PROSODIC STRUCTURE AND THE REPRESENTATION OF L2 FUNCTIONAL
MORPHOLOGY: A NATIVIST APPROACH

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Abstract

In this paper, we argue against the emergentist position that functional morphology can be acquired by induction from properties of the target-language surface phonetic string. Two experiments are presented, which examine oral production data from Mandarin speakers at intermediate levels of proficiency in English. The first experiment is on the acquisition of English past tense morphology, the second on the acquisition of English articles. In both cases, learners are quite successful at supplying the appropriate morphology. A detailed examination of the phonetics of learners' outputs shows that many of their productions cannot be derived from the surface strings available in the ambient input. In particular, the L2 learners produce tense and articles in ways which are not found in either the L1 or the L2, namely, with fortis release on tense inflection and stress on articles. We maintain that options made available by Universal Grammar, together with transfer of prosodic representations from the L1, best account for such behaviour.

Keywords: prosodic structure; transfer; inflection; determiners; Mandarin

1. Introduction

Emergentists argue that complex linguistic generalizations can be arrived at on the basis of general learning mechanisms without the need for an innate Universal Grammar (UG), maintaining, rather, that "structural regularities of language emerge from learners' lifetime analysis of the distributional characteristics of the language input" (Ellis, 2003: 63). In syntax, emergentists have attempted to reduce syntactic categories to a semantic base and to derive hierarchical phrase structure, as well as long distance dependencies, from computational principles of sentence processing which are not specifically grammatical (O'Grady, 1997, 2003). In phonology, emergentists hold that surface regularities in the phonetic output are sufficient for learners to arrive at the set of generalizations that appropriately characterize the phonological grammar. Behaviour which has led nativists to postulate abstract, highly-articulated representations governed by UG is instead captured through reference to string-adjacent segments (e.g., Côté, 2000; Steriade, 1999); and the set of constraints which relate levels of representation is not innate but, rather, is seen to emerge from learners' experience with the ambient input and its interaction with the (developing) articulatory and perceptual systems (Boersma, 1998; Hayes, 1999).

A corollary of the emergentist view is that frequency plays a critical role (Bybee, 2001; Ellis, 2002). Order of acquisition is not seen to be a consequence of the complexity of the representations that must be built, as it is in nativist approaches, but is instead determined by how robustly attested particular constructions are in the ambient input. In the burgeoning literature on emergentism, frequency has been argued to be a determining factor in the acquisition of segmental contrasts (Zamuner, 2001) and prosodic complexity (Levelt, Schiller and Levelt, 1999/2000), in shaping the developing and adult lexicon (through neighbourhood

density effects) (Bybee, 2001; Storkel, 2002), and in chunking, considered to be the basis for the establishment of syntactic and morphological generalizations (Ellis, 2002, 2003).

Along with emergentist accounts of first language (L1) acquisition, there have been proposals to account for second language (L2) behaviour in this way, that is, without recourse to 'special' nativist assumptions about what the learner brings to the acquisition task (e.g., Ellis, 2002, 2003; Ellis and Schmidt, 1997; MacWhinney, 1997; O'Grady, 2003). In this paper, we challenge the emergentist position through an examination of L2 learners' production of functional morphology in English. While we agree that sensitivity to certain kinds of distributional regularities in the ambient input is necessary for acquisition, we argue that the prosodic structures necessary for the appropriate representation of functional morphology cannot be induced solely from properties of the surface phonetic string. Rather, they are constructed from options made available in Universal Grammar: UG provides the constituents from which prosodic structure is built, as well as constraints on their organization. Language learners, both L1 and L2, must determine which prosodic analysis is appropriate for a given input; this requires a 'deep' distributional analysis of the available data and knowledge of appropriate syntax-phonology mappings.

The empirical focus of this paper is on patterns observed in the production of inflectional morphology (tense) and function words (articles) in the L2 English of Mandarin speakers. We begin by re-examining some of our earlier results on Mandarin speakers' productions of English regular and irregular past morphology in light of the emergentist-nativist debate. We follow this with new data involving production of articles by another group of Mandarin speakers. In both cases, we will show – via an examination of non-target productions – that L2 learners display a sensitivity to prosodic structure which is not directly derivable from the target-language phonetics, nor on the basis of frequency in the ambient input, nor, in some cases, from the L1 grammar. These results, we contend, implicate a nativist approach, specifically, UG (including a theory of markedness).

2.   The role of transfer

Before turning to the acquisition of English past tense and articles, we briefly outline emergentist and nativist positions on transfer in L2 acquisition. Ellis (2003: 72) appears to consider that transfer does not play a major role in shaping interlanguage (IL) grammars: "Unless there is evidence to the contrary, it is a reasonable expectation that naturalistic SLA develops in broadly the same fashion as does L1…and that this development similarly reflects the influences of type and token frequencies in the input". Hence, with respect to the kinds of cases we shall consider, namely an L1 which lacks tense morphology and has restricted use of articles and an L2 which requires both, one might expect transfer to play no role;[1] the L2 learner could start from scratch, so to speak. Furthermore, as Ellis (2006) notes, given the high frequency of closed class items in the input, one might expect L2 learners to be as accurate in their acquisition of grammatical morphology as L1 acquirers are, contrary to what has commonly been observed.

Recognizing this potential problem for emergentism, Ellis (2006) articulates a more significant role for transfer. He provides a number of reasons why certain highly frequent items in the L2 input should fail to be perceived (i.e., fail to become *intake*). These include redundancy and lack of salience; the claim is that prior L1 experience may block L2 learners from noticing such forms.[2] Ellis (2006: 184) suggests that the L1 may have effects when it lacks categories required by the L2 (one of the cases under consideration here, namely tense) but more so when existing categories must be restructured (the other case under focus, namely articles).

Along with many researchers in the field, we assume a major role for transfer in L2 acquisition, within a nativist framework (see White, 1989, 2003 for an overview of this position). In particular, representations based on the L1 grammar are implicated in L2 acquisition (e.g., Schwartz and Sprouse, 1996). As far as phonological transfer is concerned, in previous work, we have proposed the Prosodic Transfer Hypothesis (PTH) (Goad and White, 2004; Goad, White and Steele, 2003), according to which the production of functional material is constrained by L1

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prosodic representations. L2 speakers, at least initially, adopt L1 prosodic representations and are predicted to have difficulty in accurately producing function words and inflectional morphology when the L2 requires a prosodic representation unavailable in the L1. In consequence, they resort to structures available in the L1 grammar, sometimes adapting these in a variety of ways (Goad and White, 2004, 2006a). Note that we are not claiming that the L1 prosodic representation prevents the *perception* of L2 functional material, contrary to the view of L1 transfer advocated by Ellis (2006). Rather, the L1 representation constrains speech production. As we will show, L2 learners make distinctions within past tense contexts and within their suppliance of articles which suggest much more subtle sensitivity to structure than blocking by prior L1 experience would suggest, and which do not relate to properties of the target-language phonetics.

3. Past tense morphology in Mandarin-English interlanguage

The acquisition of regular and irregular inflection (including in L2 acquisition) is an area which emergentists have explained by means of associative learning (Bybee, 1985, 2001; Ellis, 2006; Ellis and Schmidt, 1997). Here, we suggest that an explanation in terms of input frequency and associative learning is inadequate (see also Gregg, 2003).

The L2 literature on the acquisition of past tense morphology has commonly shown that performance on irregulars is better than on regulars (e.g., Lardiere, 2003), at least as far as production is concerned. This observation is consistent with emergentist approaches to acquisition. According to Bybee (2001), for example, phonological representations emerge directly from phonetic similarities observed across stored forms; high frequency items – including irregularly-inflected verbs – have "stronger" representations than low frequency items. As a result, they are learned more easily.

Better performance on irregular verbs has posed a challenge for nativist approaches to syntax, as regular and irregular inflection are represented in the same way morpho-syntactically; hence, one might expect such forms to be produced with equal ease. They are, however, represented differently at the level of prosodic structure and in earlier work (Goad, White and Steele, 2003), we provided an explanation for the better performance on irregulars which appeals to this difference.

3.1. *Prosodification of past morphology*

UG provides several ways to prosodify function words and inflectional morphology (see, e.g., Peperkamp, 1997; Selkirk, 1996). In the unmarked case, functional morphology is organized outside the prosodic word (PWd) which contains the lexical material on which the morphology depends. This view of markedness follows from the position that syntactic and phonological representations strive to be isomorphic. Learners can then use their knowledge of the functional-lexical split in syntax to bootstrap into the prosodic representation or they can use their understanding of differences in the phonological properties of functional and lexical material to bootstrap into the syntactic representation (see, e.g., papers in Weissenborn and Höhle, 2001).

Consistent with this view, in the unmarked case, bound functional material is adjoined to the PWd of its host as an 'affixal clitic' (Selkirk, 1996). In English-type languages, regular inflection respects this structure, as shown in (1) for long-stemmed (VXC-final) 'helped' and short-stemmed (VX-final) 'wrapped' (see Goad, White and Steele, 2003; Goad and White, 2006a).[3]

(1)   PWd

        PWd

          hɛlp   t
          ræp   t
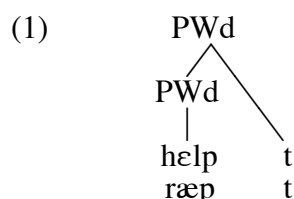
Evidence for adjunction in such cases comes from constraints that hold on PWds. With a handful of exceptions, PWds in English allow a maximum of three positions (VXC) at the right edge (e.g., [hɛlp] 'help'). The addition of a fourth position is only permitted if the consonant is an inflectional suffix (e.g., [hɛlpt] 'helped'); monomorphemic words of this shape, which are single PWds by definition, are thus illicit. This difference between monomorphemic and regularly-inflected words is expected if inflection is prosodified outside the PWd of its host.

'Pseudo-inflected irregulars', on the other hand, are always suffixed with [t] and display stem changes not observed with regulars, including vowel shortening (*keep-kept*), obstruent devoicing (*leave-left*), and [d] deletion (*build-built*). In contrast to regularly-inflected forms, pseudo-inflected irregulars are like monomorphemic words in that they cannot have a fourth position at the right edge. Instead, the attachment of [t] to a VXC-final base triggers vowel shortening ([kiːp]-[kɛpt]), in order to accommodate the inflection within the PWd of the stem, as shown in (2).

(2)   PWd
          /|\
        kɛp   t

An examination of the surface string is not sufficient to arrive at the difference in representation between regular and irregular inflection in (1) and (2) because short-stemmed regulars and pseudo-inflected forms permit the same degree of complexity at the right edge of the base, namely VX only. Indeed, the phonetic parallels between the surface forms for bases that end in voiceless obstruents such as [kɛp-t] and [ræp-t] may incorrectly lead learners to the same PWd-internal analysis of the inflection in these two types of stimuli.

We have argued elsewhere that adjunction to the PWd is not available at the right edge in Mandarin, the L1 under consideration (Goad and White, 2006a; Goad, White and Steele, 2003); transfer of the L1 representation will thus not help the learner to acquire the appropriate prosodifications for English past tense. Unless PWd adjunction is given by UG as the unmarked representation for inflection, positive evidence for this structure – the presence of an extra consonant which is not permitted at the right edge of single PWds – will only be available for the long-stemmed regulars and there will be no phonological (prosodic) explanation for shortening in the case of pseudo-inflected irregulars.

3.2.   Acquisition of regular versus irregular past morphology in Mandarin-English interlanguage

In this section, we review a study designed to systematically examine the effects of stem shape and the regular-irregular contrast on acquisition (see Goad and White, 2006a, for details), considering the results from the point of view of emergentism versus nativism. The study involved intermediate-level Mandarin-speaking learners of English who undertook a combined sentence completion and elicited production task which examined performance on past tense and participial morphology, contrasting regular and irregular (pseudo-inflected) forms. Regular stimuli were divided into two classes determined by the length of the stem-final string, long (VXC-final; e.g., [hɛlp] 'help') or short (VX-final; e.g., [ræp] 'wrap'). Crucially, pseudo-inflected irregulars were similar in shape to the short-stemmed inflected regulars (e.g., [kɛp-t] 'kept' vs. [ræp-t] 'wrapped'). Stimuli were selected such that regular and irregular verbs were (broadly speaking) paired for frequency (according to frequency ratings available on the companion website for Leech, Rayson and Wilson, 2001).

Suppliance of past morphology was high for all stimulus types (on average 92%), and suppliance was equally good for verbs of high and low frequency, regardless of stimulus type. In and of itself, this does not argue against the emergentist position; it might be that the L2 learners were beyond the stage when the stronger associations for irregulars have an effect. However, patterns observed in the phonetic detail of learners' outputs, we believe, challenge the emergentist view. The evidence comes from the distribution of fortis release on the inflectional

suffix and on stem-final stops. Consonants with fortis release (transcribed as C^h) have stronger bursts and are of greater duration than stops in these positions in native English outputs.

As far as the inflectional suffix is concerned, the most commonly observed pattern in the L2 data was for this consonant to be realized as fortis, regardless of stimulus type (short-stemmed regular, long-stemmed regular, irregular). Importantly, for all subjects, fortis release occurred equally often after stems ending in sonorants and obstruents. This, we have argued, indicates that it is not a phonetic strategy that L2 speakers employ to realize articulatorily-difficult strings of obstruents but, rather, reflects a particular syllabification of the inflectional consonant: this consonant is a word-final onset whose featural content has spread into the following empty nucleus ('Onset-Nuclear (ON) sharing'); see (3a) and (3b), the IL representations of short-stemmed regulars like *wrapped*. In the target grammar, on the other hand, the inflection is syllabified as the onset of an empty-headed syllable (see (3c)) and is thus not realized with fortis release (see Goad and White, 2006a for details). In both the target (3c) and IL (3a, b) representations, the nuclei of the syllables containing the inflectional affix are 'featurally-impoverished': in (3a, b), the nucleus has acquired its segmental content from the preceding onset and so contains no vocalic features, unlike ordinary nuclei; in (3c), the nucleus is featurally empty. We will return to the significance of this shortly.
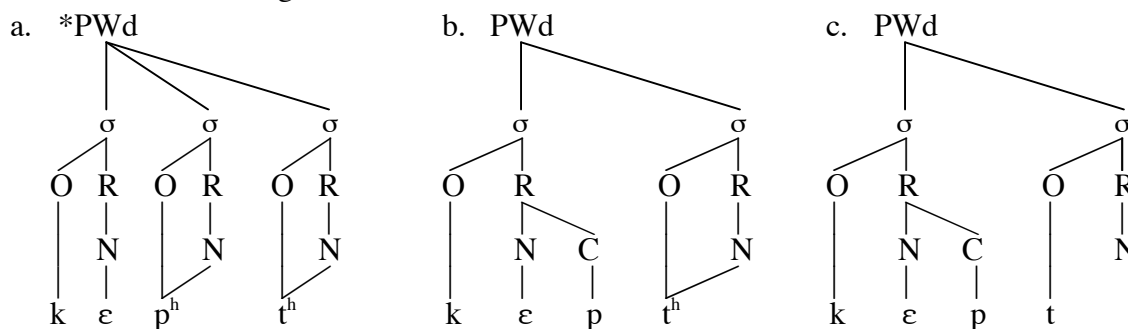
(3)   Short-stemmed regulars:

a. PWd [with syllables O-R-N structure: r æ p^h t^h]
b. PWd [r æ p t^h]
c. PWd [r æ p t]
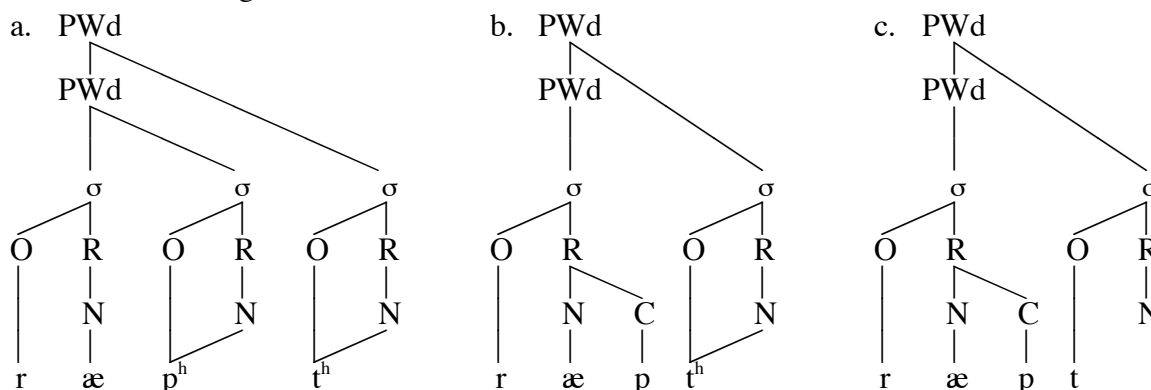
ON sharing is not permitted in the grammars of either the L1 (Mandarin) or the L2 (English). Accordingly, the syllable structure for inflection in (3a) and (3b) cannot be transferred from the L1, nor can it emerge from the input to which L2 speakers are exposed. Where, then, does the representation come from? Drawing on evidence from developing and end-state L1 grammars, Goad (2002) and Goad and Brannen (2003) propose that ON sharing represents the least marked way to syllabify word-final consonants. It is not, however, the phonetically 'easiest' solution which would involve vowel epenthesis (e.g., [ræptə] for 'wrapped'). Thus, this representation cannot be arrived at through a phonetically-based theory of markedness. Instead, it requires access to a UG-governed theory of markedness.

Stem-final stops in IL outputs also display fortis release but only under certain conditions. For regularly-inflected short stems, two patterns are equally favoured. The stem-final stop may surface as fortis ([ræp̚^{h}t^h]), as in (3a), or as plain ([ræpt^h]), as in (3b).[4] Crucially, even though the short-stemmed regulars and pseudo-inflected stems are segmentally parallel (as detailed above), the learners treat them differently as far as fortis release is concerned: pseudo-inflected irregulars surface *only* with plain stops at the right edge of the base, as in (4b) rather than (4a). As detailed below, this behaviour strongly suggests that the Mandarin speakers have acquired the correct representations for English inflection, even though their production is not phonetically target-like. In the case of regulars, inflection is appropriately adjoined to the PWd (compare (3a-b) with target (3c)), while pseudo-inflected -*t* is PWd-internal (compare (4b) with target (4c)).

(4)   Pseudo-inflected irregulars:

a. *PWd   b. PWd   c. PWd

      σ   σ   σ   σ   σ   σ   σ

   O R   O R   O R   O   R   O   R   O   R   O   R

      | | | | | | | | | |
      N   N   N   N   C   N   N   C   N   N

   k ɛ   pʰ   tʰ   k ɛ   p   tʰ   k   ɛ   p   t

In Goad and White (2006a), we propose that the differential treatment of regulars and pseudo-inflected irregulars in L2 outputs stems from the differences in higher prosodic structure shown in (3) and (4), coupled with conditions on the occurrence of syllables with featurally impoverished nuclei, specifically, the Empty Category Principle (ECP). The ECP regulates the distribution of empty-headed syllables in Government Phonology. It is informally defined as: Adjacent syllables with empty nuclei are not permitted; empty nuclei must be licensed by a following segmentally-realized nucleus or by a domain edge (see Kaye, 1990; Kaye, Lowenstamm and Vergnaud, 1990).[5] If the ECP applies to all syllables with featurally-impoverished heads, not only to those with empty heads, the result will be a universal ban against [...CʰCʰ]$_{PWd}$, as well as against [...CØCØ]$_{PWd}$. This principle will thus be responsible for the lack of fortis release on stem-final consonants in pseudo-inflected forms: if the inflectional suffix is internal to the lower PWd, the stem-final consonant must be syllabified as a coda (see (4b, c)), not as an onset followed by a featurally-impoverished head (as in (4a)); the latter representation violates the ECP. For regulars, on the other hand, the stem-final and inflectional consonants can both surface as fortis, as in [ræpʰtʰ], because the two syllables which involve ON sharing are separated by a domain (PWd) boundary (see (3a)).

   To summarize, concentration on the phonetic detail in learners' outputs has shed light on their prosodic representations. Specifically, the distribution of fortis release, which occurs in neither the L1 nor the L2, motivates a target-like prosodic difference between regular inflection and pseudo inflection, namely, the presence or absence of adjunction respectively. Our analysis for the distribution of fortis release in the L2 data has appealed to a theory that permits consonants to be syllabified in a number of ways: as onsets with overt vocalic heads (CV), as onsets with featurally-impoverished heads (CØ and Cʰ), and as codas (C]$_o$). Importantly, the representations for CØ and Cʰ cannot be 'read off' the surface, and instead require the assumption of access to a UG-governed theory of prosodic well-formedness. As the heads in these two types of syllables do not sound vocalic, in emergentist theories of syllable structure, these consonants would be analysed as codas and differences in the distribution of fortis release on stem-final consonants in the two types of inflected forms would go unexplained.

4.   Articles in Mandarin-English interlanguage

   We turn now to another example bearing on the emergentism versus nativism debate, namely the L2 acquisition of English articles by Mandarin speakers. As in the case of tense inflection, we again demonstrate that attention to phonetic detail in learners' productions can illuminate their prosodic representations and suggest that these representations cannot derive from the target-language phonetic string.

4.1.   *Prosodification of determiners*

   We begin by outlining the prosodification of determiners in the two languages we are concerned with. In English, definite and indefinite articles link directly to the Phonological
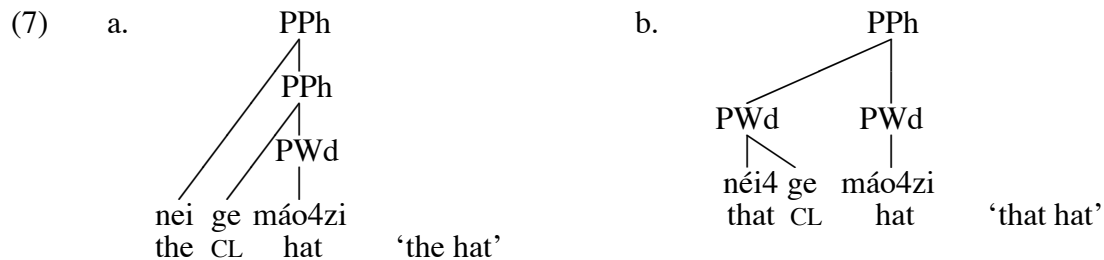
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Phrase (PPh) as 'free clitics' (Selkirk, 1996); see (5a). Other determiners (demonstratives, numerals, quantifiers, etc.), as well as stressed articles, form independent PWds, as in (5b).

(5)   a.   PPh   b.   PPh

              PWd   PWd PWd
               | | |
   the/a   hát   óne   hát
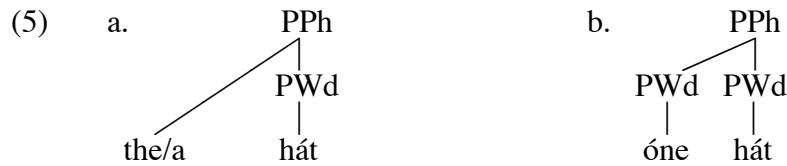
While Mandarin has traditionally been described as a language with no articles, some determiners are beginning to take on the function of articles in spoken discourse. Huang (1999) details the emergence of *nage* ('that') as the definite article in Taiwanese.[6] Li and Thompson (1981: 131-132) observe that *nei* is interpreted as 'that' when it is stressed and tone-bearing (1-4 mark toned syllables) and as 'the' when it is unstressed and toneless (unmarked);[7] see (6a) and (6b) respectively (examples from Chen Qu, p.c., based on Li and Thompson).

(6)   a.   ta1   mai3-le   nei4-ge mao4zi
           3sg buy-PERF that-CL   hat
           'S/he bought that hat.'

      b.   ta1   mai3-le   nei-ge mao4zi
           3sg buy-PERF the-CL   hat
           'S/he bought the hat.'

These observations suggest that Mandarin permits the free clitic structure in (7a) for articles, identical in relevant respects to that provided for English in (5a). The structure for other determiners, which form independent PWds, is given in (7b), parallel to (5b).[8]

(7)   a.   PPh   b.   PPh

                PPh
                                          PWd   PWd
                  PWd
                   | néi4 ge   máo4zi
        nei ge máo4zi   that CL   hat   'that hat'
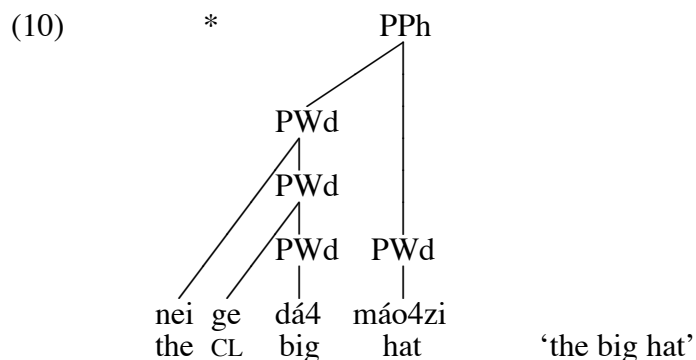   the CL   hat   'the hat'

        The free clitic representation in (7a) is motivated by a consideration of DPs containing adjectives. A possible alternative would be the structure in (8) where the article and classifier adjoin to the PWd as affixal clitics/prefixes.

(8)   PWd

                PWd

                  PWd
                   |
        nei ge máo4zi
        the CL   hat   'the big hat'
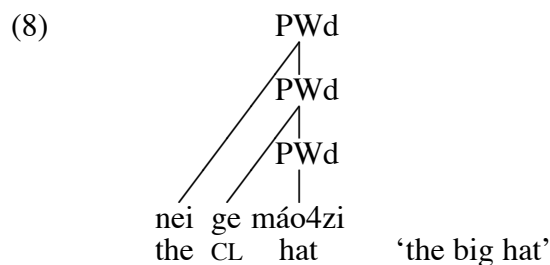
However, adjectives are positioned between the classifier and noun in Mandarin, as shown in (9).

(9)   ta1   mai3-le   nei-ge da4 mao4zi
       3sg buy-PERF the-CL big   hat
       'S/he bought the big hat.'

Affixal clitics must be prefixed onto the constituent which they modify, here the head noun, rendering a representation like (10) ungrammatical (see Goad and White, 2004 on Turkish). Consequently, the fact that the article (and classifier) precedes the adjective implicates the free clitic structure in (7a) over the alternative in (8).

(10)   *   PPh

                       PWd

                        PWd

                          PWd   PWd

            nei ge   dá4   máo4zi
            the CL   big   hat   'the big hat'

In short, Mandarin speakers have the necessary structure to represent articles in English in target-like fashion.[9]

4.2.   *Predictions*

With the representations in (5) and (7) in mind, we turn now to the predictions that emergentism and nativism make for the L2 acquisition of English articles. Recall that for emergentists like Ellis (2006), interference effects are expected, such that L1 experience prevents learners from noticing frequent forms in the L2 input; this is claimed to hold especially when L1 categories must be restructured in the L2.

From Huang's (1999) examination of the grammaticalization of *nage* as the definite article, it is evident that for the Mandarin-speaking learner of English, restructuring is required in the case of article acquisition. First, Mandarin displays a subject-object asymmetry; articles are emerging in object position first, a restriction which does not hold of English. Second, the development of this category has largely been restricted to the definite article. Third, articles in English are multi-functional whereas the definite article in Mandarin is much more restricted. It follows that under the approach outlined by Ellis (2006), articles should initially be omitted from the Mandarin-English IL grammar, since they involve what he claims is the most difficult situation, namely transfer which requires restructuring of existing categories. It is furthermore not clear whether articles are predicted to be acquired in the longer term, since the mapping of English articles to their meanings involves considerable 'fuzziness and complexity' (p. 167).

According to the PTH, on the other hand, the target representation for articles in (5a) is available in the L1 grammar (at least for those speakers where the demonstrative has been grammaticalized as a definite article). Hence, on phonological grounds, the representation in (5a)/(7a) should be available to the interlanguage grammar from the onset of acquisition, for both definite and indefinite articles, since these are prosodified in the same way in English. However, other factors may come into play. Both emergentists (e.g., Ellis, 2006) and nativists (e.g., Ionin, Ko and Wexler, 2002; Ionin and Zubizarreta, this issue) have argued for semantic effects on the L2 acquisition of articles, which may result in article omission.[10] In other words, article deletion at early stages in development is not unexpected on either account (emergentism or nativism) and, hence, cannot be used to decide between them.

However, the PTH predicts other patterns of phonological behaviour which would appear to be unexpected on an emergentist account. Because the incidence of (7a) in Mandarin is quite

restricted, when L2 speakers produce English articles, they may in fact organize these function words using alternative prosodic representations which result in non-target productions. In particular, they may resort to the representation in (5b)/(7b), either by stressing articles or by substituting other determiners in place of articles.

Below, we report on an experiment which shows that, while L2 speakers' representations of English articles can be attributed to properties of the L1, how they realize articles in production indicates a sensitivity to prosodic structure which does not reflect the phonetics of English. This, we argue, supports nativism.

4.3. *Experiment*

The experiment presented here was designed to investigate the nature of L2 speakers' prosodic representations of English articles. Fifteen adult native speakers of Mandarin participated. All subjects had attended English classes in high school in China from the age of 12 and most of them had also taken English courses at university in China. They had moved to Canada as young adults (age range on immigration 20-34) and had been in Canada for an average of two years. Proficiency was determined by means of a cloze test.

An elicited production task was designed, involving a sequence of pictures telling a story, which subjects had to describe in their own words. The story was constructed to elicit lexical items varying in prosodic shape (differing in stress patterns, for example). The production data were taped on DAT recorders (SONY TCD-D100 and PCM-M1). The data were then narrowly transcribed by a native speaker of English with extensive training in phonetic transcription, and were coded for determiner use.

4.4. *Results*

As far as proficiency is concerned, subjects fell into three groups: high intermediate (M1, M4, M14, M20), intermediate (M2, M3, M7, M10, M15) and low intermediate (M5, M6, M16, M19, M21, M22).

We confine our analysis to singular count noun contexts, since these obligatorily require an article or other determiner.[11] Furthermore, we exclude DPs containing adjectives, in order to concentrate on the relationship between the article and adjacent noun. The task yielded an average of 135 such contexts for articles (as opposed to other determiners) per person (range: 60-218). We collapse definite and indefinite articles in the analysis because, as mentioned earlier, they share the same prosodic representation in English (namely (5a)) and, as expected, we found no definite-indefinite asymmetries in our data (see Goad and White, 2006b). Figure 1 presents the subjects' treatment of articles in obligatory contexts. Subjects are grouped by proficiency (as well as article suppliance within groups). We start by looking at suppliance of articles from a morpho-syntactic point of view, in other words, whether they are appropriately supplied ('overt'), inappropriately omitted ('deletion'), or whether some other determiner is produced in their place ('substitution').

Insert Figure 1 about here

As can be seen in Figure 1, production of overt articles is high, ranging from over 90% by some subjects, at all levels of proficiency (M4, M3 and M21), to 54-61% by some low intermediate subjects (M6 and M22). While production of these articles is appropriate in the context (singular count nouns), they are not necessarily target-like vis-à-vis their prosodic relationship to the following noun; in particular, they are often stressed, as discussed in section 4.4.2 below.

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4.4.1. Deletion and substitution

Failure to supply an article in an obligatory context (deletion) is quite common and ranges from just under 4% (M3) to 38% (M22); with a couple of exceptions (M21 and M19), lower proficiency subjects show a somewhat higher incidence of deletion than higher proficiency subjects. Typical examples are shown in (11).

(11)   She decide to...buy umbrella. (M22)
         Hat is 40 dollars. (M7)

As discussed above, both emergentists and nativists can account for article deletion. However, on the emergentist assumption that L2 articles will take a long time to emerge robustly, the relatively high incidence of overt articles in our data is perhaps unexpected. It is important to note that deletion is not the most commonly adopted strategy to deal with L2 articles. Almost all subjects, regardless of proficiency level, produce articles in obligatory contexts to a considerable extent.

One strategy for providing an overt form in a context requiring an article involves substitution by other determiners. Since these are stressed, they form independent PWds, a representation that is found in both Mandarin and English for determiners other than articles (see (5b) and (7b)).

As can be seen in Figure 1, two subjects (M6 and M15) substitute other determiners for articles to a noticeable extent (M6 in 27% of article contexts; M15 in 12% of contexts). M6 mostly produced *one* in place of *a*: 80% (39/49) of cases where she supplies an overt form in indefinite contexts involve the substitution of *one*. M15 used various determiners (*this*, *that*, *her*, *some)* in place of definite and indefinite articles, 14% (19/117) of overt forms being determiners in contexts where articles would be more felicitous. Representative examples are provided in (12).

(12)   Eh…there is one eh…table, one table…and one cashier…there. (M6)
         And this boy put out a piece of chips. (M15)

Such substitutions are only very occasionally produced by the remaining subjects.[12] Note that all subjects use other determiners appropriately, such as demonstratives, possessives, and quantifiers. We do not report on these data here.

We suggest that substitution cannot have emerged from a frequency based analysis of English surface forms; the indefinite article *a*, for example, is much more frequent than the numeral *one*. Rather, we suggest, other determiners are used in place of articles in order to circumvent a particular kind of prosodic representation, the free clitic structure in (5a), which, although available in the L1 (see (7a)), is much more limited in its scope, as discussed above.

4.4.2. Suppliance of articles with the vowel stressed

We now focus in more detail on the non-target productions involving stressed articles and suggest how these challenge emergentism, instead supporting a UG-based view of prosodic transfer. Specifically, this strategy does not appear to be a consequence of sensitivity to the phonetics (broad stress contour) of the ambient language but, instead, shows a responsiveness to prosodic structure.

As shown in Figure 1, subjects were quite successful in supplying overt articles. However, these articles were often inappropriately produced as stressed. Stressing of articles in contexts where an unstressed article is expected avoids the target representation in (5a), since stressed articles form their own PWds, as shown in (13).[13]

(13)
```
                    PPh
                   /|
              PWd  PWd
               |    |
               á   hát
```
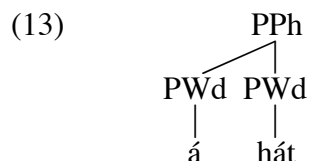
Table 1 provides the incidence of stressed articles as a proportion of all overt articles which were not followed by a pause or filler. Pauses and fillers necessarily break up the prosodic representation; hence the prosodic relationship between an article and the following noun cannot be established. All subjects, with one apparent exception (M15), stress articles, often to a considerable extent. (M15 produced numerous stressed articles but they were invariably followed by a pause or filler; hence, they have been excluded from the analysis.) As can be seen in Table 1, stressing ranges from 4% (M22) to 47% (M21); use of this strategy appears to be largely independent of proficiency.

Table 1. Overt articles produced with stress

	M4	M20	M1	M14	M3	M2	M7	M10	M15	M21	M19	M16	M5	M22	M6
#	17/79	7/83	23/167	14/157	41/155	53/136	26/111	26/75	0/69	27/57	6/94	34/88	9/53	1/26	8/74
%	22	8	14	9	26	39	23	35	0	47	6	39	17	4	11

Representative examples are provided in (14); stressed articles are underlined. Both definite and indefinite articles were subject to this strategy.

(14)   […] she dreamed of uh driving a car with uh canoe on the top of the car. (M4)
        Take a fork in her left hand. (M16)

We maintain that stressing of articles is unexpected on an emergentist account. Although under limited circumstances, English does permit articles to bear emphatic stress, stressed articles are significantly less frequent than unstressed ones. Furthermore, when the L2 learners produced stressed articles, this was not in contexts where emphatic stress would have been appropriate. Thus, there seems to be no reason, given the surface stress contour found in English, for such a high level of stressed articles to emerge in L2 outputs.[14] Recall that the definite article that has become grammaticalized in Mandarin is unstressed, so stressing of articles cannot be the result of direct transfer from the L1. Instead, we argue, the high degree of stressing of articles reveals that L2 speakers are able to represent and produce articles, as required by the syntax of English, without necessarily constructing a prosodic representation involving free clitics (as in (5a)). Since Mandarin permits the prosodic representation in (13) for other determiners (see (7b)), we maintain that this L1 representation is being adopted here.
    If we exclude stressed articles and articles followed by fillers and pauses, the incidence of prosodically target-like (i.e., unstressed) productions of English articles is considerably lower than the overall incidence of overt articles reported in Figure 1. Nevertheless, for all subjects, more than 50% of overt articles are produced in a target-like manner, as shown in Table 2. This is independent of L2 proficiency.

Table 2. Unstressed articles (target-like)

	M4	M20	M1	M14	M3	M2	M7	M10	M15	M21	M19	M16	M5	M22	M6
#	62/87	78/99	152/183	144/181	124/177	92/152	87/126	50/81	71/117	30/57	89/113	56/102	45/62	26/37	67/83
%	71	79	83	80	70	61	69	62	61	53	79	55	73	70	81

We have shown that production of English articles by Mandarin speakers involves non-target deletion, substitution and production of stressed articles, as well as appropriate production of unstressed articles. Some of these findings cannot be used to decide between emergentist and nativist accounts. For example, appropriate article suppliance is neutral between the two positions: once the appropriate representation has been acquired, it is not possible to establish exactly how it was arrived at. Some non-target outputs are also neutral between the two positions: on both types of account, deletion of articles is not unexpected. The high incidence of production of stressed articles, on the other hand, does not appear to be consistent with emergentist accounts. Where would such behaviour emerge from? Rather, it suggests that the L2 learners under study are sensitive to the fact that English requires overt articles and that these articles must be represented both in the syntax and in the phonology. Their problem is one of prosodic representation. Given difficulties in constructing the free clitic representation in (5a), due to the fact that articles are much more circumscribed in the L1, Mandarin speakers resort to the stressing of English articles, which allows them to make use of an alternative prosodic representation, a representation which is available in their L1, although not, of course, for articles.

In short, there is no morphological, syntactic, semantic or pragmatic explanation for stressing of articles, and the phonological explanation we have provided does not emerge from the L2 surface phonetics, nor is it motivated by frequency. This, we contend, supports nativism and a UG-governed theory of transfer.

5. Discussion

To summarize thus far, we have presented two studies involving L2 English speakers whose L1 is Mandarin, one case involving inflectional morphology (past tense, not available in the L1) and the other involving function words (articles, currently being grammaticalized in the L1). As far as past tense is concerned, we have presented evidence that the Mandarin speakers in question have acquired the target prosodic representations which distinguish between regular inflection and pseudo-inflection, even though the segmental profile and syllable structure complexity permitted for short-stemmed regulars and pseudo-inflected irregulars is parallel. The difference in prosodic representation was motivated by differences in their use of fortis release on stem final consonants, itself not a property of either the L1 or the L2. Hence, we submit, this group of speakers has moved beyond available L1 syllabification constraints and has arrived at appropriate L2 representations for higher prosodic structure, representations which could not have been read off the English phonetic string.

As for articles, the very fact that they are produced (in syntactically and semantically appropriate contexts) indicates that they have been acquired as a category. There is evidence for target-like production of articles, suggesting that they can link directly to the PPh as free clitics, the appropriate prosodic representation for articles in English, a representation which is also available, although to a more limited extent, in Mandarin. At the same time, non-target outputs are frequent and all the strategies we have described appear to be adopted independent of L2 proficiency. These outputs, particularly the production of stressed articles in place of unstressed articles, do not reflect properties of the L2 surface string, nor of L2 frequency. Rather, they suggest persistent L1 influence of a different prosodic representation.

In conclusion, arguments for UG depend on the so-called logical problem of language acquisition, the claim being that the linguistic competence of L1 acquirers is underdetermined by the input. Speakers end up unconsciously knowing more than they could have learned from input alone. Similar claims are made for second language acquisition; that is, L2 speakers exhibit unconscious knowledge of the target language which could not have come solely from the L2 input. The argument, for both L1 and L2 acquisition, is typically made with respect to subtle syntactic (e.g., White and Juffs, 1998, amongst many others) or semantic (e.g., Dekydtspotter,

Sprouse and Anderson, 1997) properties. In this paper, we have argued that parallel arguments can be adduced in the prosodic domain. In particular, the prosodic representations necessary to account for production of inflectional morphology and function words (whether or not this production is target-like) are underdetermined by the input: they cannot emerge as a consequence of exposure to phonetic properties of the L2 alone. Instead, they must be constructed on the basis of options made available in UG. At the same time, we maintain that prosodic representations from the L1 constrain the options available in L2 production, parallel to *full transfer* proposals made for L2 syntax (Schwartz and Sprouse, 1996).

Acknowledgments

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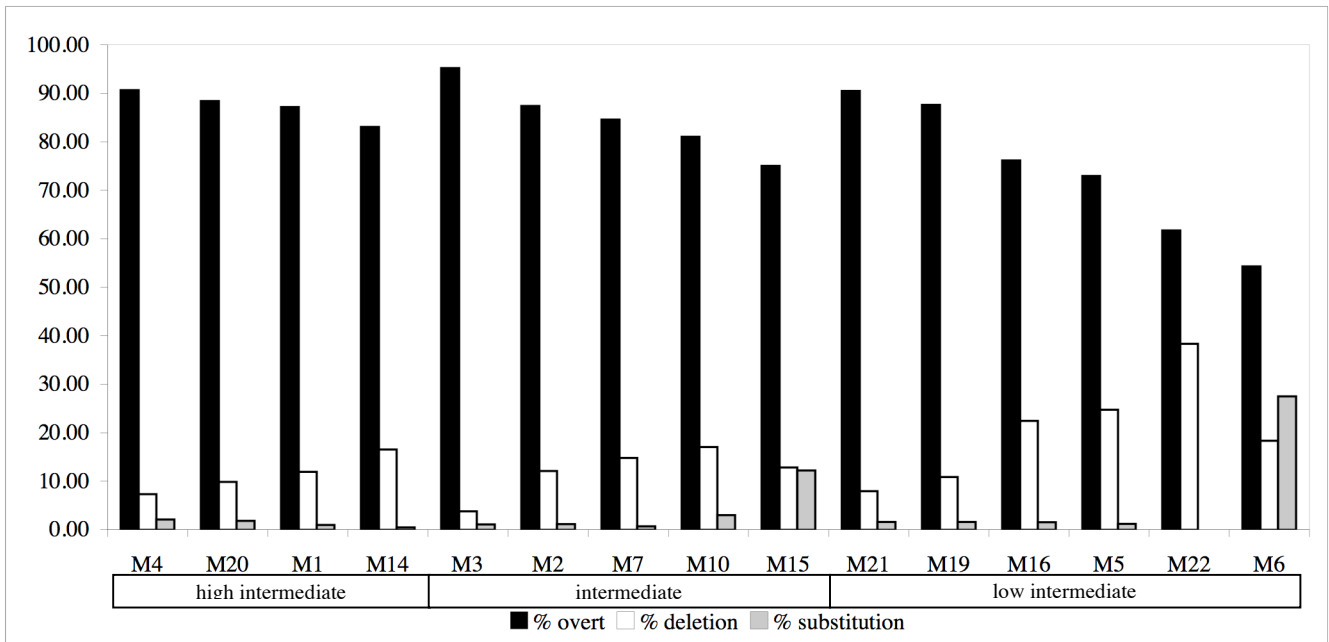Figure 1. Production of articles in obligatory contexts (singular count nouns)

[1] While the commonly-held view is that Mandarin lacks articles altogether, this position has been challenged by Huang (1999). We will return to this issue in section 4.1.

[2] In fact, such a claim is not unique to emergentism; nativists have also argued that the L1 grammar in certain cases prevents the learner from perceiving properties of the L2. For effects of the L1 feature inventory on L2 phonological acquisition, viewed from a UG perspective, see Brown (1998).

[3] X = V or C; i.e., VXC collapses VVC and VCC, and VX collapses VV and VC.

[4] The structure in (3a) avoids L1 codas that are illicit (Mandarin permits sonorant codas only) by syllabifying the stem-final consonant through ON sharing; it thus surfaces as fortis. Lack of fortis release on this same consonant in (3b) suggests that the consonant is syllabified as a coda, as it is in the target grammar; see (3c).

[5] We interpret "domain" as PWd and "adjacent" as structurally-adjacent within the lowest PWd.

[6] Thanks to an anonymous reviewer for drawing Huang's work to our attention.

[7] In discussing these observations from Li and Thompson, Huang (fn 1) points out that *nei* is invariably realized as *na* in his corpus.

[8] In (7b), the classifier is internal to the PWd (and foot) of the determiner, as Mandarin has a preference for HL trochees (see Goad, White and Steele, 2003 for details).

[9] We will assume from now on that the representation in (7a) is indeed available to the subjects under study, i.e., that grammaticalization of a definite article has taken place in their dialects. We do not, however, have direct evidence to this effect.

[10] Ionin and colleagues also argue for substitution of definite articles in place of indefinite, or vice versa. The phonological representation would not be affected by such substitutions and we do not consider them in this paper.

[11] In fact, the majority of nouns produced were singular count nouns. Mass nouns and plurals were eliminated from the analysis, as were singular count nouns which do not require a determiner, for example, the second noun in a conjunct or nouns occurring in isolation, such as self-corrections. Exact repetitions of the experimenter were also excluded.

[12] This strategy has also been observed by Robertson (2000) who reports 6.7% overuse of *one* for *a* and 8% overuse of *this* and *that* for *the* by a group of 18 Mandarin-speaking learners of English. It is not possible to tell from the way his results are reported whether some subjects use this strategy more often than others.

[13] The weighting of cues for stress is different in English versus Mandarin (e.g., Fry, 1958; Lehiste, 1976 versus Duanmu, 2001; Shen, 1993). Since L2 learners may assign stress to a particular syllable but rely on non-target-like weighting of cues to express this, the vowel in an article was coded as stressed when it was perceived as having higher than target-like pitch, greater than target-like duration, and/or greater than target-like loudness (based on narrow transcription).

[14] One could argue that the source of this pattern is the non-native English input that the subjects received in their English instruction in China. While Mandarin-speaking English instructors may well exhibit the same pattern of stressed articles seen here, the question then simply goes back one generation: on an emergentist view, how did these instructors arrive at a grammar with stressed articles?