen in English simple past forms and lexical monomorphemic words. Since the goal was to have comparable sets of past forms and monomorphemes, only past forms whose consonant cluster had a similar monomorphemic counterpart were included. This resulted in a selection of 15 past forms and 15 monomorphemes that ended in the consonant clusters [Id], [nd], and [st]. Additionally, in order to obtain a fairly uniform selection of targets, all past tense forms and monomorphemes were monosyllabic. To control for frequency, all targets were selected from the 5,000 most common words in the Corpus of Contemporary American English (COCA) and we followed a protocol similar to that in Marshall & van der Lely (2006). That is, for every token, we obtained the total number of hits from the COCA, and then calculated the natural logarithm
for each value.\textsuperscript{16} Taking into consideration the natural log values, we ran a $t$-test between the past forms and the monomorphemes ($\alpha = .05$) to verify that there were no statistically significant differences between each set. The resulting list was: ‘build’, ‘field’, ‘wild’, ‘mild’, ‘bald’, ‘send’, ‘blind’, ‘pound’, ‘blend’, ‘pond’, ‘test’, ‘list’, ‘dust’, ‘priest’, and ‘nest’ (see Appendix 3 for complete information).

Simple past forms with a single consonant in the rhyme were originally included (n = 6) as well as pseudo inflected forms (n = 6). This helped gather data that were more inclusive of simple past forms in general, providing a more global picture of overall performance on simple past use.\textsuperscript{17} All verbs included in this condition were monosyllables that resulted in a three-element rhyme with the single consonant [d], resulting in the tokens ‘played’, ‘fried’, ‘tried’, ‘paid’, ‘cried’, and ‘stayed’. Previous research on L2 English past tense has shown that irregulars are supplied differently than regular verbs by L2ers. This asymmetry has also been a matter of discussion in terms of whether regular and irregular verbs are represented in the mind in the same way (see Pinker 1991; Clahsen & Rothweiler 1992; Prasada & Pinker 1993; Bybee 1995; Clahsen 1999; McClelland & Patterson 2002; Pinker & Ullman 2002).

For example, Lardiere (2007) noticed that in Patty’s data, irregulars were more often marked with past morphology than regular verbs, but that even though the most frequent verb used was \textit{have}, it was never marked for past. Additionally, Patty’s written data show almost no difference in suppliance of past verb forms between regular and irregular verbs. Hawkins &

\begin{footnotesize}
\begin{itemize}
\item[\textsuperscript{16}] Calculation of the natural logarithm of the total number of hits makes comparisons easier, given that the values range greatly, e.g., ‘killed’ had 46,714 hits and ‘field’ had 72,594 hits. Their natural logarithms, however, are 10.75 and 11.2, respectively.
\item[\textsuperscript{17}] We do not report results about these two types of verb for a number of reasons. The number of regular simple past forms was much higher than either pseudo inflected (n = 6) or singleton coda past forms (n = 6), additionally, singleton coda past forms and pseudo inflected forms were much more frequent in the corpus than regular simple past forms, making comparisons between these conditions was less than ideal. The reason why fewer tokens in these two conditions were included was that a larger pool would have meant an even greater difference in terms of frequency. It was also found in the results that some targets were frequently omitted by participants (specifically, ‘kept’ and ‘went’), making the comparison even weaker.
\end{itemize}
\end{footnotesize}
Liszka (2003) found higher accuracy on irregulars, while Goad & White (2006) found no significant difference. The past irregular forms selected for inclusion had to end in a consonant cluster and be distinguishable from their infinitival forms phonologically and orthographically. As such, pairs such as ‘cut’ – ‘cut’ were not considered. The complete list of past forms used in the tasks is outlined in Table 4.

Table 3. Past tense tokens

<table>
<thead>
<tr>
<th>Regular simple past forms with consonant clusters</th>
<th>sealed, filled, killed, yelled, rolled</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>joined, cleaned, trained, ruined, gained</td>
</tr>
<tr>
<td></td>
<td>passed, pressed, kissed, blessed, missed</td>
</tr>
<tr>
<td>Regular simple past forms with singleton coda consonant</td>
<td>played, fried, tried, paid, cried, stayed</td>
</tr>
<tr>
<td>Pseudo inflected forms</td>
<td>found, told, kept, left, went, lost</td>
</tr>
</tbody>
</table>

4.2.2. Picture description task

The oral picture description task was included to examine whether the patterns observed in the sentence completion tasks would hold in a task in which participants have more control over the context, the vocabulary, and the structures used. It was also the expectation that subjects’ attentional resources would not be as focused on the targets, thus reducing the possibility of subjects using or relying on metalinguistic knowledge. In order to elicit the expected simple past targets, each picture contained printed words or short phrases that called for the intended targets. Participants were first asked to describe two pictures as practice. Afterwards, they were introduced to a fictional character, Jane, and were asked to describe a typical day of work for Jane by looking at a series of pictures of a woman performing different activities. Then, they were given a series of images that showed Jane’s day off, which was a set of pictures that elicited simple past tense (see Appendix 1). In order to set a context of pastness, participants were told the following:

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18 See Bonner (2013) for details on effects of performance factors on oral suppliance.
OK, we know Jane, and we know she is a secretary and that she works a lot. In fact, she works too much, but she finally took a day off, and so we are interested in talking about that. Here are all the things that she did yesterday. So, just like before, describe what she did and follow the sequence of the pictures. Make sure you use the words below each picture and mention the times.

In order to ensure that participants would interpret all the events as taking place in the past, rather than as habitual actions or ongoing events, they were asked to start the description with the prompt ‘yesterday, it was Jane’s day off...’. The targeted past forms were: ‘slept’, ‘worked’, ‘bought’, ‘washed’, ‘cleaned’, ‘baked’, ‘walked’, ‘drank’, and ‘went’.

### 4.2.3. Data coding

For all tests, past morphology suppliance was coded in the following way. In a target such as ‘called’, if the second consonant of the consonant cluster [ld] was not pronounced, this was considered not to be supplied. Conversely, if the consonant that carries past tense morphology (here, [d]) was pronounced, it was considered as supplied. Past tense morphology was also considered supplied in the case that the stem-final consonant was deleted but the tense morpheme was supplied (e.g., [kli:d] for ‘cleaned’). Likewise, in comparing simple past forms against monomorphemes, when the second consonant of the cluster in the monomorphemes was not pronounced, it was coded as not supplied, e.g., ‘cold’ pronounced as [koul]. The idea was that, had it been a simple past form, it would have been interpreted by a potential listener as an infinitival form. For each participant in each group, a measure was obtained for his/her overall past suppliance.  

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19. In the picture description task, a total of three native, two L1 Spanish, three L1 Mandarin, and four L1 Japanese productions were eliminated from the count due to potential coarticulation effects, e.g., if a participant said ‘washed the car’, it was difficult to determine whether the past tense morpheme was actually being produced since the onset of the following word was /θ/.
5. Results: Sentence completion tests

5.1. Between-group comparisons: Written responses

Figure 1 shows suppliance of simple past morphology in all written data. An ANOVA was conducted, and since the assumption of homogeneity of variance was violated; the Welch $F$-ratio is reported, revealing a non-significant main effect $F(3, 23.915) = 1.539, p > .05$. Therefore, differences among groups are not statistically significant, and the groups evidence high levels of suppliance. This finding suggests that when morphology suppliance is not dependent on phonological production, all groups perform in a native-like fashion regardless of the L1 feature configuration. We take this evidence to not support the predictions of RDAs, although we acknowledge that these approaches do not preclude metalinguistic knowledge and/or other compensatory strategies from explaining this better performance in a written modality.

![Figure 1. Simple past suppliance in written responses](image)

We also examined L2er individual performance in order to quantify how many of the L2ers truly performed in a native-like fashion. A look at the control group data shows that controls performed within a range from 92% to 100%, which therefore constitutes the native
speaker range. In both the Spanish (12 of 13) and the Mandarin (14 of 15) group, all but one subject in each group performed within the native range, and in the Japanese group, eight out of 11 did. These data suggest that when morphology is supplied in written modalities, most advanced speakers perform in a native-like way regardless of the presence of [upast] feature in their L1.

5.2. Inter-group comparisons: Oral responses

This data set contains all (oral) simple past forms in the study: regulars with a consonant cluster coda, regulars with a singleton coda, and irregulars with consonant clusters. As shown in figure (2), native controls supplied past morphology close to ceiling (\( M = 96.7\% \), \( SD = 3.39 \)), while the Spanish group provided past morphology at a lower rate (\( M = 83.24 \), \( SD = 15.26 \)), as well as the Mandarin group (\( M = 79.49 \), \( SD = 12.12 \)) and the Japanese group (\( M = 88.41 \), \( SD = 17.37 \)).

![Figure 2](image)

Figure 2. Simple past suppliance in oral responses

A one-way ANOVA was conducted and since the assumption of homogeneity of variance was violated, the Welch \( F \)-ratio is reported, revealing a significant main effect for Group (\( F(3, 21.217) = 11.9, p < .001 \)). The Games-Howell post hoc test reveals that the
Native control group’s rate of suppliance is significantly higher than both the Spanish group \((p = .049)\) and the Mandarin group \((p = .000)\), but no significantly different from the Japanese group \((p = .315)\). Among the L2er groups, no significant differences were found \((p > .05)\).

The data here support some of the predictions: the Mandarin group performs differently than the control group, and the Japanese group performs in a native-like fashion. However, the Spanish group data cast some doubts since RDAs predict that performance should be target-like for this group, as well, and certainly that this group should fare no worse than the Japanese group. Recall that we included the Spanish group precisely to have a novel group in the literature that unambiguously has the relevant syntactic features in the L1 but similar L1 prosodic constraints to Mandarin and Japanese, which are comparably much more widely studied. For the PTH, the predictions leave more room for variation since it stipulates that target-like performance in oral data is possible if the target prosodic structure can be built by combining existing structures (which is the case in all of the L1s at play).

Since the PTH claims that some L2ers may attain a target-like prosodic representation, it is worth examining individual data. The control group performed within a range of 88% to 100% suppliance, which constitutes the native speaker range. In the Spanish group, six out of 13 performed within the native range; in the Mandarin group, six out of 15 were within the native range; in the Japanese group, nine out of 11 were within the native range. As can be seen, the data (individual and aggregate) pose a challenge for RDAs, given the difference between the Spanish and the Japanese group, on the one hand, and the fact that a third of the native speakers of Mandarin perform within the native range. On the other hand, this data set does not pose any serious challenge for the PTH, given that native-like performance is a possible (although not inevitable) outcome.
5.3. Native control group data

5.3.1. Written and oral performance

A comparison between written and oral data for all groups shows the extent to which phonological factors can affect morphology suppliance. As expected, past morphology suppliance is very high in both modalities for the control group, around 97%-98%, as shown in figure 3. These scores were submitted to a Wilcoxon signed-rank test, revealing that past suppliance in written responses ($M = 98.98$, $SD = 2.27$, $Mdn = 100$) was not significantly higher than past suppliance in oral responses ($M = 96.78$, $SD = 3.39$, $Mdn = 96.29$), $T = 14.5$, $p > .05$ (see Figure 3).

![Figure 3. Simple past suppliance (written and oral responses) in control group](image)

5.3.2 Consonant cluster effects on simple past forms

Since it is possible that L2ers of English resort to different strategies to accommodate for inflection, especially if their L1 disallows coda consonant clusters, consonant clusters in three conditions were examined:
(i) Monomorphemes with consonant clusters [ld], [nd], and [st] (oral responses)\textsuperscript{20}

(ii) Simple past forms with consonant clusters [ld], [nd], and [st] (oral responses)

(iii) Simple past forms with consonant clusters [ld], [nd], and [st] (written responses)

Figure 4 shows the controls’ performance in the three aforementioned conditions. A repeated-measures ANOVA was carried out and a Mauchly’s test indicated that the assumption of sphericity had been met ($\chi^2(2) = 1.3, p > .05$), showing that the overall rate of suppliance was not affected by the type of answer, $F(3, 50) = 2.25, p > .05$. This verifies that the type of production (consonant clusters in monomorphemes, oral past forms, and written past forms) is not a factor in native speakers’ suppliance, and that there are no significant differences in consonant cluster production when they involve simple past morphology in oral production ($M = 97.33, SD = 4.91$), simple past morphology in written production ($M = 98.66, SD = 3.73$), or when they are part of a monomorpheme ($M = 98.22, SD = 3.05$).

\textsuperscript{20} Recall that monomorphemes were coded as if they were simple past forms, e.g., if the word nest [ˈnest] was uttered as [ˈnes], it was coded as a ‘miss’.
5.4. Comparisons within the Spanish group

5.4.1. Written vs. oral performance

The data from the Spanish group were submitted to a Wilcoxon signed-rank test revealing that simple past suppliance in oral responses ($M = 83.24, SD = 15.26, Mdn = 81.48$) was significantly different from simple past suppliance in written responses ($M = 97.95, SD = 4.32, Mdn = 100$), $T = 2, p < .05$ which strongly suggests that performance is affected by factors other than the L1 featural configuration, namely, phonological factors. Since RDAs do not, in principle, predict differences between performance in written and oral responses, this data set constitutes a challenge for it. On the other hand, the PTH predicts the possibility of markedly better performance on written responses, and therefore it seems better equipped to deal with such differences.

![Figure 5. Past tense suppliance (oral and written responses)](image-url)
We interpret these results as evidence that when Spanish natives need to orally produce simple past forms, their performance is hindered by phonological factors, arguably the articulation of complex codas inexistente in their L1. By extension, then, the same could be true of other L2er groups whose L1 do not have complex codas.

5.4.2. Consonant cluster effect on simple past forms

The results in Figure 6 were submitted to a repeated-measures ANOVA. Mauchly’s test indicated that the assumption of sphericity had been met ($\chi^2(2) = 1.3, p > .05$), showing that the overall rate of suppliance was affected by the type of answer, $F(2, 24) = 7.57, p < .05$). This was followed by tests of Within-Subjects Contrasts, showing no significant contrast between monomorphemes with consonant clusters (oral) ($M = 74.79, SD = 20.16$), and simple past forms with consonant clusters ($M = 76.63, SD = 21.83$), $F(1, 12) = .06, p > .05$. However, a significant contrast was observed between simple past forms with CC clusters (oral) and simple past forms with CC clusters (written) ($M = 97.39, SD = 4.37$), $F(1, 12) = 13.788, p < .05$. 

![Bar chart showing results](image-url)
We interpret these results as supporting the claim that when L1 Spanish speakers do not simple past morphology is not mediated via phonological production, their performance is native-like. However, when past morphology is mediated through phonology, performance is significantly lowered. Furthermore, since monomorphemes and simple past forms are supplied at the same (below native level) rates, we take this as suggestive evidence that L1 Spanish speakers treat consonant clusters in simple past forms the same as consonant clusters in monomorphemes. In other words, the \(-ed\) morpheme is prosodified internally to the PWd and, in a number of cases, subsequently deleted from the output. The relevance of this finding is that the presence of the uninterpretable past feature is clearly not enough for Spanish natives to supply simple past morphology, and that consonant cluster reduction by itself shows to be a determinant factor in production of simple past forms. Consequently, presence/absence of the uninterpretable feature in the L1 is not a sufficient condition for native-like performance even at advanced stages of acquisition, which implies that when Mandarin speakers fail to produce past forms in a native-like fashion, they may well be affected by phonological factors, just as the Spanish natives show.

To sum up, the Spanish group shows native-like use of past forms in written responses, but target-deviant behavior in oral responses. Given that their performance is lower in oral responses, we propose that L1 phonological transfer is affecting performance. To test this possibility, further examination points to L1 Spanish speakers having a single phonological structure assigned to monomorphemes with consonant clusters and simple past forms with consonant clusters. Because the L1 Spanish speakers treat consonant clusters in monomorphemes and simple past forms in a similar (target-deviant) manner, and show a higher rate of suppliance in past forms with a singleton coda, we can conclude that the morphological production differences between this group and the controls is mainly a
phonological one. Recall that Spanish has the relevant syntactic feature for past instantiated and it is thus available for transfer. RDAs do not, therefore, anticipate that these learners should have deficits in underlying representation for past in L2 English (nor does the PTH, of course). These data alone do not present any direct challenge to RDAs, but they allow us to isolate how phonological factors weigh on functional morphology. Additionally, this discussion will be crucial to the development of the logic we present in section 5.6 as it relates to the Mandarin group for which other studies have claimed their suppliance of past tense morphology in L2 English supports representational deficit L2 theories. If we show the same for the Mandarin group as we show here for the Spanish group, then we will by extension be able to argue that these and previous data on past morphological suppliance cannot be used to unambiguously support RDAs, but might in fact be more accurately understood as showing an L1 intervention effect at the level of phonology.

5.5. Comparisons within the Japanese group

5.5.1. Written vs. oral performance

Figure 7 shows the Japanese group’s scores for these two conditions. Simple past suppliance was high for both oral responses ($M = 88.41, SD = 17.37, Mdn = 95.83$) and written responses ($M = 94.08, SD = 8.48, Mdn = 100$). The results from a Wilcoxon signed-rank test revealed that suppliance in simple past forms in oral answers was not significantly higher than for simple past forms in written answers ($T = 11, p > .05$). These results are in line with the expectations of RDAs for this group in that they show that L1 Japanese speakers perform in a native-like fashion across modalities. The results can also be viewed as consistent with the PTH, which argues for the possibility of target-like prosodic structures being built in the IL.
5.5.2 Consonant cluster effects on simple past forms

The same three conditions were examined as with the control and Spanish groups. The results showed high rates of suppliance for all conditions: monomorphemes with CC clusters \(M = 94.54, SD = 12.22\); simple past forms with CC clusters (oral) \(M = 83.22, SD = 21.86\); simple past forms with CC clusters (written) \(M = 92.72, SD = 11.72\). A repeated-measures ANOVA was carried out and Mauchly’s test indicated that the assumption of sphericity had been met \(\chi^2(2) = 3.55, p > .05\). The results showed that the overall rate of suppliance was not affected by the type of answer, \(F(2, 20) = 1.698, p > .05\).
Thus, these results show that L1 Japanese speakers’ morphology suppliance is not significantly affected by phonological factors, while also showing high levels of suppliance. This data set is consistent with the predictions of RDAs because Japanese has instantiated the [\text{upast}] feature in L1 acquisition, as well as the PTH, in the sense that it is possible for Japanese natives to build the target prosodic structures for inflectional morphology. It is intriguing that Japanese speakers perform significantly better than the Spanish natives in the oral responses, given that both languages face similar phonological challenges. A possible explanation could be that as a group, these L1 Japanese participants had a longer length of residence (LoR) in the US than the Spanish group. If LoR differences are indeed a factor, this would cast doubts on our results, since simple past suppliance could be attributed to proficiency rather than common linguistic properties between the L1 and the target.
One way to examine this possibility is to examine individual demographic information and data from each L2er, which we take up in section 6.2.

5.6. Comparisons within the Mandarin group

5.6.1. Written vs. oral performance

As can be seen in Figure 9, there is an asymmetry between the rates of suppliance for the written and oral conditions. A Wilcoxon signed-rank test showed that written suppliance of past forms ($M = 97.5, SD = 3.64, Mdn = 100$) was significantly higher than oral suppliance of simple past ($M = 79.49, SD = 12.12, Mdn = 80.76$), $T = 0, p > .05$.

The results from these two conditions are not predicted by RDAs in two ways: First, performance on the written responses is native-like, and second, the performance between

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21 It should be noted that all efforts were made to pair L2ers according to their level of proficiency, age of arrival and length of residence. However, difficulty in procuring L1 Japanese participants made it a challenge to control for these variables.
these two conditions is markedly different. Since RDAs do not incorporate phonological factors in morphology suppliance, this is hard to explain under an RDA, although Hawkins & Liszka (2003) examine the effect of L1 phonotactic constraints in morphology suppliance and find that consonant clusters did not appear to be a factor responsible for lower morphological suppliance among the Mandarin speakers. On the other hand, for the PTH, the difference between oral and written responses is not unexpected, since phonological factors are thought to influence morphology suppliance.

5.6.2. Consonant cluster effects on simple past forms

As before, the following comparisons were made: Monomorphemes versus consonant clusters, simple past forms versus consonant clusters (oral suppliance), and simple past forms versus consonant clusters (written suppliance); results are illustrated in Figure 10. A repeated-measures ANOVA was carried out and Mauchly’s test indicated that the assumption of sphericity had been met ($\chi^2(2) = 1.8, p > .05$), showing that the overall rate of suppliance was affected by the type of answer, $F(2, 28) = 31.55, p < .05$. This was followed by tests of Within-Subjects Contrasts, showing a significant contrast between monomorphemes with consonant clusters and simple past forms with consonant clusters (oral), unlike the L1 Japanese and Spanish groups, $F(1, 14) = 16.1, p < .05$. A significant contrast was also observed between simple past forms with consonant clusters (oral) and simple past forms with consonant clusters (written), $F(1,14) = 33.44, p< .05$. In summary, all visual differences in Figure 10 proved to be statistically significant.
The findings that 1) oral rate of suppliance is lower than written rate of suppliance and 2) learners are better at producing complex codas in monomorphemes than in inflected forms strongly suggest that when L1 Mandarin speakers do not need to deal with phonological factors, their performance is native-like, but when past morphology is mediated through phonology, performance is negatively affected. The higher suppliance in CC monomorphemes compared with inflected CC forms also points to the possibility that the inflection is prosodified in an adjoined structure. The fact that monomorphemes show a significant (but not absolute) degree of consonant cluster reduction precisely shows that consonant clusters are challenging by themselves, and therefore, production of simple past forms will imply violation of L1 phonological restrictions. In order to further examine whether or how phonological factors affect morphology suppliance (and the implications for how these data support RDAs or the PTH), in the next section we compare past morphology production between targets that resulted in simple and complex codas. The logic behind doing so is that if the problem in morphology suppliance stems from a syntactic deficit only,
then the rates of suppliance for simple coda past forms should not be significantly different from suppliance of past forms in complex coda past forms.

5.7. Summary of results from sentence completion tasks

As seen, neither RDAs nor the PTH can fully account for the data sets presented here. However, some generalizations can be made about the acquisition of morphosyntax and its connection to L1 phonological influence as it relates to morphological production. First, the preponderance of the data shows that differences between morphology supplied in written and oral modalities can be marked, and L1 phonological factors can (negatively) influence (functional) morphology suppliance. We take this to mean that an examination of L1 phonological factors in L2 oral performance is warranted in general. The Spanish group data and their striking similarity to the Mandarin group data underscore that the possibility of L1 transfer of target syntactic features does not nullify L1 phonological effects. By extension, if L1 phonological effects are likely responsible for the behavior of the Spanish group, and given the striking conformity of the Spanish and Mandarin group performances, it seems reasonable to suggest that these target-deviant performances stem from the same source. That is, these performances are rooted in L1 transfer at the morphosyntax-phonology interface. At this point, we can make the following generalizations about the data in connection to the predictions of RDAs and the PTH:

(i) Phonology is an undeniable factor in L2 morphology suppliance, especially as evidenced by the data discussed for the L1 Spanish and the L1 Mandarin groups, given that performance in written responses is higher than in oral responses. This asymmetry suggests that phonological factors strongly influence morphology suppliance and that they may be much more complex than they appear.
(ii) In written performance, all L2er groups perform in a native-like fashion, and the great majority of individual speakers perform within the native range.

(iii) Only the L1 Japanese group performs in ways similar to the control group in all conditions. RDAs are seemingly supported by the results from the Japanese group, the target-deviant oral performance of the Mandarin speakers, and the target-like written performance of the Spanish speakers. However, RDAs cannot easily account for the target-like written performance of the Mandarin group and their high performance on past forms with a single consonant. The target-deviant oral performance of the Spanish group also presents real challenges for RDAs, at least in isolation of considering phonological factors.

The PTH is seemingly supported by the difference in performance observed in both the Spanish and Mandarin group between the written and the oral data. Additional (although indirect) evidence for a phonological account comes from the trend observed in the L2er groups of reducing consonant clusters in monomorphemes and arguably in past forms. Unlike the Mandarin and Spanish speakers, however, recall that that the Japanese learners as a group are much more successful in acquiring the L2 phonological structure than the other two groups. 22

6. Picture description task results

As can be recalled, this study includes a picture description task in order to elicit oral production of past morphology. In what follows, we report the results and compare them with data from the sentence completion tasks. 23

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22 As one reviewer points out, if the tense morpheme is represented similarly in English and Japanese, then these results are not surprising. This is because the learning task for the Japanese speakers is confined to syllable structure complexity and is therefore simpler.

23 Auxiliary forms and the copula be were removed from the count.
6.1. Group results

The first comparison across groups provides the rates of past morphology suppliance (Figure 11). All controls performed at ceiling ($M = 100$, $SD = 0$), the L1 Spanish group performed highly ($M = 86.9$, $SD = 17$), similarly to the L1 Mandarin group ($M = 87.6$, $SD = 16$) and the L1 Japanese group ($M = 90.9$, $SD = 15.9$). While a Kruskal-Wallis test revealed a significant effect of group on past morphology suppliance ($\chi^2(3) = 9.226$, $p < .05$), such an effect is most likely due to the control group, given that its mean and standard deviation are markedly different from those of any of the L2er groups.\(^{24}\) This test was followed by a one-way ANOVA run only on the learner data. Homogeneity of variance was met ($\chi^2(2, 34) = .003$, $p > .05$), and the results revealed no significant differences among the groups, ($F(2, 36) = .496$, $p > .05$). Since the L2er groups perform similarly to one another, this data set suggests that instantiation of the $[\mathit{u}]$ past in the L1 does not seem to affect suppliance of simple past morphology.

![Figure 11. Simple past production in picture description task](image)

\(^{24}\) An ANOVA could not be carried out because homogeneity of variance was violated and robust tests of equality of means could not be performed for accuracy because the control group’s variance was zero.
Thus, at this point we can conclude that at advanced stages of development, L2ers’ morphology suppliance does not seem to be inevitably limited by the L1 syntactic feature configuration (in this case, the [upast] feature), since the Mandarin group performs similarly to the Spanish and Japanese group. However, this data set also suggests that L2ers and the native controls perform differently in less controlled types of test, and that phonological factors are most likely at play given that performance on written responses was target-like for all L2er groups. It becomes relevant, then, to examine individual performance in order to examine how many participants (and in what way) perform in a native-like way, and to explore other factors that could be at play. We examine individual variation in the next section.

6.2. Individual performance

Given that the results of the elicited production task are different from the sentence completion tests, it is worth exploring native-like performance in individual L2ers. Recall that RDAs make strong as well as compelling claims for L2 acquisition: New L2 syntactic features are inaccessible to adults as a result of some type of biological maturation, which is an appealing idea given that generative research assumes that language is a biological phenomenon. If this is indeed the case, then, the Japanese and Spanish group should pattern together, while the Mandarin group should be consistently different from both of them. Likewise, most if not all native speakers of Japanese and Spanish (who are advanced speakers of L2 English) should perform like native controls, while no or few native speakers of Mandarin should perform in a native-like way. Thus, a closer examination of individual performances is warranted in order to see how individual performance compares with group results. We now turn to a discussion of how LoR relates to proficiency scores, and how both variables relate to target-like performance.
Tables 4, 5, and 6 show information about each participant in each L2er group. From left to right, the information includes: participant ID, age of arrival in the US (AoA), length of residence (LoR), combined proficiency score, suppliance of past tense in oral responses (Past Oral), suppliance of simple past tense in written responses (Past Written), and simple past suppliance in the elicited description task (Elicited). Participants are listed in order of highest proficiency score to lowest. Scores in shaded cells indicate that a given score falls within the score range obtained by the native speaker group and thus implies native-like performance.

Table 4. L1 Japanese group data

<table>
<thead>
<tr>
<th>Participant</th>
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<th>Proficiency</th>
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<th>Past Written</th>
<th>Elicited</th>
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As can be seen in Table 4, proficiency scores and LoR seem to be closely related; higher (shaded) proficiency scores come from participants with over a decade of residence in the US. This suggests that proficiency increases according to LoR. In relation to native-like performance, a total of four participants performed in a native-like fashion on all three tasks. It should be noted, though, that one of them (participant 205) had resided in the US for only one year and four months and his/her proficiency score was below the controls’ range. The table also shows that LoR and/or proficiency scores do not unequivocally predict target-like production of simple past tense. Indeed, participant 596 has the highest LoR and proficiency
score (98) and yet, suppliance in the Past Oral test (70) is well below that of participant 891 (96), who has the shortest LoR and the lowest proficiency score (76). From this, we conclude for now that LoR has an effect on proficiency, but perhaps not so much of an effect on simple past morphology suppliance.

Table 5. L1 Spanish group data

<table>
<thead>
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<th>Participant number</th>
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</table>

In the Spanish group, table 5 shows that the relationship between LoR and proficiency score is not entirely predictable. For example, participants 747 and participant 1351 have similar LoRs and a large difference in proficiency scores, while other proficiency score-LoR relationships do not seem to follow a particular pattern. However, when we look at target-like performance across the three tasks, we do observe that participants 962, 293, 862 and 782 tend to have longer LoRs (17, 10, and 14 years, respectively).

Table 6. L1 Mandarin group data

<table>
<thead>
<tr>
<th>Participant</th>
<th>AoA</th>
<th>LoR</th>
<th>Prof</th>
<th>Past Oral</th>
<th>Past</th>
<th>Elicited</th>
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</thead>
</table>

25 One of the reviewers raises the question of the possible influence of the specific Spanish dialects. As is well known, some Spanish dialects are more conservative than others in maintaining consonants in coda position. In the dialects represented in the study, Colombian and Mexican Spanish are particularly conservative, European Spanish (Castilian) less so, and Chilean Spanish is the least conservative. While we acknowledge that this was not controlled for and it should be in future studies, the data do not seem to suggest that those from more conservative dialects tend to keep complex codas more often than the other dialects.
Table 6 shows the Mandarin participants’ data, and it is evident that these learners’ LoRs are much shorter than those of the Spanish and Japanese groups. We also observe that LoR and proficiency scores do not appear to correlate. For example, the participants with the three highest proficiency scores have a LoR of less than two years, while participants with longer LoRs have lower proficiency scores. Additionally, participants 688 and 715 have the same LoR but proficiency scores that differ by 13 points. Moving on to a comparison of proficiency and performance, an examination of those participants who performed in a native-like way in all three experimental tasks indicates that proficiency scores do not seem to predict target-like performance. Specifically, of the four participants with target-like performance in all three tasks (688, 1045, 689, and 865), three have a LoR of 1;4, and only one has a LoR of seven years. Considering that Mandarin is the only group whose L1 does not instantiate the [u] feature, it is remarkable that 27% of the participants have attained truly native-like performance, and that all of them performed in a native-like way on at least one task.
7. Discussion and conclusion

Results from the oral picture description task are mostly in accord with the findings from the sentence completion tasks. The general pattern observed is that native-like production of simple past morphology is attained by around half of the participants in each L2 group while group means are around 80%-90%. It was also found that the Mandarin lack of the [\textit{u}past] feature does not preclude its speakers from attaining target-like performance on these tasks, indicating that these learners have access to linguistic universals in adulthood and presenting a challenge for RDAs. Additionally, given that the performance on the written sentence completion tasks was target-like for all L2 groups while performance on the oral production task was not, it seems that phonological factors can and do hinder suppliance of past morphology. Looking beyond statistical results, however, the overall trend was that the L1 Japanese participants were more accurate than the Spanish and Mandarin speakers. In the case of Mandarin speakers, we originally thought that a lack of suppliance would be due to syntactic reasons (i.e., retrieval of [\textit{u}past]). However, we have presented evidence that even the Spanish speakers show less-than-target performance, which cannot be attributed to lack of the [\textit{u}past] feature. The predictions of RDAs are not supported by a preponderance of all the data taken together because: (a) Phonological issues proved to be significant in past tense morphology suppliance for the Mandarin natives, and (b) the Mandarin and Spanish groups patterned together in performance. Since RDAs state that problems in functional morphology suppliance stem from a syntactic deficit that is maturationally conditioned and no specific claims are made about the role of phonological factors, it is unclear how the hypothesis can account for the overall tendency that functional morphology suppliance is lower in oral production.\(^{26}\) It is interesting to note that phonological factors seem to be the best candidate

\(^{26}\) An anonymous reviewer brought up the possibility that the L1 Mandarin learners could have used domain-general strategies to supply past tense morphology. While this is certainly a possibility (and is hard to verify), the design of both tasks was identical, as were the testing conditions. For example, when participants
for explaining why the L1 Spanish group performed as it did, since this group undoubtedly has the syntactic feature for past. Conversely, the PTH is better equipped to account for such differences in performance. Thus, we conclude that the PTH is on the right track in placing great importance on phonological factors in oral production of functional morphology. We believe that L1 phonological factors can strongly influence functional morphology production, in that performance is lowered when morphology suppliance is mediated by phonological production.

Given the evidence that points to oral suppliance affected by phonological factors, we raise the question of whether L2 prosodic structure can be acquired, or if a learner’s phonological grammar will fossilize rather than constructing the target PWd adjunction. The L1 Japanese participants appear to have acquired the target structure, which indicates the ability to build novel L2 prosodic structure via the combination of pre-existing (L1) prosodic structures and points to at least partial access to UG in the domain of prosodic phonology. This brings us to the question of why, 1) if all three learner groups meet one of the conditions of Minimal Adaptation, and 2) if all three groups demonstrate acquisition of the past feature, do several individuals in each group demonstrate acquisition of target prosodic structure, but only the Japanese group as a whole demonstrates acquisition of these structures? This is especially interesting given that both Spanish and Japanese disallow the word-final consonant clusters tested in the current study. While this unexpected result is without serious implications for the general argumentation, it is still of interest to explore different possible explanations. In what follows, we consider language-specific possibilities, followed by factors that could be responsible for individual variation.

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completed sentences in the written task, they had the opportunity to think before completing the answer and to change their response. For the oral sentence completion task, participants were told they could take as much time as they wanted and that they could change their answers. When an answer was revised in either task, only the last response counted. Thus, we are confident that if any domain-general strategies were used, they were used similarly in both tasks.
One possible explanation for the Japanese group’s performance is the different L1 phonological repair mechanisms for consonant clusters employed in each language. While Japanese repairs English borrowings with consonant clusters by epenthesizing a vowel in between consonants, Spanish deletes one (or more) of the consonants in the cluster. Thus, we may hypothesize that in the phonological system of the Japanese speakers, the “extra” consonants can still be recovered in future stages of development, whereas the L1 Spanish speakers may not have them available for future stages because they have been reduced. We have also proposed in this study that the Japanese past tense marker is prosodified than in the target language. However, if it is the case that the past marker in Japanese is prosodified in the same way as English (as pointed out by one of the reviewers), then the data could more easily be explained. Another possible explanation for inter-group variation was explored in the previous section regarding LoR. As was seen, Japanese speakers have the longest LoRs. However, the data do not suggest that this could have impacted past morphology suppliance, although it did seem to impact overall proficiency.

Beyond group differences, it is of interest why each group consists of a number of learners that tested within the native range as well as a number of those that did not. Recall that while the Japanese speakers’ rate of suppliance was higher than that of the Mandarin and Spanish speakers, the rates of seven of the 11 L1 Japanese participants, seven of the 13 Mandarin participants, and seven of the 15 Spanish participants were not within the native range for the picture description task. We briefly discuss two factors that have been hypothesized in the literature to affect L2 inflection production: 1) input factors, including perception, salience, and frequency, and 2) performance factors, i.e., processing costs.

A link has been proposed between perception and production, whereby L2 input must be converted to intake before production can occur (e.g., Flege 1991, 1995; Wode 1995, 1997). Researchers such as Brown (1998) and Kabak & Idsardi (2007) claim that such conversion
can be blocked by the L1 phonology, thus impeding intake and therefore production. In fact, there is ample evidence that L1 phonotactic constraints can impede accurate L2 perception (e.g., Dupoux, Kakehi, Hirose, Pallier & Meller, 1999; Kabak & Idsardi 2007; Dupoux, Parloto, Frota, Hirose & Peperkamp 2011). That being said, if it is the case that perception indeed precedes production, past inflection production data from a number of studies (e.g., Hawkins & Liszka 2003; Goad & White 2006, Lardiere 2007; Bonner 2013) would indicate that learners are indeed able to perceive coda consonant clusters that violate L1 phonotactic constraints. Indeed, recent research (e.g., Martahardjono, Valian & Klein 2011; Bonner & Martahardjono 2012) shows that L1 constraints do not affect perception, but rather that salience and processing costs are the culprits when it comes to inflectional variability.

Given the nature of the tokens that were used in the tasks, it is conceivable that salience is partially responsible for non-native-like performance. First, the targets employed were utterance medial or utterance final, which Barcroft & Van Patten (1997) found to be less salient than an utterance initial target (although we recognize that the stop release in word-final position should aid perception, see Goad 2011, for discussion). Second, targets contained the non-syllabic voiceless allomorph [t], also found to be less salient than syllabic and voiced [Id] (Bonner & Martahardjono 2012). Third, some CC targets contained adjacent segments with identical manners of articulation, which has been shown to affect perceptibility (e.g., Adams 2004). Finally, Martahardjono, Valian & Klein (2012) found that bound morphemes are less salient than free morphemes. Thus, it is conceivable that some learners have not converged on the target because the input is not salient enough in certain contexts (see Archibald 2009 for a discussion of the importance of salience in overcoming L1/L2 differences).

A growing body of research (e.g., Trenkic 2007; Hopp 2009; Martohardjono, Valian & Klein 2012; Bonner 2013) proposes that variability, even at advanced levels of proficiency,
is a result of processing load effects. Hopp (2009) found that in tasks with a higher processing demand, near-native L2ers evidenced processing deficiencies similar to those of native speakers that were tested. Bonner’s (2013) findings echo those of Hopp: he found a significant effect of sentence length in both perception and production of past tense inflection. Considering the findings reported in this section, the issues of L1 perceptual constraints, salience, and processing load all warrant further exploration and is currently underway (Authors, in preparation).

To conclude, we believe that the data clearly show that uninterpretable features are retrievable from the universal inventory in adulthood, but in order for these features to manifest in a fully native-like way on the surface, additional knowledge beyond syntactic representation is necessary. Beyond the fact that Mandarin and Spanish speakers seem to parallel each others’ performance, further compelling evidence to be highlighted comes from the fact that 4 out of the 15 Mandarin speakers supplied past tense morphology in a target-like fashion in all tasks, which casts doubts on the (absolute) unavailability of new uninterpretable features as well as the impossibility of constructing L2 prosodic structure. In the end, perhaps not all uninterpretable features are equal, in the sense that they interact differently with phonological properties.
References


http://corpus.byu.edu/coca/ (21 May, 2014)


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Appendix 1: Picture description

Jane’s day off
Yesterday it was Sunday so Jane took the day off. Please tell the story of her day off. Start your story with: *Yesterday, it was Jane’s day off…*

**Morning**

sleep – 10:00  
work out -10:30  
buy groceries - 11:15

**Afternoon**

wash - 1:00  
clean – 1:30  
bake - 2:00

**Evening**

walk 5:00  
drink - 6:30  
go to the movies – 9:00
Appendix 2: sentence completion tests.

[ld] coda type

1. Sealed
She wrote her comments and suggestions, placed them in an envelope and then _______ it (20 syl) [seal  kneel  work]

Mary put everything back in her room quickly, closed the door and _______ it with tape. (20 syl) [call  send  seal]

2. filled
Johnny had a terrible headache, so he _______ a glass with water and took two aspirins. (21 syl) [fill  write  type]

In 1950, all computers in existence were huge. Each one _______ a whole room! (21 syl) [send  fill  smell]

3. Killed
Surprisingly, last year human diseases _______ an exceptional number of lions. (22 syl) [lose  yell  kill]

Last summer in Colorado, the West Nile virus _______ more than 100 thousand birds (20 syl) [call  crash  kill]

4. Yelled
Since they were losing the game, coach Jason was mad and _______ angrily at his team. (20 syl) [mail  write  yell]

Dylan was desperately looking for his wife, so he opened the window and _______ “Anne!!” (22 syl) [run  sneeze  yell]

5. Rolled
Well, his car slipped on the wet road, and then it _______ over and crashed into a ditch (20 syl) [roll  drive  feel]

John is helpful but never listens. I asked him to clean the carpet, but he _______ it up instead. (24 syl) [drive  feed  roll]

Monomorphemes [ld]
1. build
The city also plans to upgrade the aquarium and _______ a new park next year. (20 syl)
   [build  call  field]

The property is owned by developers planning to _______ a casino resort (21 syl)
   [touch  build  hear]

2. wild

One-fourth of seafood harvested from the _______ is not used for human consumption (20 syl)
   [wild  book  sleep]

She is proud of herself for doing something that was on the _______ and crazy side. (20 syl)
   [book  wild  shirt]

3. field

If student athletes don’t do well in their tests, they can’t go to their basketball court or football _______.
   [field  lab  work]

Gender equality has long been an issue in the _______ of education (20 syl)
   [man  cup  field]

4. mild

Go to a hospital if you have severe symptoms, but stay home if your symptoms are _______. (22 syl)
   [nice  than  mild]

Many economists thought that the impact from the US crisis would be globally _______. (23 syl)
   [car  mild  fresh]

5. fold

Usually when I'm done painting, I _______ a paper towel and wipe off the excess paint. (22 syl)
   [fold  call  eat]

First, slice one onion and then _______ a sheet of foil in half to put the slices on it. (21 syl)
   [buy  fold  smell]

[nd] coda type

1. joined

I wanted to get closer to her, so I even _______ a sculpture club to learn her craft (22 syl)
   [eat  see  join]

We invited faculty to be a part of the spiritual life group and everyone _______. (22 syl)
   [throw  see  join]
2. cleaned
John was in charge of building administration. He checked the locks nightly and _______ everything. [clean  train  cut] (23 syl)

When the factory found out about the water pollution, they _______ up the river. (20 syl) [kill  clean  throw]

3. trained
As many European basketball players, Ivan left his country and _______ in the USA. (23 syl) [train  buy  catch]

“John said that to prepare for his fight last September, he _______ everyday for three months”. (20 syl) [fall  train  have]

4. ruined
I had a beautiful restaurant but yesterday the police _______ it while chasing a suspect. (24 syl) [buy  eat  ruin]

The Kansas team had a very bad coach, who actually _______ a whole season of games. (21 syl) [write  ruin  call]

5. gained
Last month, I stopped eating healthy food; I started eating doughnuts and _______ about ten pounds. (21 syl) [gain  drink  train]

Pakistan was created when India _______ its independence in 1947. (22 syl) [house  gain  call]

Monomorphemes [nd] (2)

1. pound
Few people know that a distance runner needs more protein per _______ of body weight than a weight lifter. (24 syl) [pound  fork  work]

He was taken into custody after a search of his car showed half a _______ of drugs (22 syl) [book  pound  field]

2. send
“Well, everything is by phone, and I have no idea where to _______ a complaint letter” (22 syl) [buy  fry  send]
If you want a paper version of this article, please _______ a self-addressed, stamped envelope. (22 syl).

[blend catch send]

3. blend
If you want a good sweater, only buy one made of wool or cashmere, or a _______ of both. (22 syl).

[team pound blend]

What makes for a good dessert? I believe, a _______ of anything chocolate and peanut butter (23 syl)

[blend leaf cold]

4. pond
My dad and I were driving, and suddenly he stopped the car and pointed at a nice frozen _______. (24 syl)

[pond sky truck]

They installed a waterfall and also, they used pretty flowers to cover the _______. (21 syl)

[fall pond cry]

5. blind
My sister always wanted to become a child psychologist for the deaf and _______. (21 syl)

[soon blind home]

A crisis exists in the US because of the shortage of teachers for students who are _______. (24 syl)

[more draft blind]

Past forms [st]

1. passed
Sacred lands have been protected for 10 years now thanks to the law that the Supreme Court _______. (22 syl)

[buy pass say]

The regulations in his basketball team are strict, and he _______ a drug test just yesterday. (23 syl)

[pass sleep type]

2. pressed
Paul refused to attend the meeting and _______ other people to stay away, too. (20 syl)

[above press know]

Jim was in the hospital, and whenever he felt worse, he just _______ a button for help. (22 syl)

[rent throw press]

3. kissed
This very young student said that the first time she _______ a guy, she thought it was disgusting. (21 syl)

[kiss write call]
I was driving through the town with my father and he showed me where he first ________ a girl. (21 syl)

4. blessed

She hugged everyone as if preparing for a long journey, and she ________ us over and over (24 syl).

The nun prayed for all of us and ________ all of us, especially the sickly ones. (20 syl)

5. missed

My dad was a wonderful father, he never ________ a soccer game or a hockey game. (22 syl).

I ended up in the emergency room with salmonella, and ________ a whole week of work. (24 syl)

Monomorphemes [st]

1. test
She said that only one in three fourth graders here can pass the state's basic math ________ (20 syl)

Based on the research, the student or team should plan, build, and ________ a working model of the system (24 syl)

2. list
They told me to drink plenty of water and also gave me a ________ of healthful foods to eat. (24 syl)

I never liked my high school teacher. Once, she gave us a ________ of a hundred words to memorize. (24 syl)

3. dust
Don’t apply solvent, just use a cloth moistened with water to clean off the ________ after sanding (23 syl)

Most big cities are incredibly polluted because factories contribute to smog and ________ . (24 syl)

4. beast
He is big, and his feet are huge. He is like a creature from mythology, like half man, half ________ . (24 syl)

The story makes no mention of the hero, though it suggests that someone killed the ________ . (21 syl)
5. nest

The old lady found several tiny slips of paper in a bird _______ in her backyard. (21 syl)
[rust  tribe  nest]

Her heart was filled with joy. She loved looking at the baby bird in the artfully hidden _______ (23 syl)
[nest  old  frame]

SIMPLE CODA TOKENS IN PAST TENSE

1. Played
On our soccer team, we like challenges, so last weekend we __________ against the best team in the
[play  want  try]

city. (25 syl)

Yesterday, we cleaned the playground, and today in the morning, my kids __________ in the sandbox
[cook  sell  play]

for hours. (25 syl)

2. Fried
My mom cooked all day long. For lunch, she made a salad, and then she __________ a chicken. (20
[shift  fry  run]
syl)

I was very hungry this morning but didn’t have much time, so I just __________ an egg and ate it. (23
[fry  know  cut]
syl)

3. Tried
At the picnic there were 5 types of pie but I couldn’t choose just one, so I __________ a piece of each.
[scan  try  write]

(23 syl)

After looking at the options at their health club, Camille and Kent __________ a fitness yoga class.
[make  try  cut]

(23 syl)

4. Paid
Last weekend, Allan was caught by the police driving while drunk. He __________ a $1,000 fine. (23
[write  call  pay]
syl)

John always cheats. Yesterday, for his math exam, he __________ a friend to take the exam for him. (23
[pull  pay  lift]
syl)

5. cried
Mary was talking on the phone and was told that her father had died. She got off the phone and
[cry  write  roll]

___________. (24 syl)
[cry  write  roll]

I’m not emotional at all, but I admit that when my brother got married, I ___________. (22 syl)
[mark  cry  run]
6. stayed
Stan flew back from vacation in Mexico on Sunday, and he __________ at Rob's Sunday night. (20 syl) [drive stay cry]

Because of the snowstorm last week, schools were closed but only some of the children __________ at home. (22 syl) [stay buy go]
Appendix 3. Monomorphemes and simple past forms (numbers indicate natural logarithm)

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Past form</td>
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<td>Monomorpheme</td>
</tr>
<tr>
<td>filled (10.28)</td>
<td>build (10.52)</td>
<td>joined (10.15)</td>
<td>send (10.42)</td>
<td>passed (10.65)</td>
<td>test (11)</td>
</tr>
<tr>
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<td>field (11.2)</td>
<td>trained (9.6)</td>
<td>blind (9.48)</td>
<td>missed (9.74)</td>
<td>list (10.78)</td>
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<td>wild (10.21)</td>
<td>gained (9.3)</td>
<td>pound (9.03)</td>
<td>pressed (9.3)</td>
<td>dust (9.7)</td>
</tr>
<tr>
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<td>mild (8.78)</td>
<td>cleaned (8.41)</td>
<td>blend (8.7)</td>
<td>kissed (8.72)</td>
<td>priest (9.14)</td>
</tr>
<tr>
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<td>bald (8.14)</td>
<td>ruined (8.25)</td>
<td>pond (8.7)</td>
<td>blessed (8.47)</td>
<td>nest (8.56)</td>
</tr>
</tbody>
</table>

\[ p = 0.6 \quad p = 0.74 \quad p = 0.36 \]