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Language Acquisition

Author(s): Ann M. Peters

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Language Typology and the Segmentation Problem
in Early Child Language Acquisition

Ann M. Peters
University of Hawaii

A universal early task for children learning any language is to pick out recurring sequences of sounds from the surrounding language which are predictably associated with some meaning. In a perceptual sense, at least, such recurring sequences will be a child's first "words". These sequences may or may not, however, coincide with the "words" of either the adult speaker's intuitions or the linguist's analysis. Thus, they may be too long, as when a child perceives whole phrases as unsegmented units, e.g. all gone, or what's that, or even open the door (Peters, 1977). Or, they may be too short, as we might infer when the first words of a child learning an inflected language turn out to be uninflected stems. I will call this task of isolating the first perceptual "words" of a language "the initial segmentation problem".

The growing literature on individual differences in language acquisition suggests that not all children solve the initial segmentation problem in the same way. Some of the factors which may affect how a particular child goes about solving this problem include (1) individual differences in cognitive abilities and style, (2) the kind of speech she regularly hears, and (3) certain phonological and morphological properties of the language she happens to be learning. This paper is about the third class of factors, but to provide some needed perspective I will comment briefly about the first two. It should be borne in mind that considering these factors in isolation from each other is only a heuristic device to allow us to focus on them one at a time. In reality, no one factor operates alone, rather they interact with each other in complex ways.

The increasingly large number of studies of the acquisition of a single language, English, has turned up a clear range of differences in learning strategies and cognitive style among the children studied. These differences seem to fall along a continuum, the endpoints of which have variously been characterized as Expressive vs. Referential (Nelson 1973), Gestalt vs. Analytic (Peters 1977), or Noun leavers vs. Noun lovers (Horgan 1980). One characteristic of those children on the Expressive/Gestalt/Leaver end of the continuum seems to be a propensity to include whole unanalyzed phrases among the first "words" produced. Referential/Analytic/Lover children, on the other hand, seem to stick to smaller early "words" which correspond more closely to single adult words. Since all of these children were learning the same language, English, it can not be varying properties of the particular language being

learned (factor 3) that caused these differences. There may have been some influence from the kinds of caretaker speech the children heard (factor 2), but there also seems to be evidence that some of these differences in strategy were due to individual differences in cognitive style. (See especially Horgan 1980 for a good review.)

Since 1970 the number of studies of the kind of speech (now generally referred to as "caretaker speech") regularly addressed to young language learners has grown tremendously (e.g. Snow & Ferguson 1977). Although many of these studies have been of English, several recent studies have looked at caretaker speech in other languages and cultures (esp. Schieffelin 1979, Ochs 1980a). Certain attributes of caretaker speech may facilitate or hinder the child in finding solutions to the segmentation problem which coincide with word boundaries of the adult language. Thus it is probably the case that the tendency to produce modified repetitions of utterances (including reductions and expansions) gives the child very useful data for performing segmentation as well as morphological analysis. Similarly, the kinds of predictably recurring interactive verbal routines described by Ninio & Bruner (1978: What's that? That's an X), Sachs & Truswell (1978: Where's your nose/toes/...?), and Thomas (1980: What color is that? Red/blue/...) seem to encourage not only segmentation of the novel items in the routines, but the child's participation in the routines, i.e. not only perception but production. The verbal support routines that have so far been identified in caretaker speech for English learners seem particularly to support segmentation of and learning of labels, especially nouns, although there are also routines for learning longer chunks of speech via routines such as Peekaboo and Pattycake as well as nursery rhymes. Schieffelin's study of the Kaluli in New Guinea, however, found none of this support for segmentation of labels. Caretaker support in this culture was focused on language to be used in everyday interactions, especially with third parties (i.e. other than mother and baby). The question of early segmentation is not explicitly addressed in Schieffelin's dissertation, so the question remains open as to how exposure to and encouragement of repetition of sentences appropriate to normal everyday interactions affects success in segmentation.

Before discussing the typological factors affecting the child's success at segmentation I need to acknowledge two methodological points that have an effect on whether we can legitimately discuss the problem at all. One has to do with how, or whether, we can infer how the child perceives language. The chief evidence for how children do this comes from their own linguistic productions. Especially at the very earliest stages of first language learning, a child's perception abilities may be very different from her production abilities. Thus, while production may be heavily constrained by poor articulatory control, and thus limited, e.g. to a single CV syllable at a

time, perception may not be so constrained. Since we have very little evidence on what kinds of perception constraints may exist, and since some children do seem to perceive and produce long chunks of adult speech as units even at the earliest stages (Peters 1980), for the purposes of this paper I have assumed that it is universally the case that children perceive much more complex units than they can produce. Note also that just because a child has failed to produce a particular word or morpheme or sound, this is not sufficient evidence that she has failed to perceive it. This is a very sticky area in which to make inferences, but we should be willing to keep our minds open to the possibility that although certain linguistic markers may not turn up in a child's productive repertoire she may nevertheless use them perceptually as segmentation aids.

The other methodological point concerns the slippery concept of the "word". In some languages, in particular those which have predictably recurring stress on either the first or last syllable of each lexical unit (e.g. Finnish or Quiché), it is very easy to get agreement, both among native speakers and among linguists as to what constitutes a word. For languages which do not have such word-based predictable stress, however, the concept of word may be very hard to get agreement on, especially in languages which have phenomena such as pervasive cliticization and/or strong phrasal stress. In such languages it seems that those "words" which are lexically defined and those "words" which are phonologically defined (e.g. in terms of stress patterns) do not line up very well. In particular, phonological words seem to slop over the edges of lexical words. In spite of the fact that the term cannot be generally defined for all languages, it is nevertheless a useful concept if used carefully in specific situations. In this paper I use this term in specific ways for each language, without relying on any general theory of the word.

The influence of language typology on early segmentation strategies has not been systematically addressed up to now because so much of the work on language acquisition has been done on a single language, English. And such cross-linguistic work as has been done, in the sense of comparing acquisition across languages, has tended to focus on more developmentally advanced stages rather than the isolation of early words. Now English is a more or less isolating language, having relatively little inflectional morphology (as compared to e.g. Finnish or Turkish), and words that are relatively simple (as compared e.g. to Russian or German or Mohawk). Thus it is not particularly surprising that, in general, the early words that English-learning children have tended to isolate have coincided with adult words pretty well. Of course, there have been a few "phrasal words" such as what's that? and lookit! But on the whole there have been few enough of these that most researchers have felt safe in merely remarking on them and then ignoring them. And there have been many early words where the child's

version is shorter than the adult model, such as (gi)raffe.

If, however, one has become acutely aware of the Expressive/Gestalt strategy among English learners (see Peters 1980), and then starts to look at what early words are like across languages, a number of tantalizing tidbits begin to appear. The challenge, then is to make sense of gleanings such as the following:

1. In Turkish, which is highly agglutinative, early words tend to consist of more than one morpheme, and children show awareness of the word-internal morphemic patterning of words, even before they know explicitly how to fill out the patterns (Slobin & Aksu 1980).

2. In SiSwati, which is also an agglutinating language, early words seem to consist of stems rather than whole adult words. Awareness of the morphological patterning within the word does not show up, productively at least, until later (Kunene 1979).

3. In Hungarian and Finnish, which are both inflecting languages, children are likely to begin with either stems or "amalgams" of stem plus inflection (MacWhinney 1974). There is some evidence to indicate that there may be a strategy difference operating here, in that some children may choose to produce stems while some may choose to produce amalgams (Argoff 1976).

4. In Slavic languages, which are more highly inflected than English, but which have portmanteau type inflections (as opposed to the more nearly one form/one function inflections of Finnish and Hungarian), children's early words seem to be stems rather than amalgams (Radulović 1975).

5. In Hebrew, which has interdigitation of morphemes, children of necessity start with whole words (Berman 1980a).

There is as yet no data on how children go about learning polysynthetic languages.

One way of making sense of these observations is to approach them with the hypothesis that certain phonological and morphological properties of the language that a child is learning will work to either help or hinder her in segmenting out adult words and later in segmentation at the morpheme level. In any case, a detailed awareness of these properties in a particular language should precede any study of acquisition of that language, especially any study of the acquisition of its morphemes. What follows, therefore, is a list of such properties as I have been able to identify. For each I have indicated the effect on segmentation which I suspect it to exert, along with an indication of the kind of evidence which I have found that it actually works that way.

A. Stress

1. Predictable location of word stress with respect to word boundaries may be used as a segmentation clue.

In fact Bolinger 1978 has already remarked that this may be one of the main functions of such predictable stress (483). Certainly, studies of the acquisition of languages which have this property show that children rarely make segmentation errors which cross word boundaries (e.g. Hungarian: MacWhinney 1974; Finnish: Argoff 1976; SiSwati: Kunene 1979; Quiché: Pye 1980). The few exceptions that I have found involve clitic-like particles which do not carry stress of their own, e.g. the definite article in Hungarian (MacWhinney 1974). Note that the fact that English, for example, does not possess this property would imply that it would be harder to segment in an adult-like fashion than e.g. Finnish.

Prediction: The existence of predictable stress will tend to prevent the acquisition of units longer than a word, except in cases where word stress is overridden by phrase stress (see A5).

Prediction: If a language has such predictable stress for almost all words, the few exceptions are likely to be involved in segmentation errors.

2. The existence of characteristic word rhythms may allow the extent of a word to be recognized by its rhythmic envelope.

The pervasiveness of the phenomenon of "filler syllables", where children produce phonologically underdifferentiated syllables which seem to serve the function of filling perceived but not yet analyzed slots in words or phrases, attests to the fact that children are sensitive to such rhythmic envelopes. Filler syllables are mentioned in descriptions of the acquisition of such diverse languages as English (Bloom 1970, Peters 1977), Turkish (Slobin & Aksu 1980), Serbo-Croatian (Radulović 1975), Spanish and Cakchiquel (Tolbert 1978), and SiSwati (Kunene 1979).

Prediction: There will be fewer segmentation errors that involve word boundaries in languages that have such regular rhythms.

3. The existence of clitics which affect stress patterns will make word boundaries harder to find.

Thus, clitics are probably part of what makes segmentation hard in languages such as French and English. Guillaume 1927 cites examples in French of cliticized pronouns which were evidently perceived as parts of verbs beginning with vowels: tu la l'ôtes, moi la l'ai vue, il la l'ouvre. In English some of the most common segmentation errors involve particles that behave like clitics: lookit, wanna, woulda. In Hungarian the definite article (a/az) precedes its noun, does not carry stress, and is joined to its noun by absence of juncture. Although segmentation errors which cross word boundaries are uncommon in Hungarian they do occur with the definite article: az ebed → azebed (MacWhinney 1980, 26-7).

Prediction: A clitic will tend to be perceived as an integral part of the "host" word.

4. Segmentation will be facilitated to the extent that phonological words and lexical words coincide.

This property is related to A3 (clitics). Other causes for such mismatch may include former "words" that have lost their independent status and are now affix-like but not really clitics in that they do not have the same privileges of movement as clitics. In a language with vowel harmony, such near-affixes may still be independent enough not to undergo vowel harmony (Anatole Lyovin, personal communication). (See C2 below.)

5. Segmentation will be facilitated to the extent that word-stress is not altered by phrase stress.

I suspect, but don't currently have the documentation to support, that the over-riding of word stress by phrase stress is another reason that French is hard to segment despite the fact that in citation form French words have the "helpful" property of regular word-final stress (A1). In English, formulaic phrases (such as look at that, my turn, that's mine, which are in fact probably lexicalized by adults as units, Fillmore 1979) tend to be stressed as if they were in fact single words. Thus, it is not surprising that children should acquire many of these phrases as units (see, e.g. Peters 1980, Wong Fillmore 1979, Clark 1977).

Prediction: Phrasal articulation of lexicalized chunks is particularly likely to cause segmentation problems.

6. A property that needs investigating is the relative influence on segmentability of stress-timing vs. syllable-timing.

B. Pitch and Tone

1. The existence of characteristic pitch envelopes (as in pitch-accent systems where there is one pitch peak per word) may act as a segmentation aid.

Thus, the Japanese pitch accent system, where pitch drops can occur only once per accented word (see e.g. Goldsmith 1974) could provide segmentation clues in a way that the purely lexical tones of a language like Mandarin would not. Certainly, children are sensitive to pitch contours: it has long been observed that they acquire the intonation contours of English very early. Some children even seem to adopt a strategy of acquiring the "tunes" of words or phrases before they acquire the segments (Peters 1977). In SiSwati it was observed that the first agreement markers to be acquired by one child were copulative markers characterized by a lowering of the tone of the nominal class prefix. In fact, the first form that these markers took was a segmentally underdifferentiated a-, but it was recognizable by the low tone that it carried. It is thus as

if the child was trying to produce the correct tonal envelope even before she had differentiated the various class prefixes segmentally (Kunene 1979, 256). Not only is this strategy reminiscent of the "tune before the words" strategy found in English, but it can also be argued that the characteristic low tone of the copular construction could have been used as a segmentation marker by the child, even before she started producing it.

C. Phonemics and Morphophonemics

1. The existence of characteristic word-initial or word-final allophones may help in boundary location.

Thus if, e.g. word-initial stops are more tense, or more aspirated than stops in other positions, or if gottal stop occurs only as an onset marker, these features could serve as segmentation clues. Such allophonic variants, however, may be subject to neutralization in rapid speech, with lexicalized formulaic chunks being particularly vulnerable.

2. Word-internal vowel harmony should be an aid to perception of word boundaries, although it will tend to obscure word-internal morpheme boundaries.

The vowel harmony in Hungarian, Finnish, and Turkish undoubtedly contributes to children's success in segmenting these languages at adult word boundaries, although this is not the only property these languages have which helps with segmentation.

Prediction: If there are affixes which do not harmonize they will tend to be perceived as separate words.

Prediction: Conversely, if there are free functors which do harmonize, they will tend to be perceived as parts of the words they occur with. In Turkish, Ekmeci 1979, describes some confluations which involve harmony and which one would predict would be difficult to segment:

e.g. ne 'what' + için 'for' → niçin 'why' (105-6).

3. The existence of "heavy" sandhi (e.g. metathesis, epenthesis, deletion, diphthongization or fusion of vowels) at morpheme boundaries will tend to obscure these boundaries and make segmentation harder.

In particular, phenomena such as French liaison with its epenthetic consonants, are expected to be particularly hard to deal with. Grégoire 1949 describes a 2-year-old boy who makes a number of attempts at saying arbre 'tree' in a single conversation. They include: le beau z-abe, le beau t-arbe, un petit n-arpe, au l'arpe. Clearly the child is having segmentation problems with this word which begins with a vowel, and these problems are aggravated by liaison. In English, rapid articulation (sloppy speech) tends to obscure morpheme

boundaries especially in lexicalized phrases such as that's a girl → attagirl or all gone → ahgone.

Prediction: Languages which are "purely agglutinative", i.e. with no sandhi at morpheme boundaries, will be easy to segment. To date this is supported by evidence from Turkish (Ekmeci 1979, Slobin & Aksu 1980) and SiSwati (Kunene 1979) where children have minimal difficulty finding morpheme boundaries.

4. The existence of any resyllabification processes which cross word or morpheme boundaries will tend to obscure such boundaries.

In his study of the acquisition of Quiché, Pye 1980 found such resyllabification hindering accurate segmentation. Thus, when a morpheme of the shape VC precedes a vowel stem, VC'VC, it resyllabifies as follows (' = stress):

C + VC + VC'VC → CV-CV-C'VC
k + aw + il'oh → ka-wi-l'oh 'you see it'

and the child first produces wil'oh, splitting the morpheme aw in the middle (88).

Prediction: Infixing, which radically alters the syllable pattern of a stem, can be expected to cause difficulty with morphological segmentation. This difficulty, however, will manifest itself in the form of perception of morphologically complex structures as units, rather than in the form of assigning morpheme boundaries in the wrong places.

Prediction: The existence of any kind of "bottom up" rhythmic restructuring of a sentence or phrase along purely syllabic or metric lines will tend to obscure lexical boundaries. For instance, the existence of the kind of "accent measure" that Schütz has documented for Fijian may have such an obscuring effect, at least at first. In the following Fijian example the lexical units are shown on the left while the metrical units are shown on the right:

- (1) sa: toka → sa:.toka 'she resided'
 (2) sa: totoka → sato.toka 'she is beautiful'

In example (1) the metrical units coincide with the lexical boundaries, but in example (2) they do not. (Schütz 1976)

D. Morpheme and Word Structure Properties

1. The existence of distinctive canonical shapes for words and morphemes, especially when coupled with distinctive stress or pitch patterns, should make boundaries easy to find.

It is not clear whether few (vs. many) canonical shapes makes segmentation easier or harder. Thus it has been pointed out to me that although English has a very high number of

canonical shapes, those for the beginnings of words may be sufficiently distinct from those for the ends of words that segmentation is facilitated. It has also been pointed out to me that the fact that Hawaiian has relatively few canonical shapes may make segmentation of this language harder (Irwin Howard, personal communication). On the other hand, the distinctive penultimate stress of Hawaiian, coupled with simple canonical shapes, may make segmentation easier. (Unless it has metrical restructuring like Fijian.) It is clear that careful perception studies are needed. It is also clear that these properties do not work in isolation, but interact in complex ways.

Prediction: Words which have rare or exceptional canonical shapes (within a particular language) are more likely to be involved in segmentation errors. An example of this can be seen in SiSwati where nouns consist of class prefix + stem and the most common shape is CV + CVCV. Nouns of the form CV + CV may be perceived instead as \emptyset + CVCV, as evidenced by the addition of a "superfluous" prefix. Thus, one child produced li-lutshi 'straw', evidently having perceived lu-tshi as \emptyset -lutshi and added the prefix li- (Kunene 1979, 71).

Also from SiSwati comes another example at the morpheme level. The nominal class prefixes are generally of the shape CV, with only two exceptions, in- and tin-. The child studied by Kunene seems to have perceived these according to the (C)V-canonical pattern, i.e. as i- and ti-, and to have considered the nasal to be a part of the stem. (Evidence for this is inferred from the child's choice of corresponding plural or singular classifier.) (Kunene 1979, 213-216.)

MacWhinney has suggested that in Hungarian segmentation, a line of last resort (when no well-known root is recognized) may be to "attempt to preserve simple phonological structures such as CV structure" and he gives the example of the name Szlávik Attila which was segmented as Szlávi Katijja [Katilla] (1974, 342-343). Such a strategy could also explain Hungarian children's common missegmentation of the variant of the definite article which occurs before words beginning with vowels, viz. az + V... is perceived as a + zV..., as in

az ebéd → a zebéd (339-343).

2. If stems and affixes have distinct canonical shapes, word-internal segmentation will be easier for the child to figure out.

This is true for Turkish and SiSwati, although it is not the only helpful property these languages possess. In any case, children seem to have little segmentation difficulty in these languages.

3. It will be easier to locate the boundaries of morphemes which consist of integral numbers of complete syllables than of those which consist of only parts of syllables.

This property characterizes Turkish and SiSwati, which indeed seem to be easier to segment than languages like English and French which have morphemes that consist only of single consonants.

In his summary of findings concerning the acquisition of the inflectional morphemes of Quiché Pye 1980 (87) proposes a four-level saliency hierarchy, whereby those morphemes which rank high will be easier for the child to acquire than low-ranking morphemes, viz. (1): the morpheme is entirely included in a stressed syllable: r-'il; (2): the morpheme consists of a whole syllable but it is not stressed; (3) the morpheme is occasionally split over a syllable boundary; (4) the morpheme is always split over a syllable boundary (as in the example in C4 above). Note again that in actuality these properties do not operate in isolation to affect segmentation: Pye's saliency hierarchy involves not only the attribute of syllabicity, but the interaction of syllabicity with stress.

4. Morphological agreement phenomena which produce alliterative or rhyming concord may provide clues for segmentation.

In Bantu languages agreement is very regular in that it (almost) never crosses classes and it is thus consistently alliterative. Such predictably recurring alliteration could serve as a useful segmentation clue. Note that just because a child fails to produce these concords right away is not sufficient grounds for inferring that the child does not use them as (perceptual) segmentation clues. As to rhyming concord, for it to be useful as a segmentation marker it would have to be predictable enough to be a reliable clue. Thus in inflectional systems like those in many of the Indo-European languages, due to the existence of several inflectional classes which can mix and match, agreement does not result in rhyme predictable enough to serve as a segmentation aid.

5. Interdigitation of morphemes will preclude segmentation until enough interdigitated chunks have been acquired that the pattern can be extracted.

In Hebrew it has been observed that the inflection patterns of the language (where the inflections are suffixes or affixes) are acquired earlier than the productive interdigitation patterns (Berman 1980a, 1980b).

6. Portmanteau or fused morphemes (where an unsegmentable (sequence of) phoneme(s) carries multiple semantic functions) may be particularly confusing to deal with. On the other hand, the one morpheme-one meaning situation will be much easier for the learner to handle.

Here we can contrast the ease of acquisition of the inflectional systems of Russian and Turkish, where the former is reported to take up to age 8 to acquire (Slobin 1966, 140-1) whereas the latter seems to be acquired by age 2 (Slobin & Aksu

1980). The difficulty with the Russian inflectional system does not seem to be so much one of segmentability (since Slobin reports that "the Russian child has no apparent difficulty in discovering morpheme boundaries" 1966, 137). It is rather caused by homonymy and lack of one-to-one correspondence between inflectional forms and their functions. It would be nice to be able to contrast the situation in these two languages with what happens in the acquisition of languages like Eskimo.

7. Affixes which are obligatorily and regularly attached, to pro-forms as well as substantives, will be more easily perceived as segmentable than irregularly or variably applied affixes (see Slobin 1980, 19).

Thus the Kaluli ergative marker is a suffix which can have two forms, -e or -me, and is applied only under certain conditions, whereas in Samoan the ergative marker is regularly proposed to pro-forms as well as to full forms (Ochs 1980b). One might predict from this that the ergative marker would be acquired earlier in Samoan than in Kaluli. This is another case, however, in which various factors interact. It turns out that in Samoan caretaker speech the ergative rarely occurs, so a potential test case melts away.

This last serves to emphasize the fact that none of the properties proposed above operate in isolation. Rather, they interact in complex ways. The only advantage of listing them one by one is to focus our attention on them one at a time. The next step should be to try to look at their interactions.

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