Word Accent

1. The basic phenomenon

Consider the English word *hippopotamus*. Almost every speaker of English will pronounce the medial syllable of this word with more 'articulatory force' than all other syllables. It is common to refer to this syllable as being *stressed*, or carrying *stress*. Dictionaries often signal the location of word stress using a dash or 'accent mark' (hippo'potamus) before the stressed syllable, or sometimes they use capitalization (hippoPOtamus). Phonetically, 'articulatory force' involves a number of properties which the stressed syllable has to a greater degree relative to the unstressed syllables. For example, the stressed syllable is more precisely articulated, longer, louder and often higher pitched. Duration, loudness and pitch are all properties that all syllables have to some degree, but the stressed syllable has all of these to the greatest degree. In addition, its consonants and vowel may have special allophonic properties such as aspiration or 'full quality' (as opposed to being reduced). All these phenomena can be observed in our example which might be transcribed phonetically as follows: [hɪpəpʰɑɾəməs]. The /p/ of the medial syllable is aspirated unlike the /p/ of the second syllable. The second, fourth and fifth vowel is [ə], the schwa, a vowel that never occurs in a stressed syllable, where we always find the full vowel quality; the occurrence of the vowel [ɪ] in the first syllable will be discussed below. Besides phonetic and allophonic cues, stress also has phonotactic cues in that stressed syllables often allow more phoneme combinations (like more complex onset clusters, or more complex nuclei).

2. From stress to accent; cues for accent

While many languages display the phenomenon of word stress (the percentage of languages is not known) as just described, many other languages display a quite similar phenomenon in that a particular syllable in the word is singled out, the difference being that the cues for its special status are not the same phonetic, allophonic and phonotactic cues that we find in English. In one specific case, that is often mentioned, the syllable that stands out is mainly or perhaps exclusively associated with a high(er) pitch. The typical example is (Tokyo) Japanese in which words have pitch patterns that involve a high pitch on what is called the *accented* syllable (in addition, there is leftward spreading of this high pitch); McCawley (1968), Haraguchi (1977). Hyman (1977) referred to such systems as *pitch-accent systems*, while proposing to use the term *stress-accent systems* for cases like English. In this terminological proposal, the term 'accent' refers to the property of 'standing out', while the terms 'stress' and 'pitch' refer to the phonetic cues that signal the location of the accented syllable. It is conceivable that a fine-grained typology of cues for word accent will reveal many more types such as duration-accent systems (in which duration is the primary or only cue). It would seem that in such a typology, the term 'stress' refers to a rather heterogeneous collection of phonetic, allophonic and phonotactic properties. It may be that such a collection of properties represents a true type, but it may also be that, on closer investigation so-called pitch-

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accent languages may also involves additional allophonic and phonotactic cues. In short, accent may be signaled in terms of many combinations of cues of various sorts. The cross-linguistic array of accentual cues is at present far from understood and much detailed phonetic and phonological analysis is needed in this respect; cf. Dogil and Williams (1999). The important point here is that is seems useful to separate the notion accent (a formal property of syllables without any link to specific cues) and accentual cue(s). In this article, the main attention will be on the notion accent. Before embarking on a formal characterization of this notion, it must be pointed out that it is by no means necessary (given the above) that accents manifest themselves by cues in all cases. Of course, a discussion of accent in a language that apparently lacks any cue is pointless, but we must reckon with situations in which accents manifest their presence in specific circumstances or in specific ways in a language. As already indicated, in the absence of phonetic cues such as extra duration, loudness, etc., allophonic or phonological phenomena may designate a syllable as being accented. Also, it could be that in languages that have lexical tones (so-called lexical tone languages which are often placed in opposition to accentual languages), distributional restrictions on tonal patterns may be accountable in terms of a distinction between accented and unaccented syllables. It has, in fact, been recognized that it is sometimes difficult to draw the line between tone languages with certain distributional restrictions and pitch-accent languages, the term tonal accent language being put forward as a label for the intermediate categories (cf. van der Hulst 1999a, section 1.5).

3. Functions of word accent

3.1. Intonation

Turning back to English, let us note a so far ignored cue for word accent. Consider the example *hippopotamus* in the following sentence:

```
      H                          H
      |                          |
I have always wanted to be a hippopotamus
```

The 'H' symbols represent some of the units that make up the so-called *intonational melody*; in a full account other tones will be specified (cf. *Article*). In English, speakers can draw the listener's attention to specific parts of the utterance (among other means) by associating high tones to certain words. The point here is to see (or hear) that these tones associated to specific syllables in those words, namely the accented syllables. Thus, we see that intonational tones can be cues of word accent in the sense that these tones tell us which syllables in word that carry them are accented. If we place the word *hippopotamus* in a sentence in which the speaker does not draw attention to it (because it has already been mentioned before), the H tone no longer signals the accent which is now only cued by the other properties (in fact, it may be that pitch is not significantly among those, the claim that pitch is a relevant cue mainly being based on cases in which words carry an intonational tone). Intonational tones have been called 'pitch accents' which can lead to

some confusion with the notion pitch accent that was used above with reference to pitch-accent systems (such as Japanese). The point is that word accent can be signaled by non-intonational pitch property at the word level, as in a pitch accent language, or, as in English, by an intonational pitch property. In both cases we deal with a pitch property that associates to an accented syllable, at the lexical level (Japanese) and post-lexical level (English), respectively.

The role that accents play in the anchoring of intonational tones can be understood both as providing a cue for word accent, but also as a function of word accents, given that a system must be in place for anchoring the intonational units to the 'text'. Conceivably other anchoring systems could be, and probably have been adopted, for example those in which intonational units consistently associated to the first or last syllable in phrases, irrespective of the location of word accents.

3.2. Demarcation

It has also often been suggested that word accents function as parsing cues, the idea being that listeners can use knowledge of accent location to cut up sentences into words. This has been called the *demarcative function* of word accent. If the location of accent is consistently on the first syllable, listeners know that every accent marks the beginning of a new word. From this perspective, it is expected that word accents always occur on word edges, i.e. on the first or last syllable. But this is not the case. As we will see below, word accents can occur on non-edge syllables, either consistently (in which case their location can still be a useful cue for finding word edges by making the relevant computations), or non-consistently (for example, when syllable weight plays a role; cf. below). We will learn that some of the non-consistent cases can no longer be said to have a demarcative function.

3.3. Rhythm

Speech depends on sequential motoric behavior involving repetitions of units such as syllables, words and phrases. It seems to be so that human bodies (and human minds) function best when sequential motoric behavior is carried out 'rhythmically', i.e. in terms of alternating 'stronger' and 'weaker' actions that are spaced out fairly regularly. Thus sequences of syllables might display a strong-weak pattern. Let the string in (1) be a sequence of words (delimited by square brackets) in which the sigma symbols represent syllables. At level 1, each word has been rhythmically organized into strong (indicated by 'x') and weak syllables. With several level 1 x-marks being present in longer words, we expect to find a further rhythmic grouping *within* words of strong syllables (level 2). (To keep the structure consistent, we will also assign a level 2 x-mark in shorter words that have only one level 1 x-mark. Each word now has a perfect rhythmic structure. Note that the specific form of this rhythmic structure might be different depending on how in particular we distribute the level 1 marks, i.e. whether we start on the left or right side of the word, or whether we start on the syllable at the (left or right) edge or first skip one

syllable. Below we will see that such choices are real in that languages may display different types of rhythm.

Now we encounter a sequence of words forming phrases (indicated by '(...)'). To be in rhythmic alternation, words must have a designated syllable that functions as the anchor of strong beats within the phrasal domain. Let us say that this is the rightmost strong syllable in the word at level 2, but this could again be different in that we could have picked the first strong syllable at this level. Having now created level 3 (the so called 'primary *word accent*'), we are in a position to assign a rhythmic structure to the sequence of words that form a phrase. Let us say that each last word, and every other preceding word, in the phrase must be rhythmically strong; this gives us level 4. Finally we may rhythmically group the phrases that form the sentence (indicated by '{...}') and for this it is necessary that poly-word phrases have a potential anchor point for rhythmic beats. Let us say that in our hypothetical example this is always the last word in the phrase (level 5, 'the *phrasal accent*'). At level 6 we represent the rhythmic alternation of phrases (ignoring a potential cyclical procedure enforced by any subgrouping of phrases within the sentence, or, for that matter the question of whether the sentence as a whole has a strongest beat, the so-called *sentence accent*, which would then be level 7):

(1)

```
6                       x                                                   x
5                       x                           x                       x
4                       x                           x   x                   x
3           x           x             x             x   x       x           x
2   x       x   x       x     x       x   x         x   x       x           x
1   x   x   x   x   x   x     x   x   x   x   x   x     x   x   x   x   x
  {([σ σ σ σ σ σ] [σ σ σ σ σ]) ([σ σ σ σ σ] [σ σ σ σ σ σ]) ([σ σ] [σ σ σ] [σ σ σ])}
   Apalachicola     etc.
```

It should be clear that the x marks at level 3 and 5 are necessary in order to allow a rhythmic grouping of words and phrases. These x's represent word accents and phrase accents, respectively. It can now be said that the function of such accents is to allow rhythmic organization of words and phrases. Accents would not be necessary if the rhythmic grouping of sentences would ignore such units as words and phrases and simple rhythmically organize the sentence as a string of syllables. We will see below that *rhythmic adjustments* do occur that result from the fact that the rhythmic structure of a whole phrase or sentence may be non-ideal in that non-alternating patterns easily emerge when words and phrases are concatenated. For example, given that in our example each initial syllable is rhythmically strong at the word level, a clash results at the juncture of the second and third word because two adjacent syllables (the last and the first of each word, respectively) are both rhythmically strong.

4. Primary and secondary accent

In section 3.3, reference has been made to rhythmic structure at the word level (and also at higher levels). Students of stress (or, more properly: of accent), have long noticed that the syllables that constitute words exhibit prominence patterns that involve more than just a primary accented syllable in a 'wordscape' of unaccentedness. In the word *hippopotamus*, for example, the first syllable is noticeable stronger than the second. Indeed, in English at least, the first syllable of words is typically 'strong' when the second syllable does not carry the primary accent. This initial strength has been called *secondary accent* (or, often secondary stress). In words that are long enough, one can even encounter more than one non-primary accent as in *Apalachicola*, which has a strong syllable in first, third and fifth position. The latter forms the primary accent. Among the first and third syllable linguists notice a strength difference such that the first syllable is stronger than the third. The third syllable apparently carries a *tertiary accent*. Recognizing all accents is relevant in that, at least in English, the occurrence of the schwa-vowel is directly determined by accent: full vowels can only occur in syllables that bear some degree of accent. Intervening unaccented syllables can only contain the vowel *schwa* (or sometimes somewhat 'colored' *reduced vowels* such as [i] or [o] (as in *happy* and *widow*). Non-primary accents may also display other cues such as the ones we mentioned for primary accent such as extra duration, aspiration or certain phonotactic complexities. A complete theory of word accentuation, then, must reckon with all accents at the word level.

5. Phonological constituent structure

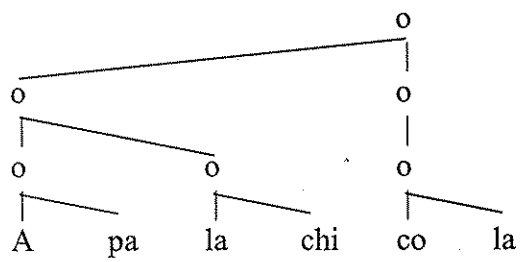
The structure in (1) with columns of x's that are assigned relative to increasingly larger domains (word, phrases), conveniently displays rhythmic structure with relative degrees of prominence as well as word and phrasal accents. Structures of this sort have been called *metrical grids*. The term 'metrical' originates from an idea (found in Liberman 1975, Liberman and Prince 1977) that the rhythmic organization of words and phrases is reminiscent (if not formally identical) to the rhythmic organization of verse lines which is traditionally called (poetic) *meter*. In fact, the authors just mentioned regard metrical grids as one of two structures that are needed to represent the prosodic or suprasegmental organization of words and sentences, the second structure being the *metrical tree*. We will see in a moment that the metrical tree, as traditionally understood *incorporates* a grid structure so that, in the end, only one structure is needed.

Trees primarily express the notion of constituency or grouping. Terminal elements are grouped into constituents and these constituents are then grouped into successively larger groupings. In linguistics, the left-right order of symbols (imposed by the two-dimensional graphic display) is usually interpreted as expressing the left-right order of the linguistic units that they stand for. A third piece of information can be expressed by trees, namely the fact that in each grouping one element has a special status; this element is called the *head*, the other element(s) being called dependent(s). Metrical phonology (or, as it is often called, prosodic phonology) offers a theory of phonological grouping that incorporates the idea of headedness. The specific structures that are

advanced exhibit mostly binary branching nodes as well as *strict layering* (rather than recursion) of constituent types (such as syllables, feet, prosodic words, etc.). The idea of headedness in phonological grouping has also been the cornerstone of Dependency Phonology (see *Dependency Phonology*) and its relevance to stress has also been proposed by (Rischel) (1972).

Within the domain of words, phonological grouping starts with segments which form syllables (and possibly subsyllabic units such as onsets and rhyme and/or moras, see Article). The novelty of metrical theory and Dependency Phonology lies in the proposal that the grouping of syllables into headed, binary constituents (called *feet*), can be used to express rhythmic alternation in the sequence of syllables. A further grouping of feet can then we used to express word accent:

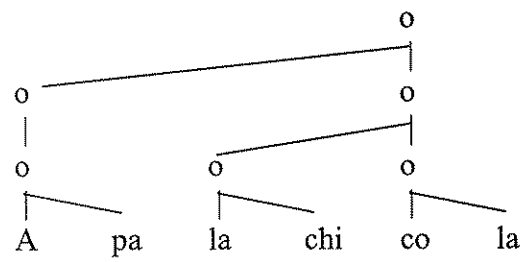
(2)



The notation adopted here is the one proposed in Dependency Phonology. We also find it in Hammond (1984) within the metrical model. Each unit that is a head is dominated by a vertical line and a small circle. Metrical phonology originally used the labels 'S' for head and 'W' for dependent. It is obvious that the little circles if taken in isolation represent the exact same structure as the grid structure in (1) (cf. Ewen 1986).

The organization of feet into words has been subject to some debate. In (2), the first two feet form a 'superfoot' (or *cola*). This structure clearly expresses that the first syllable is more prominent than the third. An alternative would be to group feet into uniformly branching trees only:

(3)



Independent of this issue, others have proposed to disregard the level in between the foot and the word. Halle and Vergnaud (1987), who adopt a bracketing notation for tree structure adopt this view (using the grid-like x symbols to represent headedness):

(4)

(				x	)	word level
(x	)	(x	)	(x	)	foot level
A	pa	la	chi	co	la	

This bracketing approach has been further developed in Idsardi (1992, to appear) with an interesting twist. Idsardi suggests that structure can be built up by rules that insert isolated left or right brackets (forming what one might call *open constituents*). Apart from providing highly economical algorithms, it might be that such open constituents are useful devices in cases where we deal with metrical incorporation (of 'stray syllables' or clitics; cf. 7.5). Pushed further, Idsardi's approach might lead to a theory in which the symbols (the brackets) function more like boundary symbols than graphic devices for tree structures (cf. van der Hulst, to appear).

The claim that phonological constituents are headed provides a formal reconstruction for the notion accent: being accented can now be understood as being a head. In that sense, it may be that the 'function of accent' is identical to the function of heads, which is perhaps a purely cognitive function, i.e. a necessary property of mental representations of a certain type. If such a view can be defended, it follows that all languages must necessarily be accentual, even those that lack accentual cues. Accentual cues would exist as parasitic (and potentially useful) devices to a structure that exist for independent, cognitive reasons.

6. A parametric theory of accent

If the accentual pattern of the word *Apalachicola* is anywhere near representative of accentual word patterns of English words, we might conclude that the following two statements characterize English word accent:

(5) The feet are left-headed (i.e. trochaic)
The word is right-headed (the rightmost foot is the head foot)

Together these two statements characterize a penultimate (paroxytone) accent on the assumption that syllables are grouped into feet from right-to-left, i.e. starting at the end of the word. That direction of footing matters becomes evident when we consider a word with an odd number of syllables:

(6)

Winnepesaukee

To achieve penultimate accent a left-headed foot must span the two rightmost syllables, a result that would not be obtained if grouping from proceed from left-to-right:

(7)

Winnepesaukee

Unfortunately, for English, we cannot always assume that feet are formed throughout the word from right to left. A consistent application of this procedure would yield:

(8)
| | \ | \
Winnepesaukee

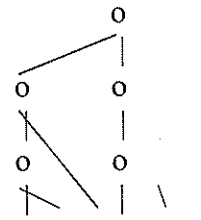
But the second syllable of this word bears no accent, witnessed by its schwa-vowel. Here we find a first indication that generalizations concerning primary accent and non-primary accent may not be not expressable straightforwardly in a single set of statements. It would seem that something like (9) is required:

(9) Form one right-headed foot at the right-edge
Form a right-headed foot from left to right *avoiding clash*
The word is right-headed

(10)
| \ | \
Winnepesaukee

The medial syllable that so far remains unfooted could now be incorporated by convention into the first foot, forming a (derived) ternary foot, assuming that metrification must be exhaustive:

(11)



Winnepesaukee

Below, we will see that a full statement of English word accent requires additional statements (bearing on the role of syllable weight). However, (5) would do quite well for almost all words in Polish where weight effects are missing. Let us now investigate how other types of word accent can be accounted for.

Languages display a rich variety of accentual types and although many matters are still unclear or unsettled, accent typology forms a quite well-developed and highly interesting area of phonology. Many questions that remain involve the character and formal representation of non-primary accents. Here, let us focus first on primary accent locations. In many languages, primary accent locations are fixed on a specific syllable for the vocabulary as a whole (barring exceptions that may always occur):

(12) Initial accent: Icelandic, Hungarian
Second syllable accent: Dakota
Third syllable accent: ?
Antepenultimate accent: Macedonian

Penultimate accent: Polish
Final accent: Turkish

A rich source of information about these and many other accentual systems, containing references and many detailed analyses, remains Hayes (1995). It would seem that five locations occur, third syllable accent being attested in one questionable case (Winnebago). But there are significant frequency differences in as far as we can tell from the present databases:

(13) [σ σ … σ σ σ]

Penultimate and initial location are favored over final location, second syllable and antepenultimate accent being rare (cf. Hyman 1977). It is easy to see how initial accent can be derived. We simply form a left-headed foot at the left-edge of the word and make sure that the word is left-headed. But how do we derive second syllable and final accent? Vergnaud and Halle (1978) and Hayes (1980) proposed that such systems involve right-headed (or iambic) feet. Clearly, a right-headed initial foot delivers second syllable accent, while a right-headed final foot delivers final accent (provided that in both cases these feet are heads of the word). We now have the rudiments of a parametric theory of word accent:

(14) *Accentual parameters (for primary accent)*
Foot type: left-headed/right-headed
Edge: left/right
Word type: left-headed/right-headed

In fact, the parameter Edge and Word type could be considered one and the same if we simply assume, as suggested above, that separate statements are made about primary and non-primary accents and that, by convention, primary accent feet are heads of words. Thus for English, we might then state:

(15)

Primary accent	*Non-primary accent*
Foot type: left-headed	Foot-type: left-headed
Edge: right	Edge: left

In this view, as a matter of convention, foot formation for primary accent is non-iterative, while foot formation for non-primary accent (i.e. rhythm) is iterative. It remains to be seen whether, perhaps, the foot type for rhythm is always identical to the foot type for primary accent, or, alternatively whether the foot type for rhythm is universally trochaic.

Standard metrical theory did not adopt the idea of separating primary and non-primary accent. This model adopted a procedure which would first construct a layer of feet across the whole word, while then 'promoting' a left or right peripheral foot to head status of the word. Under this approach, differences between generalizations concerning primary and non-primary accent would necessitate the formulation of adjustment rules of various kinds. The idea to separate primary and non-primary accent was suggested in van der Hulst (1984) and developed in subsequent work (van der Hulst 1996, 1997, 1999a,b, to appear). Others (within metrical or other frameworks) have made similar suggestions

(Roca 1986, Hurch 1992, Harms 1981). In an approach that separates both phenomena, it must be stated that primary accents are not only more prominent than secondary accents, but also that they literally take precedence over secondary accents in that the latter fill out the accentual space that is left open by the primary accent foot, while paying respect to the primary accent location by avoiding clash. Such 'top-down' effects are inexpressible in a procedural bottom-up standard metrical account which is incompatible with the idea that primary accent is somehow assigned first or somehow takes precedence. In Optimality Theory this fact has been taken as an argument to adopt a non-procedural constraint-based approach which allows constraints bearing on head feet (primary accent) to outrank constraints bearing on dependent feet (non-primary accents). Alternatively, it might be argued that primary accent and non-primary accents are constructed in different planes, or that primary accent assignment and assignment of rhythmic structure are fully complementary (cf. van der Hulst, to appear for this latter approach).

7. Further issues

7.1. Extrametricality

In the preceding discussion, we have ignored the case of Macedonian in which accent regularly falls on the antepenultimate syllable. Little of interest has been said about how to handle such cases. It is apparently the case that the right-most syllable of words can be 'ignored' when metrical structure is constructed. Hence, this syllable is said to be *extrametrical*. This is a parametric option that, apparently, is limited to the right-edge, hence the absence of third syllable accent. An extrametrical syllable can be incorporated into the rightmost foot if metrification of words must be exhaustive. Technically speaking, we could now reconsider penultimate systems as involving extrameticality and iambic feet, but little would be gained by such a move, especially in light of the view that trochaic grouping seems to be the preferred type (witnessed by the preference of initial over second syllable accent, and by the predominance of trochaic patterning of non-primary accents).

7.2. Exceptions

Even in Polish some words may exceptionally have either final or antepenultimate accent. The latter can be accounted for by assuming that extrametricality may be lexically marked in such cases (rather than following from a parametric setting). Final accent also requires a lexical mark. It has been suggested that such cases can be handled by lexically 'specifying' a silent syllable. This has been called *catalexis* in by Paul Kiparsky (cf. Kager 1995 for discussion). Alternatively, the final syllable can be marked as a head, using a diacritic mark. The marking device is preferable if we find that left-edge systems (with fixed initial or second syllable accent) also can have exceptions, such as a second syllable accent in an initial system. If extrameticality is not available as a left-edge device, only marking could do the job. In the reverse case of first syllable accent in a second syllable system only marking could be used even if extrametricality would be

adopted at the left-edge. Below, it is suggested that the head marking option is also preferable for other reasons.

It has been argued that languages can have so much lexical marking that the suggestion that accent is fixed looses its meaning. It has been suggested that such cases should be referred to as *free accent* and it has sometimes been implied that in such systems accent can be anywhere in the word, i.e. in locations other than those in (13). Such claims must be looked at with skepticism. Excluding consideration of so-called unbounded accent systems (cf. section 7.4.), exceptions, even when highly frequent, are restricted by occurring with the left- or right edge two-syllable window (module extrametricality). In Spanish, for example, accents may occur in the final, penultimate or antepenultimate syllable and (excluding the effects of morphology, cf. section 7.5.) lexical marking is required to derive two of these three options (cf. Roca 1999 for a comprehensive account).

It seems furthermore likely that the occurrence of exceptions is also restricted in that exceptions do not seem to occur on the opposite edge of where regular accents occur, or, if the notion 'regular' is not applicable, that accents are located on opposite edges within the same language. To the extent that such mixes occur, we would expect that the languages in question have mixed vocabularies with words that originate from other languages, while maintaining different phonological systems for these lexical strata. In that case, one would have different accentual accounts of the two cases and there would be no exceptions in the true sense of the word.

7.3. Variable weight

We have so far considered cases in which accent is fixed on a specific syllable in all words (barring exceptions and free accent systems). Many languages have accentual systems like that. Many others display the effect of *syllable weight* (cf. Hyman 1984, Goedemans 1996, 1999). Here is an example:

(16) Accent falls on the final syllable if it is closed, otherwise on the penultimate syllable

Even though accent placement is predictable by rule, accent location is not fixed. Rather it varies due to the influence of the content of the syllables within the accentual window. In a system of this type, closed syllables are said to attract accent. The regular foot type is trochaic but there is a constraint that bars closed syllables from being the dependent member in a foot, or stated positively that requires 'heavy syllables' to be heads. In a parametric view, this constraint would be parametrically present or absent in the grammar. If present, the system is called *weight-sensitive.*

It is easy to understand what is going on in weight-sensitive systems. Accent can be understood as 'positional prominence', i.e. as prominence due to position with reference to a word edge. A syllable is assigned head status simply for being in the right position in the word. But syllables are not all equal in terms of their *phonological content.* Arguably, closed syllables have more content. If a language has closed syllables (some do not), and there is an accentual system, a potential conflict arises when a syllable

that is prominent due to content is placed in a position that is positionally non-prominent. This is exactly what happens if a final heavy syllable is left unaccented, while the penultimate syllable (whether heavy or light) is accented. If the weight-constraint is active in a language (or high ranking in an Optimality Theoretic account), final heavy syllables will form the head of a (non-branching) foot, which, as the rightmost foot can then end up as the head foot of the word.

What makes syllables heavy can differ from language to language, or several factors may be at play in a single language. Typical weight factors are syllable closure and vowel length. In some cases, the type of consonant that closes the syllable may be critical such that only closing sonorant consonants make the syllable heavy. Other factors are full vowel quality as opposed to reduced vowel quality, or having a lexical high tone. It may even be the case that vowel height (or vowel sonority) plays a role, with open (more sonorous) vowels attracting accent. Typically, there are just two weight classes (heavy and light), but is has been argued that in systems where segmental sonority is a factor more than two weight classes may be distinguished. In such cases, the weight constraint cannot absolutely bar certain syllable types from dependent position. Rather, a constraint must be postulated which prevents the dependent syllable from being heavier than the head syllable. (The more typical binary weight systems are simply a special case of this more general 'mismatch' constraint).

English word accent is clearly weight-sensitive (in addition to being governed by a substantial number of lexical exceptions); cf. Kager (1989) for a detailed treatment.

Returning now to the phenomenon of lexical exceptions, one might suggest that syllables which must be marked as heads (such as final accented syllables in Polish) display what might be called *diacritic weight*. Thus by using marking (rather than catalexis) a uniform account is possible of certain type of exceptions and accent placement that is sensitive to phonological weight.

7.4. Foot typology

In accordance with the foot parameters in (14) we could have four foot types. Hayes (1980) provides examples for all of them in both directions of footing, thus revealing eight types of languages. Subsequent research has revealed, however, that not all types are widely attested even if we consider the eight possibilities that we just mentioned. Hayes (1995) reports that systems making use of the weight-insensitive iamb and the weight-sensitive trochee are suspiciously rare, or, worse, produce unattested patterns under certain circumstances (i.e. in interaction with other parameter settings). Hayes therefore proposes to eliminate the weight-insensitive iamb and to replace the weight-sensitive trochee by a so-called *moraic trochee*. A moraic trochee is a left-headed foot type that maximally contains two light (i.e. monomoraic) syllables or one heavy (i.e. bimoraic) syllable.

The cases that were represented in earlier works with weight-insensitive iambs and the weight-sensitive trochees were now in need of an alternative analysis. By allowing certain manipulations at the edges of accentual domains (like excluding syllables from the parse by extrametricality) or postulating empty final syllables (catalexis), such alternative could usually be found.

The possibility of making these reanalyses showed that the standard theory was overly rich anyway. The reanalyses of course had to express the same prominence patterns but usually led to different constituent structures when compared to the original analyses. Even though details of foot structure may in principle play a role in the application of segmental phonological rules, such evidence requires access to details of the phonology that were often not studied or reported in grammars or phonological sketches.

The next step was taken by Kager (1993) who extended the bimoraic upper bound of moraic trochees in two ways. Firstly, he proposed that weight-sensitive iambic systems do not require (l h) feet. He suggested reanalyses for the few cases that were originally analyzed with such feet. Secondly, Kager suggested that the bimoraic requirement was also the lower bound, which implies that so-called monomoraic (also 'unary' or 'degenerate') feet were banned. Hayes (1995) accepts Kager ban on monomoraic feet with certain qualifications that I will not be discussed here.

Van de Vijver (1997) and van der Hulst (1999b) question the existence of iambic feet in more radical terms, both arguing for different ways of dealing with "iambic" systems. For extensive discussions of these developments see van der Hulst (1999a,b, 2000).

7.5. Unbounded systems

In all systems discussed so far accent placement results from the formation of a foot at the right or left edge of the word. A different type of system exists in which accent placement is purely driven by syllable weight without foot formation. Four basic types occur:

(17)
a. Last/First: accent to last heavy syllable and, if there is no heavy syllable, the first syllable
b. Last/Last: accent to last heavy syllable and, if there is no heavy syllable, the last syllable
c. First/Last: accent to first heavy syllable and, if there is no heavy syllable, the last syllable
d. First/First: accent to first heavy syllable and, if there is no heavy syllable, the first syllable

Various approaches to such systems, called *unbounded*, can be found. The classical metrical account relies on 'unbounded' weight-sensitive feet. Prince (1985) suggested an account with bounded feet that directly target heavy syllables rather than being assigned proceeding from a word edge. The fact that such systems do not appear to have rhythmic, non-primary accents (although more detailed descriptions are needed), as well as the fact that primary accents can be located anywhere in the word (dependent on where heavy syllables occur) suggest that such systems do not rely on binary feet. Hayes (1995) indeed suggests that these systems are not rhythm-based.

A different procedure is suggested in van der Hulst (1996, 1999a, to appear) where it is argued that the four options in (17), in fact, also occur in bounded systems,

albeit within a two-syllable window (reminiscent of peripheral foot formation). The proper treatment of such systems remains an open issue.

7.6. Relevance of morphological structure

What is the domain of word accentual structure? So far we have assumed that there is a clearly defined notion of 'word' that constitutes this domain. But in some cases it appears that the domain of word accent is smaller than the word *taken as the maximal morphological and minimal syntactic construct*, while in other cases it seems to be bigger. The parts that make up compounds in English clearly form separate domains for word accent. As such, English compounds require separate statements for selection a word accent from the word accents of its members. Word accents that are not thus selected survive in the accentual structure of compounds as non-primary accents. Embedded units of derived words have also been argued to form separate accentual domains, the idea being that the accentual procedure first applies to the most embedded unit and then successively applies to the larger domains that are formed by the addition of affixes. This procedure is called *cyclical assignment* of accent. Again accent of embedded cycles may survive as non-primary accents of the whole word. The facts are less clear and the cyclical account of word accent in derived (non-compound) words (as proposed in Chomsky and Halle 1968) is debatable. Predicted cyclic non-primary accents do not always show up where they are supposed to.

Cases of this sort suggest that the domain of accent, if to be called 'a word' cannot be the morpho-syntactic word. Students of accent and phonological constituent structure have introduced the notion *prosodic word* for this purpose. A prosodic word is thus a grouping of feet that may coincide with substructure of the morphosyntactic word. It appears to be necessary to regard the prosodic words as a recursive unit in those cases where we find multiple affixation (assuming the validity of a cyclic account). It remains an open question whether compounds form prosodic words that themselves consist of prosodic words.

Morphology can also be relevant in unbounded systems. In Russian, where morphemes have unpredictable ('free') accent locations, polymorphemic words need a statement to indicate which accent wins if there is more than one, or to indicate an accent location if no morpheme is lexically accented. The relevant statement is that in (17a) with 'heavy' replaced by 'lexically accented'.

Much is still unknown or unclear concerning the relevance of morphological structure to accent placement, especially in language of the 'polysynthetic' type in which we find words composed of many morphemes; cf. Revithiadou (1998).

In those cases where accent placement has been argued to refer to domains larger than the morpho-syntactic words, we also need to distinguish several types of cases. Much depends on ones treatment of inflection which, if dealt with syntactically, may necessitate application of (special) accentual rules to inflected words. Another issue concerns so-called *clitics* (see *Article*), which understood as separate syntactic units, may lack word accent and incorporate into the metrical structure of a preceding or following word, with possible effect on the accentual structure of the resulting *clitic group* (which some regard as an extended version of the prosodic word); cf. Peperkamp 1997.

A further sense in which word accent may refer, or be dependent on larger domains concerns the phenomenon of *accentual shift* in phrasal combinations. In English, for example, many adjectival words occur with different accentual structures depending on whether they are place before a noun or not. The word *thirteen* is finally accented in isolation or in final positions in phrases, but appear to have initial stress in:

(18) thirteen men

If the final pattern is taken to be basic, a phrasal adjustment is required (often called the *rhythm rule*). In any event, word accent seems dependent on phrasal context. There is a rich literature on this topic (Prince 1993, Selkirk 1984, Giegerich 1986, Visch 1989, Hayes 1994, Gussenhoven 1991).

7.7. Optimality Theory (OT)

The bloom of metrical theory occurred throughout the nineteen-eighties. With the rise of OT in the early nineteen-nineties we see an initial focus on some areas where OT appears to offer an advantage, followed by other work in which all the early generalizations are translated from parametric accounts into accounts based on constraint-ranking, often with no obvious gain or loss. The arena of accentual phenomena seems to display quite a few cases where constraint-ranking is appealing. We already mentioned the interplay between primary and non-primary accent which is problematic for a bottom-up procedural account (although an alternative approach was suggested). In the case of syllable weight, we also seem to see the effect of a conflict between positional prominence and prominence due to content. To say that weight-sensitive languages rank weight-sensitivity over some other constraint that demands 'regular rhythmic grouping' seems appealing, but, of course, an account that appeals to presence or absence of the weight constraint in the grammar works equally well. In fact, it is quite easy to restate all parametric work in terms of ranked constraints since, from a formal point of view, the power of parametric accounts is included with the power of OT-accounts.

Although useful new empirical work has been carried out within the OT area of some specific accentual systems (Hung 1993), in general, there has been much less advancement of our understanding of word accentual typology and accentual representations in the nineteen nineties than in the previous decade. Of course, it is to be expected that OT-analyses with their virtually limitless introduction of new constraints apparently can deal with subtle or 'gradient' phenomena which fall outside the reach of the 'cruder' parametric approaches. It remains to be seen, however, whether such subtle or gradient phenomena which must ultimately be dealt with necessarily require the powerful apparatus offered by OT.

8. Conclusions

This article has dealt with word accent, both in terms of the factors that constitute this phenomenon at the descriptive level and in terms of the theoretical apparatus that has been proposed to represent it in formal terms. The study of word accent (a term that is preferred over word stress; cf. section 2) forms a rich area of phonological theoretical and typological research that continues to inspire the formulation of new approaches and is thus in the forefront of the continuing development of phonological theory.

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