

Acquisition at the Prosody-Morphology Interface

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1. Introduction

It has long been observed that the acquisition of grammatical function morphemes proceeds gradually over time, taking several months to reach adult-like performance (e.g., Brown, 1973). Rather than appearing all at once, morphemes such as determiners (e.g., articles *a* or *the*) and verbal inflections (e.g., 3rd person singular *-s*) initially appear in a few obligatory contexts, increasing in appearance over time. In contrast to a parameter-setting approach, where the acquisition of a grammatical construction is presumed to be categorical, the normal course of morphological acquisition is typically a gradual ‘learning curve’. Yet theories of language acquisition generally provide no coherent explanation for this gradual learning process. Radford (1990) proposes that early productions of a particular grammatical function item are only ‘imposters’, whereas Wexler and colleagues (e.g. Wexler, 1994) propose that the variable appearance of a particular grammatical function item is ‘optional’ (i.e., random). These syntactic approaches predict that, once children have the requisite syntactic and semantic knowledge/representations, they should be able to produce a given grammatical morpheme in all obligatory contexts.

The purpose of this paper is to take issue with this view and suggest that the variable appearance of at least some grammatical function items is systematic and predictable. Specifically, I propose that the variability found in the production of some grammatical function morphemes is largely due to linguistic constraints on phonological/prosodic competence, where the first instances of a particular grammatical morpheme will appear in prosodically unmarked (prosodically licensed) contexts. I call this the Prosodic Licensing Hypothesis. Thus, although there may be interacting ‘performance’ factors (such as sentence length), I suggest that increasing competence with *prosodic* structure can account for much of the variability found in the production of some grammatical function items. If so, it is then possible to make predictions about the prosodic contexts in which grammatical morphemes will be most likely to appear, both within and across languages. This will also have significant implications for our understanding of syntactic competence, and for the design of syntactic experiments.

In the following sections I briefly review the studies to date that show support for the Prosodic Licensing Hypothesis. I first focus on pre-nominal morphemes (especially determiners), and then turn to postverbal inflectional morphology, discussing how both can be accommodated in terms of the development of prosodic representations.

2. The prosodic licensing of pre-nominal morphology

2.1 Prosodic licensing of Sesotho noun class prefixes

Connelly (1984) set out to study how Sesotho-speaking children acquire the complex noun-class system of their language, with 13 different singular/plural CV- noun class prefixes. He found few errors of commission, but many of omission, especially around the age of 2. He also noted that prefixes were typically present before monosyllabic nominal stems, but often missing before the more common disyllabic nominal stems. Similar observations were made by Tsonope (1987) for Setswana and Idiata (1998) for Isangu. Demuth (1992, 1994) suggested that this phenomenon could best be understood in terms of prosodic constraints on children’s productions. That is, these grammatical

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morphemes were included if they form part of a disyllabic trochaic foot – a privileged linguistic unit, and one which is typically considered to be the unmarked form for prosodic words (e.g., McCarthy & Prince, 2003). It has also been proposed that this form is licensed in children’s early productions (cf. Allen & Hawkins, 1978; Demuth, 1995). Recent corpus analysis has shown that prosodic licensing of Sesotho noun class prefixes shows significant effects until around the age of 2;3 (Demuth & Ellis, in press). This is shown in (1), where the morpheme in parentheses is dropped in (1b). After 2;3, noun class prefixes that do not form part of a disyllabic foot begin to be more reliably produced.

- (1) a. [mo-tho]_{Ft} ‘person’
 b. (mo)-[sadi]_{Ft} ‘woman’

Critically important to this finding was the fact that, even when the noun class prefix was not produced, children indicated that they knew the phi-features of the class prefix by using the appropriate agreement features on the following nominal modifier (Demuth, 1988). This is shown in (2), where the prefix in parentheses is dropped, but the correct possessive marker is used (from Demuth, 1994:129).

- (2) (se)-[tulo]_{Ft} [sa-ka]_{Ft} ‘my chair’ (chair my) Hlobohang 2;1

This means that children know the number and grammatical class features of the noun even though the noun class prefix itself was not produced. This provides critical evidence that omission of the noun class prefix is not due to lack of knowledge about which class the noun belongs to. Rather, prefix omission is apparently due to other (prosodic) factors (see Demuth & Ellis (in press) for further discussion).

These findings have had an enormous impact on my thinking about children’s emerging linguistic competence, especially given the disagreement amongst syntacticians as to how to treat the variable appearance of grammatical function items. If much of this variability is *prosodically* conditioned, this should have a significant implications for our understanding of how and when syntax was acquired. Thus, rather than providing evidence of syntactically or semantically impoverished representations, some of the variable production of grammatical function items may be evidence of impoverished *prosodic* representations.

However, proving that the variable production of grammatical morphemes is due to prosodic, rather than syntactic or semantic constraints, requires a significant research effort – one that can show that children’s output forms were often truncated independent of morphology. It also requires demonstrating that the variable appearance of grammatical morphemes in other languages is also prosodically conditioned. In the remainder of this paper I review some of the literature that shows broad support for the Prosodic Licensing Hypothesis, where, once a grammatical morpheme begins to appear (an indication of syntactic/semantic competence), it is more likely to be more systematically produced in prosodically unmarked (prosodically licensed) contexts.

2.2 Prosodic licensing of English determiners

Independent evidence that grammatical morphemes are prosodically licensed comes from cross-sectional experimental studies of English (Gerken & McIntosh, 1993; Gerken, 1994, 1996). Gerken and colleagues showed that 2-year-olds were much more likely to produce determiners such as *the* in object rather than subject determiners. Subject determiners, like many Sesotho noun class prefixes, fall outside the foot (i.e., are unfooted). Further study showed that children are also more likely to produce object determiners when they form part of a Sw metrical unit (trochaic foot) with a preceding monosyllabic verb, as shown in (3a).

- (3) a. He [kicks the]_F piggy
 b. He [catches]_F the piggy

Our lab has replicated this study with 2;4 year olds, showing similar effects (Gunawardena, 2006). One of the questions this raises is how long these effects last, and if these patterns are found for all children at some point in development.

To address this issue we examined the longitudinal acquisition of footed and unfooted determiners in 5 English-speaking children spontaneous productions between the ages of 1;4-2;4 (MLU 1.3-3.0). All unambiguous target determiners were coded for footed or unfooted contexts. The results are striking. Although the majority of contexts in which children's target determiners appear are unfooted (76%), 4 of the 5 children show consistently earlier and better production of footed as opposed to unfooted determiners. The fifth child showed no distinction between the two until the age of 2. Further acoustic analysis showed that she was producing all determiners as separate prosodic words, and only at the age of 2 began to produce them as unstressed, incorporating those that could be footed into a disyllabic foot (Demuth, McCullough & Adamo, in press).

These results provide strong evidence that English-speakers' earliest determiners begin to consistently appear in footed contexts between the ages of 1;6-1;10, several months before they systematically appear in unfooted contexts. Since the majority of determiner contexts in English are unfooted, this means that the developmental curves typically used to indicate determiner development seriously underestimate children's knowledge and use of determiners. That is, children may know more about the syntactic distribution and semantic constraints that govern English determiners than is typically assumed. In the following sections we show that this is also the case for determiners in Spanish and French.

2.3 Prosodic licensing of Spanish determiners

Children learning a variety of Romance languages also exhibit the prosodic licensing of determiners. Of particular interest is Spanish, where (proto)determiners appear in children's earliest utterances (Lleó, 1997, 1998). Unlike the 2-syllable limit found in Sesotho, these early determiners often result in 3-syllable productions, where the determiner falls outside the foot. Interestingly, these determiners are also often realized at the cost of omitting a syllable of the lexical stem (Demuth, 2001). This is shown in (4).

(4)	Child	Target		
	[amwéka]	/la muñéka/	'the doll'	Sofia 1;9

Roark & Demuth (2001) examined the distribution of word-shapes that English- and Spanish-speaking children typically hear in child-directed speech. They found that most of the words English-speaking children hear are monosyllables, whereas the majority of the words Spanish-speaking children hear are 2- and 3-syllable words. Thus, a large proportion of words in spoken Spanish contain an initial unfooted syllable, forming a wSw prosodic unit (e.g., *muñeca* 'doll', *manzana* 'apple', *naranja* 'orange'), and children start to produce such forms around 1;10. In contrast, many English-speaking children still truncate prosodically similar words such as *banana* until the age of 2;6 (cf. Pater, 1997).

This led Demuth (2001) to propose that unfooted determiners are licensed in early Spanish due to the fact that Spanish-speaking children develop a larger prosodic window earlier than English-speaking children. This then permits the incorporation of unfooted lexical or functional material earlier in Spanish than in languages like English or German (Lleó & Demuth, 1999).

Spanish-speaking children thus produce determiners earlier in unfooted contexts than do English or Sesotho-speaking children. To date there has been no systematic longitudinal study examining the development of determiners in footed as opposed to unfooted contexts. Consistent with the English and Sesotho findings above, I predict earlier and more consistent appearance of determiners with monosyllabic Spanish words like *pan* 'bread', than with disyllabic words. The evidence examined so far indicates that this may be a very short-lived period of development in Spanish. We see below that this is not the case for French, a language with fewer trisyllabic words than Spanish.

2.4 Prosodic licensing of French determiners

Several studies of French acquisition have reported that determiners first appear with monosyllabic words, and only later with disyllabic and trisyllabic words. These studies focused on a Canadian child (Tremblay, 2006), French children learning to talk with cochlear implants (Hilaire, Régol, & Jisa, 2002) and a cross-sectional study of determiner production with children in Paris

(Bassano & Maillochon, 2005). To explore this issue more closely we conducted a longitudinal study of two French-speaking children's development of determiners (Tremblay & Demuth, this volume). In keeping with the Prosodic Licensing Hypothesis, there was a significant prosodic effect: as in Sesotho, the French-speaking children's production of determiners preceding monosyllabic words was several months in advance of their production of determiners with disyllabic and trisyllabic words. Even though the foot structure of French is iambic, and differs significantly from all three of the languages discussed above, the earliest determiners appear to be prosodically licensed. That is, determiners that can be prosodified as part of a wS iambic foot (5a) are acquired before those that fall outside the foot (5b).

- (5) a. [dy'lɛ]_{Ft} *du lait* 'some milk'
 b. la [ku'rɔn]_{Ft} *la couronne* 'the crown'

Thus, it appears that, in French too, the first determiners produced are those that are prosodically licensed. Since about half the words French-speaking children hear are monosyllables, and half are disyllables (Demuth & Johnson, 2003), French-speaking children start producing many determiners in obligatory contexts quite early. Note that this differs from English and Sesotho, where the majority of the determiners and noun class prefixes are in prosodically marked, unfooted contexts. Thus, although all children begin to exhibit the use of footed determiners around the same age, French-speaking (and Spanish-speaking) children will look more 'advanced' than their counterparts in languages (like English) where the majority of determiners are prosodically marked and later acquired.

3. The development of prosodic representations

In the foregoing discussion I have been agnostic as to the level at which determiners are prosodified, assuming a flat, rather than hierarchical structure. However, researchers have proposed that the level at which certain grammatical function items are prosodified varies across languages, and within a language across different grammatical function items and contexts. Selkirk (1996) offers a typology for the prosodic realization of different grammatical function items (6), where Prosodic Words (PWs) can be monomorphemic or bimorphemic, and grammatical function items can constitute an entire PW, or may prosodically cliticize at the level of the PW or the Phonological Phrase (PP).

(6) The Prosodic Status of Grammatical Function Morphemes

Prosodic Word ((*fnc*)_{PW} (*lex*)_{PW})_{PP}

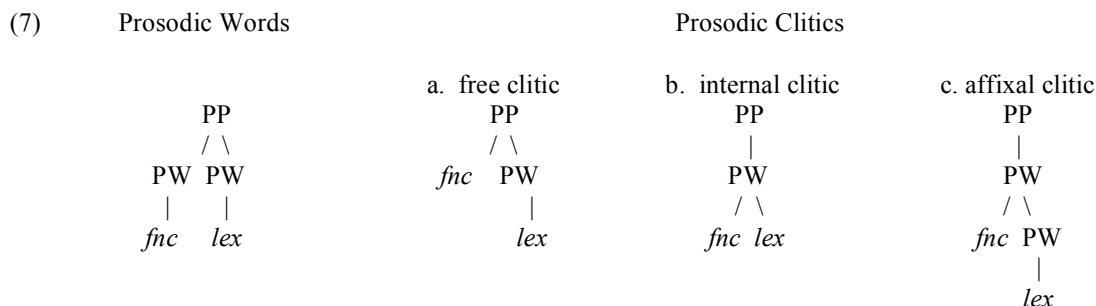
Prosodic Clitics

a. free clitic (*fnc* (*lex*)_{PW})_{PP}

b. internal clitic ((*fnc* *lex*)_{PW})_{PP}

c. affixal clitic ((*fnc* (*lex*)_{PW})_{PW})_{PP}

These structures can be schematized as in (7).



Goad & Buckley (2006) propose that French determiners are prosodified as free clitics (7a). On the other hand, Harris (1989) proposes that Spanish determiners are prosodified as affixal clitics,

except for *una* ('a' fem.), which prosodifies as a separate prosodic word (7). Gerken (1996) proposes that footed determiners in English are prosodified as internal clitics (7b.), whereas unfooted determiners are prosodified as affixal clitics (7c).

I argue that children learning many (most?) languages may prosodify their earliest grammatical morphemes as internal clitics (7b), yielding the similar results found cross-linguistically. Thus, even though they are suffixed, English learners can represent determiners as internal clitics before they can represent these morphemes as affixal clitics. The same seems to hold for Sesotho, French (cf. Tremblay & Demuth, in press; Demuth & Tremblay, in submission) and probably for early Spanish. By 1;8, Spanish-speakers have already accessed a larger prosodic window, permitting determiners to be prosodified as affixal clitics (7c). Further evidence that this is the case comes from the truncation of *una* ('a' fem.) to *na* at this time (Demuth, 2001).

(8)	Child	Target			
	a. [namáka]	/una:amáka/	'a hammock'	Sofía	1;8
	b. [namóto]	/una móto/	'a motorbike'	Sofía	1;9

Tremblay & Demuth (in press) show that language-learners may not initially posit adult-like prosodic representations for determiners. Given the enormous task of learning how to map between prosodic and syntactic structure, some learners appear to focus early on the level of the Foot and Prosodic Word (and perhaps also the Syllable), shifting their attention to higher levels of structure later in the acquisition process (see Demuth & Fee (1995) and Demuth (2001b) for similar ideas). We suggest that this 'structure building' process may be similar to that of Grimshaw's (2005) notion of 'extended projection' where the syntax only projects as needed (i.e., if an IP will do, don't project to CP). Thus, it may be that children develop fully adult-like prosodic representations only once multisyllabic words are no longer truncated, thereby filling up the lower levels of prosodic structure. At this point determiners will need to be represented at higher levels of structure, necessitating higher levels of projection. There has to date been little research examining individual differences in how functional vs. lexical material is acquired, and interactions between them (though see Demuth (2001) and Lleó (2006) for some discussion of Spanish). This is obviously a fruitful area for further research.

In this section I have suggested that the common denominator underlying the patterns of early determiner acquisition across these four languages is that of restricted prosodic representations. Thus, despite language-specific differences in the level at which determiners are prosodified, learners of these prosodically very different languages all show similar early patterns of determiner production. Some might wonder if there could be alternative explanations of the data. For example, could the findings described above be merely a 'word-length' effect? That is, perhaps more determiners are produced with monosyllables in French and Sesotho than with two syllable words simply because there are more syllables to process and produce. This might work for also for Spanish, but it cannot account for the English findings. Because footed determiners in English must prosodify with the preceding rather than the following word, the utterances in which footed determiners occur (e.g., verb+det+noun) can often be longer than those in which unfooted determiners occur (e.g., det+noun). Further analysis of the English data shows that there is no reliable interaction between the number of words in the sentence and the presence/absence of the determiner (Demuth, McCullough & Adamo, in press). Thus, it appears that word/sentence length (processing factors) alone cannot explain the patterns described above.

In sum, we argue that appealing to processing limitations cannot account for the robust patterns of data found here. A processing approach incorrectly predicts that unfooted determiners would be acquired earlier in English than footed determiners. This is not the case. Thus, we suggest that children begin the acquisition process with fairly flat structures containing Prosodic Words that initially contain a Foot, and then expand these to include unfooted functional items, realized as affixal and free clitics, and even separate Prosodic Words.

4. The prosodic licensing of post-verbal morphology

The findings presented above raise several questions about the licensing of grammatical function items more generally. Is it only unfooted morphemes that tend to be omitted from children's early speech? Or are the prosodic constraints on morpheme production more wide-spread? Recent results

from two studies indicate that prosodic constraints of a different sort, at the level of syllables rather than words, may help explain some of the variable production of English verb-final tense morphemes.

4.1 Prosodic licensing of English past tense morphemes

Marshall (2004) conducted an experimental study with G-SLI subjects, examining their production of English past tense morpheme *-d*. She found an increased tendency to omit the past tense morpheme with increasing syllable structure complexity. Thus, subjects were much more likely to preserve the past tense morpheme in a word like *sewed* than in a word like *biked*, and least likely to preserve the past tense morpheme in a word like *danced*. That is, the more complex the syllable structure (or final consonant cluster), the less likely the past tense morpheme was to be produced. Although normal controls did not show this same effect, it raises the possibility that younger children with normally developing language might. It also raises the possibility that similar phonotactic constraints might be responsible for some of the variable production of 3rd person singular *-s*.

4.2 Prosodic licensing of English 3rd person singular morphemes

Song & Demuth (2005) examined the longitudinal spontaneous production of 3 children. It was predicted that the 3rd person singular morpheme would be more likely to be produced in verbs ending in a simple coda consonant, such as *sees*, than in a verb where the morpheme formed a consonant cluster, such as *likes*. Although one slow learner showed no such effect (possibly due to sparse data issues), the other two showed a significantly greater tendency to produce the 3rd person singular morpheme *-s* in the phonotactically simple contexts. Again, this suggests that at least some of the variability in the production of 3rd person singular *-s* may be due to prosodic rather than syntactic factors.

Further research will be needed to examine the full range of prosodic factors that may adversely affect the production of tense morphemes. However, these findings point to the possibility that other grammatical function morphemes may also be subject to prosodic constraints, either at the level of the syllable or word. If this is the case, this must be factored into our theories of grammatical competence.

5. Conclusion

In this paper I reviewed several studies showing that early grammatical morphemes are prosodically licensed, appearing first in unmarked prosodic contexts. I have also shown that this is due to constraints on prosodic (i.e., linguistic) representations, rather than processing (non-linguistic) limitations. The prosodic constraints affecting determiners hold until around 2;3-2;6 years, accounting for much of the earlier variability in the production of this function item. Preliminary evidence also suggests that prosodic constraints at the level of the syllable may account for some of the variable appearance of tense/agreement morphemes in English, and that this may last for some time in language delayed populations (cf. Marshall 2004, Song & Demuth, 2005). Further study will be needed to determine if and how prosodic constraints can account for the variable appearance of other grammatical function items, and if so, how long these last.

These findings suggest that issues from the field of prosodic morphology (cf. Kager, van der Hulst, & Zonneveld, 1999) and the phonology-syntax interface (e.g., Selkirk, 1984) need to be more seriously incorporated into the study of language acquisition. First, we need to revise the way we evaluate children's knowledge of language, using prosodically unmarked contexts as the benchmark for determining children's knowledge of syntax. Second, we need to incorporate these insights into experimental design, eliciting child productions in phonologically unmarked, prosodically licensed contexts. Finally, we need to create an atmosphere that increases interactions between syntacticians and phonologists interested in acquisition. Morphology has always been an orphan in linguistics – being co-opted by syntacticians in the field of acquisition in part because phonologists were focused on lower-level segmental issues. The time is now right for a collaborative shift, bringing phonologists and syntacticians together to more effectively understand how grammatical function morphemes are acquired. The Prosodic Licensing Hypothesis provides a framework for making testable predictions about the contexts where function items are most likely to appear. With this probabilistic, phonological

approach to the acquisition of function items we should better be able to understand the nature of children's early syntactic competence.

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