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 considers L1 phonological influence as part of the explanation for problems in L2 functional morphology production. We compare the predictions of Representational Deficit Approaches and Full Access Approaches regarding L2 English past tense acquisition via morphology production by Spanish, Mandarin, and Japanese natives. While these L1s share similar phonological restrictions on consonant cluster formation, differences arise in L1 syntax (Mandarin lacks syntactic past) and L1 prosodic structure (only Japanese has an English-equivalent structure). While aggregate analyses indicate that the L1 English control group outperforms the L2 groups in oral suppliance of past tense morphology, oral suppliance rates fell within a native-like range for 33% of the L1 Mandarin group, 54% of the L1 Spanish group, and 73% of the L1 Japanese group. Results therefore reveal that 1) a lack of syntactic past does not prevent target-like performance, challenging the position that new syntactic features cannot be acquired, and 2) L1 phonological restrictions cannot fully explain non-target-like performance. These findings are discussed in light of other input and performance factors.
1. Introduction

Variability in target L2 morphological production is understood by some as a valid indicator of (deviancy in) related syntactic representations (e.g. Franceschina 2002, 2005; Hawkins & Liszka 2003; McCarthy 2008, but see Prévost & White 2000; Slabakova 2008; Lardiere 2009, 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. In particular, the feature for past tense ([\textsuperscript{\text{u}}\text{past}]) has received considerable attention particularly in the case of L1 Mandarin Chinese learners of L2 English. Different, sometimes mutually exclusive, proposals have been offered to account for the observed fact that suppliance/production of English past tense morphology proves difficult for this group (e.g., Hawkins & Liszka 2003 for morphosyntactic deficits, Lardiere 1998a, 1998b for syntax-morphology mapping difficulties, Davidson 2005, 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 pressures). Indeed, it is puzzling that past tense morphology production—spoken and even written—should be 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 English as a Second Language (ESL) classrooms from the elementary levels and throughout. Indeed, research showing that comprehension is less problematic (see e.g. Lardiere 2007) might lead one to ponder what productive measures (alone) in any modality can tell us.

Considering L1 transfer more fully, considering alternatives to a possible representational problem for L2 syntax seems warranted. Mandarin not only lacks a syntactic feature for past tense, but also has phonological restrictions on consonant cluster formation that are incompatible with many English past tense allomorphic forms. Mandarin lacks the
prosodic structure (specifically, prosodic word adjunction) found in English past tense forms. 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 better explained by L1 phonological influence as opposed to a syntactic deficit, a possibility examined explicitly in Goad & White (2006). The present methodology attempts to test and compare the predictions of Representational Deficit Approaches \(^1\) (RDAs) to L2 morpho-syntax across several L2 groups, by fully considering how phonological factors can offer an alternative account to production problems they might share in this domain. If the challenges are mainly phonological rather than syntactic, then any learner group acquiring L2 English whose L1 has similar phonological constraints against consonant clusters should show divergences similar to Mandarin natives, irrespective of whether or not their L1 instantiates a syntactic feature for past. 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). Comparison with these two other L2 groups is important to support any claims that a syntactic deficit approach is privileged over an L1 phonological transfer account for the data. This is because, despite the fact that Japanese and Spanish have the uninterpretable past \([\text{\textit{u}}\text{past}]\) feature available for transfer, all three languages share similar phonological restrictions against consonant clusters while prosodifying past tense morphology in different ways: While Japanese patterns with English via prosodic word (PWd) adjunction, Spanish and Mandarin do not. If syllable structure restrictions are deterministic in L2 morphological suppliance, then the

\(^1\) We operationalize a group of theories under the macro-label Representational Deficit Accounts (RDAs) that claim syntactic features not instantiated in the L1 grammar and thus not available for transfer are un-acquirable by second language learners in adulthood, such as Failed Functional Features (Hawkins & Chan 1997) and the Interpretability Hypothesis (Tsimpli & Dimitrakopoulou, 2007). Despite differences between these hypotheses, they make the same predictions as it relates to our study and thus can be treated as a single group.
Japanese, Mandarin, and Spanish speakers should show evidence of similar difficulties in English past tense suppliance, specifically when the cluster that results from attachment of past tense would be illegal in all three L1s. On the other hand, if prosodic structure is deterministic, it is possible that the Japanese learners could outperform the Mandarin and Spanish L1ers. To our knowledge, Spanish as an L1 has not yet been investigated in conjunction with these two languages to tease apart L1 phonological influence from L2 syntactic deficits.

This study presents data for performance tasks that require either written or oral past morphology suppliance. The oral production task in particular, which reveals that the L1 English control has a higher rate of suppliance of past morphology than all three L1 groups, does not support the predications of RDAs. Instead, the data indicate that availability of relevant prosodic structure and syntactic features (Japanese) or just the syntactic feature (Spanish) is not sufficient to guarantee native-like performance. The Japanese group, as a whole, does better than the Spanish and Mandarin groups indicating a significant role for L1 prosodic structure. A closer look at individual variation shows that target-like past tense morphology suppliance in oral mode is attested by at least 33% of each L1 group. Individual data demonstrate that phonological (coda cluster), prosodic (morpheme adjunction) and syntactic (uninterpretable past feature) constraints from the L1 can all be overcome.

2. Previous research

In this study, two broadly labeled generative approaches to adult L2 acquisition are tested against one another: Representational Deficit Accounts (RDAs) and Full Access Accounts (FAAs).

2.1. Representational Deficit Accounts
RDAs maintain 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.

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 performances for domains of grammar where surface learning could mask distinctions in underlying representation, for example, in the case of overt morphological production. Rather, RDAs might expect limited L2 variability/optionality in performance because other non-syntactic factors can help adult L2ers perform in ways that resemble the target language. For example, in the case of past tense, effects of explicit instruction and frequency of salient obligatory marking might help a learner produce past morphology consistently well, even if their L2 grammar does not instantiate the \([\text{upast}]\) feature. This prediction is particularly true of several irregular past tense forms, which tend to be frequent in the input. Additionally, compared to regular forms, the past tense marking on irregular forms creates a more salient distinction between present and past forms (e.g., ‘be’ – ‘was’ vs. ‘walk’ – ‘walked’). Therefore, RDAs would not propose a complete lack of knowledge for past if the L2er’s L1 lacks the \([\text{upast}]\) feature because L2ers would have access to other non-syntactic resources.

### 2.2. Full Access Approaches

The second SLA perspective discussed here is couched within 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 1998). FAAs propose that the noted difficulty in L2
functional morphology at advanced L2 proficiency levels does not result from a maturationally conditioned inability to acquire particular features. That is, native-like L2 syntactic representations are in principle attainable, and any difficulty is the surface outcome of other contributing variables, such as distinct learnability restrictions due to L1 transfer (Schwartz & Sprouse 1996), complexity inherent to the reassembling of features (Lardiere 2009), difficulty imposed by morphological learning and/or decomposition for adults (Slabakova 2008), mapping problems between underlying representations and spellout production (Prévost & White 2000), possible competition between taught knowledge and the underlying system of competence (Rothman 2008; Long and Rothman 2013), among others. Each of the above approaches acknowledge that L2 adult acquisition is different to child L1 acquisition on many planes, yet take the position that the locus of differences is definitively not due to the inaccessibility of syntactic features in adulthood. As such, FAAs actively 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.

2.3 Key relevant studies

Hawkins & Liszka (2003) tested advanced L1 speakers of German, Japanese, and Mandarin for marking of L2 English thematic verbs for simple past tense. In an experiment probing written responses, a close test, no differences were found across the groups. However, data from elicited spontaneous production tasks showed a significant difference between groups for both regular and irregular verbs. This difference was due to the Mandarin informants scores, which were markedly lower. The authors concluded that the difference could be explained by L1 feature difference, Mandarin being the only language without a past feature.

2 The details of the uninterpretable feature [upast] are provided in section 3.1.
The researchers also explored the possibility that L1 transfer of syllable structure might have been responsible for low past suppliance (as argued, e.g., in Lardiere 1998a, 1998b, 2000). They compared the performance of Mandarin and Japanese participants on consonant clusters since both languages impose restrictions on them in ways relevant to 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 might not the determining factor in lower suppliance of past tense morphology.

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, yet markedly non-native like manner (34.78%, 34.85%, and 33.82% at three different times over a period of nine years). Lardiere contends that Patty’s production 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.

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 suggested to be in part responsible for variable suppliance of the past –ed morpheme.
for Mandarin natives. The past morpheme in English adjoins to the verb stem (1a), which means that an external PWd directly dominates the internal PWd, while also directly dominating the external syllable. In Mandarin, however, an external PWd cannot simultaneously dominate an internal PWd and an external syllable, and thus functional morphemes (such as the aspectual perfective marker –lp), must be in a position internal to the PWd (1b, examples adapted from Goad et al. 2003:248).³ 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 morpheme  
  b. Mandarin aspect morpheme

Goad et al. (2003) propose the Prosodic Transfer Hypothesis (PTH), which predicts that an L1 prosodic structure that is not part of the L2 grammar cannot be acquired via access to UG. Goad & White (2004) determined that such a position was too strong and, 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 UG, specifically to new licensing relations not

³ For evidence in support of these English and Mandarin analyses, we refer the reader to Goad et al. (2003), pp. 248-253, and Goad & White (2006).
instantiated in the L1. However, learners can rely on L1 structures to construct the prosodic representation required for L2 English past tense. Thus, English learners are predicted to be able to prosodify inflection as adjoined to the PWd 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 syllable). Goad & White (2006) outline this notion in their discussion of Minimal Adaptation, which states that construction of L2 prosodic structure is 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).

Importantly, both of the structures necessary for PWd adjunction occur in Mandarin. First, a PWd can link directly to a syllable in a three-syllable construction in which the right-most syllable is not dominated by a foot, which can only dominate two syllables in order to comply with foot binarity (e.g. [[[man4]σ [man0]σ ]Ft ] [de0]σ ]PWd, adapted from Goad & White 2006:251). Second, a PWd can dominate a PWd in the case of compounding. However, these licensing relations do not occur in a single structure, which is a requirement of adjunction. 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 to build the adjunction structure required for inflection (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 a) pseudo-inflected forms (e.g., ‘keep’-‘kept’) involve organization of the past tense morpheme inside the PWd of its host (see example 2), and b) the Mandarin aspect morpheme is PWd-internal, L1 transfer is facilitative. With respect to a), the observation that the past morpheme of a pseudo-inflected form shortens the stem serves as evidence that the morpheme is PWd-internal. Arguably, shortening occurs to comply with the constraint that a word-final rhyme have maximally three positions (unless there are two word-final coronal consonants, in which case a VVCC rhyme can occur, e.g., ‘pound’). In this particular case, the first position is a vowel, followed by a consonant or vowel, and a consonant at the right edge of the word (Goad & White 2006: 248). That is, the learners are better at producing a form whose prosodic structure mirrors their L1 structure for inflection than they are at producing the adjoined form that is not part of their L1.

(2) English pseudo-inflection [wept] ‘wept’ (Goad et al. 2003:250)

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PWd
  /\  
Foot /  \  
  σ    σ
  \  /  
  w e p t
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In a later study, Goad & White (2006) analyzed data from 10 L1 Mandarin speakers and nine native controls. 4 Participants were required to choose one of two written sentences as a possible continuation to a prompt, as in the following example (from Goad & White 2006:252):

(3) Last night after dinner…

- you show me photos of your daughter

4 Goad and White (2006) also investigated perfective morphology in this study, which is not discussed here.
you showed me photos of your daughter

The L1 Mandarin speakers selected the correct tense 83% of the time, in comparison with the English natives’ 98% accuracy. However, in spite of the differences between the two groups, the authors argue that Mandarin speakers do indeed represent [u-past] in their IL since they correctly chose past tense 83% of the time, well above chance.

In addition to examining the production of regular versus irregular forms, production of long-stemmed (VXC-final, e.g., ‘helped’) versus short-stemmed (VX-final, e.g., ‘picked’) regular forms was compared. Stem length is of interest when investigating prosodic transfer for two reasons. First, learners could treat short- and long-stemmed regulars differently. L1 Mandarin speakers might supply inflection on a short-stemmed form, because their PWd-internal representation of inflection allows them to do so. In this case, learners might evidence higher rates of suppliance for short-stemmed forms. This would happen if learners were to treat short-stemmed forms like pseudo-inflected forms, essentially working around PWd-adjunction by constructing a PWd-internal representation of inflection, (as in pseudo-inflected forms). Pseudo-inflected forms such as ‘kept’ [kɛp-t]_{PWd} are prosodified without adjunction. Similarly, in a short-stemmed form such as [[pɪkt]_{PWd} t]_{PWd}, in comparison with a long-stemmed VXC-final form such as [[hɛlp]_{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: [pɪk-t]_{PWd}. This is the analysis provided by Goad et al. (2003) for variable suppliance of agreement morphology by the Mandarin speakers in their study. The second motive for investigating stem length is the articulatory difficulty that comes with a three-consonant cluster and its implications for L1 and L2 syllable structure constraints.

Goad & White’s (2006) data did not yield statistically significant differences between regular and irregular forms, nor 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. 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 (2006) indicate that learners will be able to build adjunction structure not available in the L1 when a minimal adaptation condition is met.

3. Past tense in English, Mandarin, Spanish, and Japanese

3.1. English

English encodes the past feature in 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., ‘keep’-‘kept’) (Lobeck 2000). As is well known, -ed affixation can manifest three ways, depending on the last segment of the verbal stem: [t] If the last segment is a voiceless consonant (e.g., ‘missed’), [d] if the segment is a voiced consonant other than [t] or [d] (e.g., ‘sinned’), or syllabic [ɪd] if the segment is [t] or [d] (e.g., ‘faded’).

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 \( v \), \( v[u\text{Infl} : ] \rightarrow v[u\text{Infl} : \text{past}] \). 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 \( v[u\text{Infl} : \text{past}] \) 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 (4).\(^5\)


Oral production of regular past tense English forms minimally involves the instantiation of the [u
past] feature. Considering Adger’s (2003) analysis, Mandarin native speakers need to access and instantiate the [u
past] feature from the universal inventory, while native speakers of Spanish and Japanese can transfer it directly from their L1. As is easily observed, however, regular -ed affixation is not simply a syntactic property. Regular past affixiation produces two-consonant clusters, e.g., ‘sinned’ [sɪnd], ‘fooled’ [fu:ld], ‘missed’ [mɪst], as well as three-consonant clusters, e.g., ‘worked’ [wɜːkt]. Following Goad et al.’s (2003) analysis, a regular form must be formed via prosodic adjunction of the –ed morpheme to the verb stem. Such an analysis explains why a form such as ‘worked’, which contains a three-consonant word-final cluster, does not violate the limit of a three-position rhyme. That is, the final consonant (that is, the allomorph), is not part of the internal PWd and therefore the rhyme of the internal PWd is a legal VCC form. Unlike regular forms, however, in pseudo-inflected forms such as ‘kept’ (VCC rhyme) and ‘sold’ (VVCC rhyme, which is only legal with a coronal cluster), adjunction does not occur and the past morpheme remains internal to the PWd of its host.

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

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\(^5\) For irregular cases such as ‘eat’-‘ate’, Adger proposes a special rule, expressed as: Pronounce ‘eat’ as ‘ate’ when it is adjacent to v[uInfl : past], and in this case, do not pronounce v[uInfl : past] (Adger 2003:171).
context. Therefore, the interpretation of a sentence without sufficient context or a time adverbial is ambiguous (example from Hawkins & Liszka 2003:26):

(5) Zhangsan kan dianying
   Zhangsan see-INF movie
   ‘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 the feature as well as the prosodification mechanism to adjoin the –\(ed\) 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), Mandarin has only two possible consonants in the rhyme, /\(ŋ\)/ (as in /tu\(ŋ\)/ ‘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 syllable structure 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 past morphemes. Another relevant point of comparison with English is the position that the past morpheme occupies with respect to the PWd that contains 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-adjointed 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’, primary stress falls on the syllable *já* in the sequence *manejábamos* ‘we drove’ (see (6)). This is the case for other regular verbs, in which primary 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. Primary stress is then assigned to the initial syllable of the rightmost foot in the lower PWd, which suggests that the TAM morpheme is PWd-internal in order to ensure that the stress-bearing foot is binary.

(6)
As established, knowledge of English past involves instantiation of the syntactic feature [\text{upast}], 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 a) their L1 can build the target structure through combining L1 licensing relations or b) the target structure involves L1 structures being licensed in new positions (Goad & White 2006:247). While Japanese can resort to L1 transfer, Spanish and Mandarin need to combine existing structures to accommodate the target structure. This should be possible in Spanish, 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.\footnote{PWd-adjunction is also found in nonverbal constituents, e.g., the prefix \textit{in-} is directly linked to the PWd, e.g., \textit{in-estabilidad} ‘instability’ (see Peperkamp 1997:91).} 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. 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:

(7) a. liquids [l] [ɾ]: e.g. \textit{sal} [sal] ‘salt’, \textit{mar} [mar] ‘sea’

b. obstruents [ð] [s] [θ]\footnote{The voiceless interdental fricative is specific to Peninsular Spanish.}: e.g. \textit{red} [reθ] ‘net’, \textit{más} [mas] ‘more’
c. nasal [n]: e.g. *pan* [pan] ‘bread’

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 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 consonant clusters (such as the ones found in several simple past forms in English, 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 adapt existing prosodic structures. 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 not inevitably so.

### 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., [neru] ‘sleep’ and [jin] ‘die’ are the nonpast forms and their past forms are [neta] ‘slept’ and [jinda] ‘died’, 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 outside of the PWd, as explained below.

Evidence for the position of the past morpheme as outside of the PWd comes from compound verbs, which are frequent in Japanese. In Japanese, two verbs can form the basis of a compound verb, such as kiritoru ‘cut off’, which comes from kiru ‘cut’ and toru ‘off’ (example from Vance 2008:191). Since the compound is a verb, it can take the past tense morpheme -ta, in which case two PWds are organized into a higher PWd ([[…]PWd […]PWd]PWd). Therefore, tense needs to be outside the PWd, resulting in the following structure: [[[…]PWd […]PWd]PWd -ta]PWd. The implication of this analysis for the present study is that Japanese natives should be in a better position to produce past tense forms than native speakers of Spanish, since Spanish tense falls within the PWd. For the Japanese native speaker, then, English regular simple past acquisition involves L1 transfer of [upast], acquisition of the morphological rule stem+ed, and transfer of PWd adjunction of the past tense allomorph. As is the case with Spanish and Mandarin, there will also need to be accommodation of consonant clusters. Japanese has heavy restrictions on the presence of consonants in rhyme position such that only a nasal (e.g., pan [pan] ‘bread’) or geminate stop consonant (e.g., kitte [kitte] ‘cut!’ is permitted (e.g., Labrune, 2012).

3.5. Interim summary: Predictions and hypotheses

The above discussion of the elements of the L2 learning task for each experimental group can be summarized in Table 1.

Table 1. Elements of the L2 English learning task for L1 Mandarin, Japanese, and Spanish speakers
Mandarin, Spanish, and Japanese disallow consonant clusters in similar ways. Japanese has the PWd-adjointed prosodic structure available for transfer, and Mandarin and Spanish have the necessary elements of prosodic structure for adjunction in their grammars. Only Mandarin lacks the uninterpretable \( [u_{p\text{ast}}] \) feature, and therefore a comparison of past suppliance among these groups should shed light on the role that lacking \( [u_{p\text{ast}}] \) alone may have on past morphology suppliance. Thus, RDAs predict that Mandarin native speakers will consistently perform below native speaker level, and differently (i.e., worse) than Spanish and Japanese native speakers.

### 4. The Study

#### 4.1. Sample population

The tasks were administered to 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. Before their arrival, they had been exposed to English mostly in a classroom setting with instructors that were not native speakers of English. 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\(^8\) (see Tables 11-13 for L2ers’ profiles for age of arrival, length of residence, and combined proficiency score). 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.

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 \((M = 21.06, SD = 3.17)\).

4.2. Tasks

\(^8\) Hawkins & Liszka (2003) 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 74% as an appropriate cutoff because most scores clustered between 74% 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, some participants with proficiency scores between 74% and 80% outperformed participants with proficiency scores of 90% or higher.
Two tasks were carried out: a written sentence completion task and an oral sentence completion task. 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.

In the first task (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. The task was designed such that one word in each set could fit in each blank to ensure that participants would all choose the same answer and therefore the data would be comparable across participants and tasks. Targets were placed at the right edge of the sentence, either in final position or preceding a word with a vocalic onset. 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. 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:

9 In the case of a proceeding vocalic onset, one might wonder if resyllabification of –ed (e.g., ‘filled’ [fɪld]) obtained, which would enable the learner to avoid the target adjunction structure for English past tense. However, if L2ers circumvent past tense morphology in non-native ways, we take this to be evidence that they know that morphology must be provided and that the constraints are phonological in nature.
(8)   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!

       [send fill smell]

To control for task effects, 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. Targets: Simple past forms and monomorphemes

A total of 26 simple past forms were included in the written and oral sentence completion tasks. Of these, 14 were regular simple past forms with a consonant cluster, six with a singleton coda, and six were irregular (pseudo-inflected) forms; in this study we focus on the simple past forms with a consonant cluster.\(^\text{10}\) Fifteen monomorphemes similar in phonological shape to the regular simple past forms were also included to obtain an indication of whether phonological constraints affect 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

\(^{10}\)We do not report on results for the verbs with a singleton coda and the pseudo-inflected verbs for a number of reasons. First, the number of regular simple past forms ending in clusters 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 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.
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 14 past forms and 15 monomorphemes that ended in the coronal consonant clusters [ld], [nd], and [st] (Table 3); all forms were monosyllabic. As Goad & White (2006) note, learners whose L1s have strict syllable structure constraints and do not have PWd adjunction could still produce past tense stimuli with a VXC-final stem (e.g., ‘sealed’) in a native-sounding way. This is because the addition of the past tense morpheme to a monosyllabic stem with a VVC rhyme (with C being a coronal consonant) results in a four-position VXCC rhyme, which is a legal shape in English in word-final position when both consonants are coronal. It thus would have been ideal to test an additional set of past stimuli with a four-position rhyme that does not contain a coronal cluster (e.g., ‘worked’), because this would give us additional evidence as to whether the learner is circumventing PWd adjunction. We return to this issue in light of our results in section 5.1.

To control for frequency, 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 (see Appendix 2 for logarithm values). A $t$-test between the natural log values of the regular past forms in consonant clusters and the monomorphemes ($\alpha = .05$) verified that there were no statistically significant differences between each set.

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11 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.
Table 2. Past tense and monomorpheme tokens

<table>
<thead>
<tr>
<th>Regular simple past forms with coronal consonant clusters</th>
<th>/ld/: sealed, filled, killed, yelled, rolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>/nd/: joined, cleaned, trained, gained</td>
<td></td>
</tr>
<tr>
<td>/st/: passed, pressed, kissed, blessed, missed</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Monomorphemes with coronal consonant clusters</th>
<th>/ld/ build, field, wild, mild, bald</th>
</tr>
</thead>
<tbody>
<tr>
<td>/nd/ send, blind, pound, blend, pond</td>
<td></td>
</tr>
<tr>
<td>/st/ test, list, dust, priest, past, nest</td>
<td></td>
</tr>
</tbody>
</table>

4.2.2. Data coding

For both tasks, past morphology suppliance was coded with a ‘1’ if the morphology was supplied and a ‘0’ if it was not. For example, in a target such as ‘called’, the item was coded as supplied only if the consonant that carries past tense morphology (here, [d]) was pronounced. 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’). In comparing simple past forms against monomorphemes, when either consonant of the cluster in the monomorphemes was not pronounced, it was coded as not supplied, e.g., ‘cold’ pronounced.

One might wonder if there were differences in morphology suppliance between stems with long and short vowels. Targets whose stems ending in [l] have such contrast: ‘sealed’ and ‘rolled’ vs. ‘filled’, ‘killed’ and ‘yelled’. The numbers are too small to submit them to statistical analysis, but the raw numbers show that in the Spanish group, participants were more accurate with ‘yelled/filled/killed’ than with ‘rolled/sealed’. In the Mandarin group, the trend is somewhat similar; ‘-ed’ was omitted the most for ‘rolled’. In the Japanese group, there were few omissions in general, and no visible differences between these two types of stems.

---

12 One might wonder if there were differences in morphology suppliance between stems with long and short vowels. Targets whose stems ending in [l] have such contrast: ‘sealed’ and ‘rolled’ vs. ‘filled’, ‘killed’ and ‘yelled’. The numbers are too small to submit them to statistical analysis, but the raw numbers show that in the Spanish group, participants were more accurate with ‘yelled/filled/killed’ than with ‘rolled/sealed’. In the Mandarin group, the trend is somewhat similar; ‘-ed’ was omitted the most for ‘rolled’. In the Japanese group, there were few omissions in general, and no visible differences between these two types of stems.
as [kowl] or [kowd], since the two consonants in a monomorphemic form do not have different morphological status.

5. Results

In this section, we report first the overall results of the sentence completion tests (section 5.1), and then focus on the written data (section 5.2) followed by the oral data (section 5.3). Given the results of our statistical analysis, we limit our discussion to inflected versus monomorphemic words and the relationships between L1 and mode. In light of L2er performance, we take a closer look at individual variation in section 5.4, followed by a discussion of the results in section 5.5.

5.1. Overall suppliance

Given the high level of performance of the near-native speakers tested in this study, the data were skewed with 2,934 supplied forms and 254 unsupplied; a total of 33 observations were removed from the analysis due to missing response values. To address the skewness, test items with two or fewer total incorrect responses across all groups were removed from the analysis. This resulted in a total of four removed items, all of which were monomorphemes with an /st/ cluster: ‘dust’, ‘list’, ‘nest’, and ‘test’. After cleaning the data, there were a total of 2,547 items (2,293 supplied, 254 unsupplied) submitted to statistical analysis.

To determine the variables that influenced past morphology suppliance on the written and oral sentence completion tasks, we started by computing a maximal binary logistic regression model using SAS software version 9.4 (SAS institute, Cary, NC). The model included the between subjects effect of L1 (English, Spanish, Mandarin, Japanese) and within-subjects effects of mode (oral, written) and word type (inflected, monomorphemic), as well as the predictors’ two-way and three-way interactions. Past morphology suppliance (yes = 1, no = 0) was the binary dependent variable. The maximal model was significant and a good fit, but none of the interactions were significant. Successive reductions of the model via elimination
of non-significant interactions with the highest $p$ values led us to the final minimal model. As a result, the three-way interaction and all but one two-way interactions were excluded. The results of the final model are presented in Table 3.

Table 3. Results of the final binary logistic regression model

<table>
<thead>
<tr>
<th>Factor</th>
<th>Wald $\chi^2$</th>
<th>df</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>8.425</td>
<td>3</td>
<td>.038*</td>
</tr>
<tr>
<td>Mode</td>
<td>3.490</td>
<td>1</td>
<td>.062</td>
</tr>
<tr>
<td>Word type</td>
<td>5.900</td>
<td>1</td>
<td>.015*</td>
</tr>
<tr>
<td>L1*Mode</td>
<td>16.853</td>
<td>3</td>
<td>.001***</td>
</tr>
</tbody>
</table>

* $p < .050$, *** $p = .001$

As seen, a significant main effect was found for L1, pointing to a difference among groups when not considering mode and word type. However, considering the significant L1*mode interaction, it is of more interest to see how the groups vary across modes, which we discuss in sections 5.2 and 5.3. A main effect approaching significance was found for mode, indicating that suppliance was higher overall in the written task (98%) than in the oral task (83%) across groups. A main effect was also found for word type, whereby rate of suppliance was higher in monomorphemic forms (92%) than in forms that require PWd adjunction (89%). However, there were no significant L1*word type or L1*word type*mode interactions when the non-reduced model was run. This finding indicates that the suppliance rates did not vary significantly across L1 groups according to a word’s status as monomorphemic or PWd-adjoined, regardless of mode (Table 4). In the event that learners show evidence of successful acquisition across modes, we recognize that the lack of a significant difference in production of clusters in monomorphemic versus past tense forms across L1 groups presents a challenge: Since our stimuli did not include items with four-position rhymes that would only be possible in an inflected form (e.g. ‘worked’), it is difficult to conclude whether learners are in fact
producing PWd-adjointed forms, or if they are circumventing adjunction by prosodifying the past tense morphology PWd-internally. However, we note that Goad & White (2006) did not find significant differences between short and long-stemmed forms, with the learners in the study evidencing 87% suppliance in the simple past condition. Crucially, their stimuli included long-stemmed forms that did not contain coronal clusters (e.g., ‘worked’, ‘helped’), in which case the inflected form could only be produced via PWd adjunction since a VXCC rhyme without a coronal cluster is illegal in English. Following from their data, we would thus assume that any evidence of production of VXCC rhymes is likely a result of PWd adjunction.

Table 4. Consonant cluster suppliance rates according to L1 and word type (oral and written tasks)

<table>
<thead>
<tr>
<th>L1 group</th>
<th>Monomorpheme</th>
<th>PWd adjoined</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>English</td>
<td>.99</td>
<td>.11</td>
</tr>
<tr>
<td>Japanese</td>
<td>.98</td>
<td>.14</td>
</tr>
<tr>
<td>Spanish</td>
<td>.81</td>
<td>.39</td>
</tr>
<tr>
<td>Mandarin</td>
<td>.91</td>
<td>.28</td>
</tr>
<tr>
<td>OVERALL</td>
<td>.92</td>
<td>.27</td>
</tr>
</tbody>
</table>

Considering the lack of significant interactions with word type in conjunction with the significant L1*mode interaction, we posit that the differences across groups is an issue that comes down to oral production. To hone in on the L1*Mode interaction, we reduced the statistical model again, removing Word Type as a factor, and excluding the monomorpheme items from our analysis. This left us with L1 and Mode as main effects, and an L1*Mode interaction. We focus the remainder of our discussion of the results on this interaction.
Similarly to the larger model reported previously, the analysis of only PWd-adjoined simple past tense forms returned a significant main effect for L1 and L1*Mode, but not for Mode (Table 5).

Table 5. Results of the reduced binary logistic regression model

<table>
<thead>
<tr>
<th>Factor</th>
<th>Wald $\chi^2$</th>
<th>df</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1</td>
<td>8.088</td>
<td>3</td>
<td>.044*</td>
</tr>
<tr>
<td>Mode</td>
<td>1.024</td>
<td>1</td>
<td>.311</td>
</tr>
<tr>
<td>L1*Mode</td>
<td>9.671</td>
<td>3</td>
<td>.022*</td>
</tr>
</tbody>
</table>

*p < .050

Figure 1 illustrates the rates of past morphology suppliance in written and oral modes by each group. Visually speaking, it is clear that suppliance in written mode is nearly at ceiling for all of the groups and the confidence intervals indicate low rates of variation. On the other hand, the L2 groups do not seem to do as well in oral mode, and there is more variation within each of the groups. We explore the written and oral data more in depth in the following sections.

Figure 1. Percentage of past tense morphology suppliance in oral and written tasks across groups (error bars represent 95% confidence intervals)
5.2. Written mode

The mean rate of suppliance in written mode for each group is presented in Table 6.

Table 6. Past morphology suppliance in written mode

<table>
<thead>
<tr>
<th>L1 group</th>
<th>Items (n=)</th>
<th>M</th>
<th>SD</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>207</td>
<td>.99</td>
<td>.12</td>
<td>.93-.100</td>
</tr>
<tr>
<td>Japanese</td>
<td>151</td>
<td>.93</td>
<td>.26</td>
<td>.78-.100</td>
</tr>
<tr>
<td>Spanish</td>
<td>181</td>
<td>.97</td>
<td>.16</td>
<td>.88-.100</td>
</tr>
<tr>
<td>Mandarin</td>
<td>210</td>
<td>.96</td>
<td>.19</td>
<td>.86-.100</td>
</tr>
</tbody>
</table>

Looking further into the L1*mode interaction, we first find that the Mandarin and Spanish groups have a statistically similar rate of suppliance to English in the written task, although the Japanese group does not do as well as the English group (Table 7). However, we point out that the Japanese rate of suppliance is 93%, which is well above chance, and a mere 11 of 151 items were not supplied. Of these 11 items, 10 of them came from three out of 11 learners that did not score within the L1 English range. Their suppliance rates were 71%, 79%, and 79% (see Table 11 for additional information about participants 785, 798, and 891, respectively).

Table 7. Between-groups p values (contrast estimates, odds ratio estimates in parentheses), written mode

<table>
<thead>
<tr>
<th></th>
<th>L1 English</th>
<th>L1 Japanese</th>
<th>L1 Mandarin</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 English</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1 Japanese</td>
<td>.011* (-1.690, .184)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1 Mandarin</td>
<td>.142 (-1.005, .366)</td>
<td>.151 (-.685, .504)</td>
<td></td>
</tr>
<tr>
<td>L1 Spanish</td>
<td>.361 (-0.673, .510)</td>
<td>.065 (-1.017, .362)</td>
<td>.566 (-.332, .717)</td>
</tr>
</tbody>
</table>

*p < .050
Beyond the group level, we further examined L2er individual performance to quantify how many of truly performed in a native-like fashion. A look at the control group data shows that controls performed within a range from 86% to 100%, which constitutes the native speaker range for this data set. In both the Spanish and Mandarin group, all participants performed within this range, and in the Japanese group, eight out of 11 did (see Tables 12-14 in Section 5.1.4 for further details of individual variation). These data suggest that when morphology is supplied in written modalities and not dependent on phonological production, learners can perform in a native-like way regardless of the presence or absence of [u\text{past}] feature in their L1. Indeed, in this sense, the Mandarin group outperformed the Japanese group in spite of lack of the [u\text{past}] feature, and thus we take this evidence to not support the predictions of RDAs, since RDAs would predict exactly the opposite, the Japanese group outperforming the Mandarin group. However, we acknowledge that these approaches do not preclude metalinguistic knowledge and/or other compensatory strategies from explaining this better performance in a written modality. Indeed, 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 a possibility that is difficult to verify, the design of the written and oral tasks was identical, as were the testing conditions (i.e., tests were untimed and learners could change their responses). We thank another anonymous reviewer for pointing out that it is likely that the written task, which affords more time and space for careful consideration prior to production by virtue of its modality, are more subject to such strategies than online speech processing is. However, we report evidence from both modalities that generally points in the same direction, both for aggregate results and certainly for individuals. Thus, we feel confident that domain-general strategies are unlikely to explain what we have found.

5.3. Oral mode

The mean rate of suppliance in oral mode for each group is presented in Table 8.
Table 8. Simple past morphology suppliance across groups, oral mode

<table>
<thead>
<tr>
<th>L1 group</th>
<th>Items (n=)</th>
<th>M</th>
<th>SD</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>207</td>
<td>.97</td>
<td>.17</td>
<td>.88-1.00</td>
</tr>
<tr>
<td>Japanese</td>
<td>141</td>
<td>.83</td>
<td>.38</td>
<td>.61-1.00</td>
</tr>
<tr>
<td>Spanish</td>
<td>181</td>
<td>.77</td>
<td>.42</td>
<td>.54-1.00</td>
</tr>
<tr>
<td>Mandarin</td>
<td>207</td>
<td>.71</td>
<td>.45</td>
<td>.48-.94</td>
</tr>
</tbody>
</table>

Comparing the L1 groups’ oral suppliance data with the written suppliance data presented in the previous section, it is clear that there is more variation in the oral task than in the written task. This observation is statistically supported: While the English (p = .311) and Japanese (p = .770) groups’ suppliance does not differ across modes, the difference across modes for the Spanish (.0624) and Mandarin (.0514) groups approaches significance. Moreover, the odds ratio estimates (.09 for both Spanish and Mandarin) are identical and distant from a value of 1, indicative of a large effect size. A comparison of the oral data across L1 groups will determine whether the Japanese/English and Spanish/Mandarin similarity shown here is indicative of a more general pattern in the data.

A statistical group comparison of the oral data (Table 9) shows that the English group’s rate of suppliance is significantly higher than all of the L1 groups, and the Japanese group’s rate of suppliance is significantly higher than all of the L1 groups, and the Japanese group’s

13 Although these p values approaching significance are not less than or equal to alpha, we would argue here that they indicate a trend that is significant to consider seriously because the Mandarin-English comparison p value is the smallest in the group of English comparisons. If the Spanish-English comparison p value were .010, on the other hand, we would not conclude the Mandarin-English and Spanish-English comparisons to be significant. Moreover, it is very likely that with a larger sample size and/or less skewed data, the p values would in fact be smaller than .050.
suppliance rate is significantly higher than the Mandarin group’s rate. That is, the English group outperforms all three L1 groups, while the Japanese group outperforms the Mandarin group in oral suppliance of past tense morphology.

Table 9. Between-groups p values (contrast estimates, odds ratios in parentheses), oral mode

<table>
<thead>
<tr>
<th></th>
<th>L1 English</th>
<th>L1 Japanese</th>
<th>L1 Mandarin</th>
</tr>
</thead>
<tbody>
<tr>
<td>L1 English</td>
<td>&lt;.001* (-1.927, .146)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L1 Japanese</td>
<td>&lt;.001* (-2.592, .075)</td>
<td>.014* (.664, 1.943)</td>
<td></td>
</tr>
<tr>
<td>L1 Mandarin</td>
<td>&lt;.001* (-2.284, .102)</td>
<td>.213 (.356, 1.428)</td>
<td>.190 (.308, .735)</td>
</tr>
<tr>
<td>L1 Spanish</td>
<td>&lt;.001* (-1.927, .146)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < .050

Recall that previous research has pointed to L1 constraints on consonant clusters as an L2 stumbling block (e.g., Lardiere, 1998a, 1998b, 2000), and it was predicted that similar performance across the three L2 groups would be indicative of effects of syllable structure constraints. The range of suppliance rates in oral mode and lack of statistical significance among the Spanish and Japanese groups and Spanish and Mandarin groups, all of which have constraints that militate against right-edge consonant clusters, could indeed be a reflection of these constraints. In fact, (indirect) evidence of this comes from the trend observed in the L2er groups of reducing consonant clusters in monomorphemes and arguably in past forms. What remains to be explained, however, is why the Japanese group’s suppliance rate, although lower than the English group’s rate, was higher than the Mandarin group’s rate but not the Spanish group’s rate. Japanese has two things that Mandarin does not: the [νpast] feature and PWd adjunction. Thus, it is possible that the combination of these differences gives the Japanese speakers an advantage over the Mandarin speakers, even though said advantage is not enough to approximate the
suppliance rate of the L1 English group. Of course, this is an empirical question, the testing of which would require the addition of a group whose L1 has no \([upast]\) feature and PWd adjunction, and a group whose L1 has no \([upast]\) feature and does not meet a condition of Minimal Adaptation.

While the L1 groups do not supply simple past morphology in oral mode at the same rate as the English group, we would like to point out that the Japanese suppliance rate is 83%, Mandarin suppliance rate is 71% and Spanish suppliance rate is 77%, which is still above chance. This is contrary to what RDAs would predict because the three L1 groups pattern together in spite of Mandarin lacking the relevant feature. The PTH assumes no difference in performance due to the presence or absence of the \([upast]\) feature in the L1. However, based on the tenets of the PTH, we predicted that the availability of PWd adjunction in Japanese could lead the Japanese group to outperform the groups whose L1s do not have the relevant prosodic structure. As seen, the Japanese group’s oral suppliance rate was not higher than the Spanish group’s rate. However, recall that the PTH posits that the necessary prosodic structure can be constructed in the L2 via Minimal Adaptation. It is therefore possible that the Spanish group had constructed PWd adjunction. The PTH also states that while possible, L2 convergence is not guaranteed. This led us to examine whether lower mean suppliance rates could be a reflection of individual variation, rather than group behavior. The English group performed within a range of 86% to 100% oral past morphology suppliance, which constitutes the native speaker range. In the Spanish group, 7 out of 13 (54%) performed within the native range; in the Mandarin group, 5 out of 15 (33%) were within the native range; in the Japanese group, 8 out of 11 (73%) were within the native range (see Tables 10-13 in section 5.5. for further details of individual variation). The fact that some, but not all, L2ers across groups have acquired English past tense morphology as demonstrated in the oral past tense data, indicates that the necessary morphosyntactic feature and prosodic structure can be acquired in the L2
even when they are not available in the L1, although, as the PTH states, target-like performance is indeed not guaranteed.

In light of our results, 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 data suggest that there are some differences between morphology supplied in written and oral modalities, 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 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 and Japanese groups, and given the 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. This generalization is based on the finding that the difference in written and oral performance for L1 Spanish and L1 Mandarin approaches significance. While the L1 Japanese group does not significantly differ between modes, this result could be attributed to the three outliers in written mode (see discussion in section 5.2). The asymmetry across modes, the difference between the English control and the three L2 groups, and the fact that the learners do not supply past tense morphology in oral mode upwards of 30% of the time, suggest that phonological factors (whether constraints on consonant clusters and/or prosodic
structure) strongly influence morphology suppliance and that they may be much more complex than they appear.

(ii) The finding that the Mandarin and Spanish groups pattern together, especially in the oral mode, challenges the assumptions of RDAs, since Spanish has the $[u_{past}]$ feature and Mandarin does not. It is true that RDAs might not face a challenge from the written data alone, that is, given that a written modality affords a greater likelihood that metalinguistic knowledge is employed RDAs can account for target written production by simply assuming that conscious knowledge is being employed to compensate for mental representation differences that still otherwise persist. What is truly problematic for RDAs are the facts that the Mandarin group can supply –ed in oral production to the extent they do and, likewise, it is difficult for RDAs to account for the poor Spanish group performance given what the L1 provides at the level of syntactic features.

Thus, at this point we can posit 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 $[u_{past}]$ feature), since the Mandarin group performs similarly to the Spanish group. However, this data set also suggests that phonological factors are most likely at play given that performance on written responses was target-like for the L2er groups, with the exception of Japanese, which we addressed in section 5.2. We give further consideration to phonology’s role in the suppliance of L2 English past tense morphology in section 6. Before doing so, however, it is necessary to examine individual performance to determine 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 this and other questions related to individual variation in the next section.
5.5. Individual performance

As mentioned, our data support the PTH’s prediction that native-like performance is a possible (although not inevitable) outcome. The question we are tasked with at this point is whether the fact that learner groups’ suppliance rates in oral mode (Mandarin, 71%; Spanish, 77%; Japanese, 83%) are not at ceiling is due to phonological constraints that affect the learner groups as a whole, or if it is due to individual variation. Tables 10, 11, and 12 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 consonant clusters in monomorphemes (Mono oral), and suppliance of simple past tense in written responses (Past Written), and monomorphemes in written responses (Mono written). Monomorpheme data are provided as a point of comparison with the simple past tense data. 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 10. L1 Japanese group data

<table>
<thead>
<tr>
<th>Participant number</th>
<th>AoA</th>
<th>LoR</th>
<th>Proficiency</th>
<th>Past Oral</th>
<th>Mono oral</th>
<th>Past Written</th>
<th>Mono Written</th>
</tr>
</thead>
<tbody>
<tr>
<td>596</td>
<td>26</td>
<td>24</td>
<td>98</td>
<td>36</td>
<td>100</td>
<td>93</td>
<td>100</td>
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<tr>
<td>777</td>
<td>28</td>
<td>21</td>
<td>90</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<tr>
<td>729</td>
<td>27</td>
<td>13</td>
<td>92</td>
<td>93</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1708</td>
<td>27</td>
<td>11</td>
<td>85</td>
<td>85</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>761</td>
<td>19</td>
<td>11</td>
<td>84</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<tr>
<td>1756</td>
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<td>92</td>
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<td>100</td>
</tr>
<tr>
<td>205</td>
<td>28</td>
<td>1;4</td>
<td>78</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>494</td>
<td>29</td>
<td>5</td>
<td>77</td>
<td>90</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
As seen in Table 10, 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, six participants (55%) performed in a native-like fashion in both oral and written past morphology suppliance. It should be noted, though, that one of these participants (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 (36%) is well below that of participant 891 (92%), 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 11. L1 Spanish group data

<table>
<thead>
<tr>
<th>Participant number</th>
<th>Dialect</th>
<th>AoA</th>
<th>LoR</th>
<th>Prof</th>
<th>Past Oral</th>
<th>Mono oral</th>
<th>Past Written</th>
<th>Mono Written</th>
</tr>
</thead>
<tbody>
<tr>
<td>747</td>
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<td>27</td>
<td>5;4</td>
<td>98</td>
<td>64</td>
<td>50</td>
<td>93</td>
<td>100</td>
</tr>
<tr>
<td>962</td>
<td>Mexico</td>
<td>24</td>
<td>17</td>
<td>93</td>
<td>93</td>
<td>60</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1182</td>
<td>Colombia</td>
<td>24</td>
<td>4;9</td>
<td>93</td>
<td>86</td>
<td>40</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>293</td>
<td>Chile</td>
<td>25</td>
<td>8</td>
<td>91</td>
<td>100</td>
<td>80</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>862</td>
<td>Spain</td>
<td>32</td>
<td>10</td>
<td>91</td>
<td>100</td>
<td>78</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>265</td>
<td>Chile</td>
<td>26</td>
<td>1;6</td>
<td>89</td>
<td>46</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>612</td>
<td>Chile</td>
<td>28</td>
<td>8</td>
<td>88</td>
<td>50</td>
<td>80</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>782</td>
<td>Spain</td>
<td>27</td>
<td>14</td>
<td>84</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
In the Spanish group, Table 11 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. The table also shows that more than half of the participants (n = 7) performed within the native range across the two simple past modes, and that most of these tend to have higher proficiency scores. While all participants performed within the native range in the written task, in the oral task, variation is spread across different levels of proficiency or LoRs. With regards to this variation, a reviewer questions 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 should be in future studies, the data do not seem to suggest that learners from more conservative dialects tend to maintain consonant clusters more often than the other dialects.

Although there was no interaction involving word type and L1, descriptively we can observe some variation in suppliance when comparing the monomorpheme and past conditions. While four participants were below the native range for both conditions and three were within the native range for both conditions, four participants’ rate of suppliance was within the target range for the past condition, but not the monomorpheme condition. This was unexpected, since

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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>595</td>
<td>Chile</td>
<td>32</td>
<td>84</td>
<td>57</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1785</td>
<td>Colombia</td>
<td>36</td>
<td>4</td>
<td>82</td>
<td>86</td>
<td>90</td>
<td>93</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>1007</td>
<td>Colombia</td>
<td>30</td>
<td>4,6</td>
<td>79</td>
<td>50</td>
<td>40</td>
<td>86</td>
<td>100</td>
<td></td>
</tr>
<tr>
<td>1966</td>
<td>Chile</td>
<td>42</td>
<td>8,4</td>
<td>79</td>
<td>100</td>
<td>90</td>
<td>92</td>
<td>100</td>
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<td>6</td>
<td>77</td>
<td>71</td>
<td>40</td>
<td>100</td>
<td>100</td>
<td></td>
</tr>
</tbody>
</table>
these monomorphemes do not require any functional morphology, and suggests that the challenge in suppliance for native speakers of Spanish is phonological in nature.

Table 12. L1 Mandarin group data

<table>
<thead>
<tr>
<th>Participant number</th>
<th>AoA</th>
<th>LoR</th>
<th>Prof</th>
<th>Past Oral</th>
<th>Mono oral</th>
<th>Past Written</th>
<th>Mono Written</th>
</tr>
</thead>
<tbody>
<tr>
<td>688</td>
<td>25</td>
<td>1;4</td>
<td>87</td>
<td>86</td>
<td>78</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>731</td>
<td>22</td>
<td>1;6</td>
<td>86</td>
<td>86</td>
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<td>100</td>
<td>100</td>
</tr>
<tr>
<td>247</td>
<td>24</td>
<td>1;4</td>
<td>85</td>
<td>86</td>
<td>100</td>
<td>86</td>
<td>100</td>
</tr>
<tr>
<td>464</td>
<td>22</td>
<td>3;4</td>
<td>82</td>
<td>62</td>
<td>80</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>869</td>
<td>26</td>
<td>6;6</td>
<td>81</td>
<td>85</td>
<td>70</td>
<td>93</td>
<td>100</td>
</tr>
<tr>
<td>1045</td>
<td>17</td>
<td>7</td>
<td>81</td>
<td>79</td>
<td>100</td>
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<td>689</td>
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<td>93</td>
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<td>100</td>
</tr>
<tr>
<td>1777</td>
<td>23</td>
<td>1;6</td>
<td>79</td>
<td>57</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>986</td>
<td>20</td>
<td>3;4</td>
<td>77</td>
<td>64</td>
<td>100</td>
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<td>22</td>
<td>2;6</td>
<td>77</td>
<td>38</td>
<td>60</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>865</td>
<td>23</td>
<td>1;4</td>
<td>76</td>
<td>86</td>
<td>80</td>
<td>93</td>
<td>100</td>
</tr>
<tr>
<td>1792</td>
<td>29</td>
<td>1;7</td>
<td>76</td>
<td>57</td>
<td>70</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>1846</td>
<td>23</td>
<td>2;6</td>
<td>75</td>
<td>71</td>
<td>50</td>
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<td>1666</td>
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<td>75</td>
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<td>100</td>
</tr>
<tr>
<td>715</td>
<td>26</td>
<td>1;4</td>
<td>74</td>
<td>57</td>
<td>78</td>
<td>86</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 12 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 the experimental tasks suggests that proficiency scores might predict target-like performance. Specifically, of the five participants with target-like performance in simple past oral and simple past written tasks (688, 731, 247, 689, and 865), four have proficiency scores within the native range. Considering that Mandarin is the only group whose L1 does not instantiate the [\upast] feature, it is of note that a third of the participants have attained truly native-like performance across the past tense conditions. Of those that have not (n = 10), three produce consonant clusters in monomorphemes at a target-like rate, which suggests a production obstacle that is phonological in nature.

Taking the three groups’ individual variation together, it would seem that the fact that learner groups’ suppliance rates in oral mode are not at ceiling is due to individual variation. We address potential linguistic and cognitive factors that could be responsible for the attested patterns of individual variation in the following section.

6. Discussion

The general pattern observed is that native-like oral production of simple past morphology is attained by 40% of the Mandarin group, 64% of the Spanish group, and 73% of the Japanese group. It was also found that the Mandarin lack of the [\upast] feature does not preclude its speakers from attaining target-like performance on these tasks, indicating that at least some of these learners have access to linguistic universals in adulthood. Considering the claims that RDAs make, L1 Mandarin speakers simply should not be able to achieve native-like levels of English proficiency since Mandarin does not have the [\upast] feature. However, the data refute the presumed impossibility of acquisition that RDA approaches propose.

Additionally, given that the performance on the written sentence completion tasks was target-like for the majority of the learners while performance on the oral production task was
not, it seems that phonological factors can and do hinder suppliance of past morphology. In the case of Mandarin speakers, we wanted to test whether a lack of (or at least a lower rate of) suppliance could be due to syntactic reasons (i.e., retrieval of [u\text{past}]). However, we have presented evidence that even the Spanish and Japanese speakers show less-than-target performance, which cannot be attributed to lack of the [u\text{past}] feature in the L1. The predictions of RDAs are not supported by the full data set because: (a) Phonological issues proved to be significant in past tense morphology suppliance for the Mandarin natives, and (b) the Mandarin and Spanish groups and Spanish and Japanese groups pattern together in oral mode. 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. We posit that phonological factors seem to be the best candidate for explaining why the L1 Spanish and L1 Japanese groups did not perform as well as the English control, since this group undoubtedly has the syntactic feature for past. Conversely, the PTH better accounts for such differences in performance; while facilitative L1 transfer is predicted to yield higher rates of suppliance, learners without the necessary L1 prosodic structure can still construct novel structures under certain conditions. 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. At the same time, it is important to note we cannot make any strong claims here with respect to the PTH. This is because the L1s we have tested all have the necessary prosodic structures that can be combined to create PWd adjunction. To explicitly test the predictions of the PTH,
it will minimally be necessary to investigate an L1 that does not meet either condition of Minimal Adaptation.

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 majority of the L1 Japanese participants appear to have acquired the target structure, which is not surprising since they had the prosodic structure available for transfer in their L1. Even the strong version of the PTH (Goad & White, 2003) predicts convergence on the L2 target in this case. However, the Spanish and Mandarin groups had to build novel L2 prosodic structure via the combination of pre-existing (L1) prosodic structures. The fact that several of the learners in these groups were successful indicates that reassembly of L1 prosodic structures is possible, and the finding that the percentages of learners in the Spanish and Mandarin groups with target-like oral suppliance were lower than that of the Japanese group suggests that convergence is more likely if reassembly is not part of the L2 learning task. However, we have yet to see evidence of native-like oral suppliance of past tense morphology, and this study is no different. Why is it that several individuals in each group (three of the 11 L1 Japanese participants, 10 of the 15 Mandarin participants, and six of the 13 Spanish participants) do not demonstrate acquisition of target prosodic structure if all groups 1) meet one of the conditions of Minimal Adaptation, and 2) demonstrate that they have the past feature in L2 English? We have already considered the role of constraints on consonant clusters, which could prove to be more difficult to overcome for some learners than others. In addition, input factors and performance factors that have been hypothesized in the literature to affect L2 inflection production.

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 syllable structure constraints can impede accurate L2 perception (e.g., Dupoux, Kakehi, Hirose, Pallier & Meller, 1999; Kabak & Idsardi 2007; Dupoux, Parloto, Frota, Hirose & Peperkamp 2011). For example, Dupoux et al. (2011) show that speakers of Japanese and Portuguese, which disallow obstruent consonants in coda position, perceive an illusory vowel in heterosyllabic consonant clusters (e.g., /ebzo/ is perceived by Japanese speakers as [ebuzo]. That being said, if it is the case that perception 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 able to perceive all elements in a consonant cluster that violate L1 syllable structure 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 (i.e., prominence in the input) and processing costs (related in these cases to sentence length and complexity) are the culprits when it comes to inflectional variability.

Considering 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] (e.g., ‘picked’), which has been found to be less salient than syllabic and voiced [Id] (e.g., ‘waited’) (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 suggest 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 factors beyond syntactic representation is must align. Beyond the fact that Mandarin and Spanish speakers parallel each others’ performance, further evidence to be highlighted comes from the fact that five out of the 15 Mandarin speakers supplied past tense morphology in a target-like fashion in oral and written modes. Such evidence casts doubt on the (absolute) unavailability of new uninterpretable features, as well as the impossibility of constructing L2 prosodic structure. However, the finding that all three learners groups are outperformed by the English control in oral past suppliance indicates that other phonological constraints, input factors, and processing factors might affect suppliance even at advanced levels of L2 English proficiency. In the end, perhaps not all uninterpretable features are equal, in the sense that their surface realization in the L2 may be dependent upon their interaction with these other factors.
References


Appendix 1: sentence completion tasks.

[lld] consonant cluster

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] (24 syl)

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

We invited faculty to be a part of the spiritual life group and everyone _______. (22 syl)

We invited faculty to be a part of the spiritual life group and everyone _______. (22 syl)

When the factory found out about the water pollution, they _______ up the river. (20 syl)

I wanted to get closer to her, so I even _______ a sculpture club to learn her craft (22 syl)

John was in charge of building administration. He checked the locks nightly and _______ everything. (23 syl)

As many European basketball players, Ivan left his country and _______ in the USA. (23 syl)

I had a beautiful restaurant but yesterday the police _______ it while chasing a suspect. (24 syl)

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

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)
5. Blind

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

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

Past forms [st]

1. Passed

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

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

2. Pressed

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

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

3. Kissed

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

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)

[bless  see  pass]

5. Missed

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

[eat  write  miss]

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

[see  clap  miss]

Monomorphemes [st]

1. Test

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

[room  test  card]

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

2. List

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

[list  dirt  help]

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

3. Dust

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

Most big cities are incredibly polluted because factories contribute to smog and ________. (24 syl) [car  peace  dust]

4. Beast

He is big, and his feet are huge. He is like a creature from mythology, like half man, half ________. 
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)

Her heart was filled with joy. She loved looking at the baby bird in the artfully hidden ________ (23 syl)

SINGLE RIGHT-EDGE CONSONANT TOKENS IN PAST TENSE

1. Played

On our soccer team, we like challenges, so last weekend we _________ against the best team in the city. (25 syl)

Yesterday, we cleaned the playground, and today in the morning, my kids _________ in the sandbox for hours. (25 syl)

2. Fried

My mom cooked all day long. For lunch, she made a salad, and then she _________ a chicken. (20 syl)

I was very hungry this morning but didn’t have much time, so I just _________ an egg and ate it. (23 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. (23 syl)

After looking at the options at their health club, Camille and Kent _________ a fitness yoga class. (23 syl)

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

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

5. Cried

Mary was talking on the phone and was told that her father had died. She got off the phone and ___________. (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 2. Monomorphemes and simple past forms (numbers indicate natural logarithm)

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