

# Re-defining English accent and stress

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## 1. The problem

In a well-known introductory text on linguistics, Langacker maintained (1968: 161), expressing a widely held view:

Linguists do not fully understand just what constitutes stress. The best we can say is that stressed vowels are apparently different from unstressed ones in that they are of greater length, higher pitch and greater articulatory force.

Now, after a lapse of over ten years, the first part of this quotation is still largely true but the second part, relating to the nature of stress, had already been shown to be either highly doubtful or evidently incorrect long before these words were written. The problem is therefore a double one: lack of understanding of what 'stress' is, and the possibility that stress is not simply to be found in phonetic relations of greater length, higher pitch, and particularly not in greater articulatory force.

## 2. Previous approaches

**2.1. Introductory.** As far as previous approaches are concerned, there have been a number of differences of opinion and since the forties discussion of stress in phonetics has essentially centred around the following problems:

(1) Is stress an objective feature of speech which is amenable to measurement procedures or is it a subjective phenomenon untestable by experimental methods?

(2) Is stress primarily related to the neurological, or the physiological, or the acoustic features of speech?

(3) Is stress the effect of greater effort (or force of production), i.e. relative intensity or amplitude (interpreted as psychophysical loudness), or is it manifested by one or more of the other attributes of sound?

The present critical appraisal will primarily address itself to the first and third complexes of questions; in particular, the notion of

stress as greater effort will be criticized and replaced by a more structural, phonologically defined system of stress and accent. The more abstract conception of stress found in generative phonology will also be briefly considered in a separate section.

The distinction between 'stress' as an abstract lexical category and 'accent' as an observable, textual category, was first clearly made by Bolinger in a number of studies in the fifties; it was practically unknown in Britain until Gimson's article of 1956 and even now is generally ignored, despite some awareness of different kinds of stress as evidenced by Kingdon's term 'kinetic' and 'static' 'stress' (Kingdon, 1958), or the terms 'prominence', 'salience', 'tone', etc., used in many studies.

**2.2. Stress: subjective effort?** The best way to illustrate the main aspects of the traditional view of stress as subjective effort is simply to cite the definitions of a variety of phoneticians.<sup>1</sup> Pike, whose work *Phonetics* is still the most comprehensive discussion of the articulation of speech, has remarkably little to say about stress (1943: 49):

A stress group is a sequence of several syllables, one of which, the stressed syllable, has much stronger initiator pressure than the others.

MacCarthy (1947) adds to this view as follows:

Stress has been defined as the degree of force with which a sound or syllable is uttered . . . usually a sound or syllable which a speaker feels to be important is uttered with relatively greater energy involving more vigorous articulation on the part of the speech organs concerned, together with strong breath-force.

Jones expresses the following related view (1950: 134-5):

Force of utterance, abstracted from the other attributes of speech sounds, is termed *stress*. Stresses are essentially subjective attitudes of the speaker. A strongly stressed syllable, for instance, is one which he consciously utters with greater effort than other neighbouring syllables in the word or sentence.

And, still more explicitly (*ibid.*: 59):

I take stress to be largely a subjective feeling of forcibleness or effort in the action of producing sounds and I may add here that I am doubtful if it will ever be found possible to determine degrees of stress by laboratory methods. I would add further that in my speech there are constant relations between intonation and what I judge to be stress.

<sup>1</sup> A detailed exposition of these points of view is given by Lehiste (1970).

There are objections to this view of stress, both on theoretical grounds and in the form of experimentally supported studies. After presenting these objections, the generative view of stress, which has something in common with the views sketched above in its phonetic aspects, will be considered.

**2.3. Theoretical objections to the 'subjective effort' hypothesis.** The classical London view of stress was first disputed by one of the present writers (Jassem, 1952 : 21-5), who suggested that

whatever cannot be heard by a normal human ear *ipso facto* lies outside the field which is covered by phonetics as a strictly linguistic discipline.

In that study, the 'subjective effort' hypothesis was consequently questioned, and it was suggested that inter-syllabic durational relations which constitute the rhythm of speech are basic to the definition of stress, rather than the articulatory effort or its physical and/or perceptual correlates.

In 1956, A. C. Gimson published what is probably the clearest critical discussion of English stress. Gimson also points out that only sound features which are capable of being perceived by the listener may be of linguistic relevance and that it is only such facts that represent linguistic reality (p. 143). Consequently (p. 145), a definition of stress in terms of a subjective activity of the speaker ('without any corresponding effect being communicated to the listener except in a recollective habit . . .') is not acceptable to a linguist. Gimson also expresses the opinion that differences in effort or loudness are (if at all) much less appreciated by the listener than those of quality, quantity (i.e. duration) and pitch (p. 146) :

The so-called distinctions by means of stress are most usually realized by means of pitch (p. 147) . . . (However) . . . sometimes intonation is not at all a good guide to the stresses (p. 148).

The examples he discusses here contain stressed syllables at lower pitches than the neighbouring syllables.

Similar criticisms were made in the same year by Mol & Uhlenbeck (1956).

**2.4. Some experimental work.** There is a certain amount of work which shows that effort in some sense is relevant for the definition of stress. Ladefoged, Draper and Whitteridge (1958) achieved results in support of the essentially dynamic character of stress using electromyographic measurement techniques. Their results were not conclusive, however, and contrary evidence has been forthcoming.

Results from several studies indicate that such a hypothesis is not correct as it stands. The most well known are perhaps those of Bolinger, who published a series of articles, both alone and in collaboration with others, in the fifties, which did considerable damage to the concept of stress as intensity or loudness (and, by implication, as articulatory effort).

In Bolinger & Gerstman (1957), the locutions she's a <sup>1</sup>light <sub>2</sub> <sub>3</sub> housekeeper (as opposed to she's a heavy housekeeper), he's a <sup>1</sup>lighthouse <sub>2</sub> <sub>3</sub> keeper, and light, house, keeper, were manipulated in synthetic speech in various ways and it was discovered that the separation of syllables in time, temporal relations between syllables ('disjuncture'), were far more important than intensity in establishing stress relations.

Bolinger proposed a solution to the stress problem, mainly concentrating on the pitch parameter, in the form of his well-known pitch accent theory; in the final sections of this paper, a related but more comprehensive solution to the problem will be outlined.

Almost at the same time as Bolinger's studies, work was done by D. B. Fry which produced similar results in exploring the phonetic nature of stress, i.e. in trying to find which of the four sound attributes (pitch, loudness, duration, timbre) is mainly responsible for the perception of what was traditionally termed 'stress' (1955, 1958, 1965). His results may be briefly summarized as follows:

(1) The duration ratio has a stronger influence on judgements of stress than the intensity ratio.

(2) Variations in duration and intensity produce gradual ('gradient', 'continuous', 'fuzzy') effects, while variations in pitch, once they exceeded a certain threshold below which they are essentially ineffective, produce judgements of stress independently of the actual magnitude of pitch change. This is a 'categorical', 'discrete', or 'all-or-none' effect.

(3) Pitch changes alone produce a very strong effect of stress even if the changes are not intended to imitate any particular change of the overall structural intonation pattern.

(4) If particular intonation patterns (Fry calls them 'sentence intonation'—not necessarily the most appropriate term) are superimposed on the words, this becomes an overriding factor and listeners judge stress according to the particular pitch pattern, even against durational cues.

(5) Quality changes are weaker in producing the effect of shift from one syllable to the other than are variations in duration.

Additional evidence was provided by Morton and Jassem (1965) who, with the PAT speech synthesizer constructed at the Department of Phonetics, University of Edinburgh, and aided by J. Anthony, achieved the following results using a listening test with 60 native speakers of British English, evaluated with advanced statistical methods:

(1) Within the range of variation used, fundamental frequency changes were by far the most effective.

(2) Both duration and intensity had weak effects, but duration was somewhat better.

In a more recent study by W. S. Brown and R. E. McGlone (1974) it was found that neither intraoral pressure nor airflow had any significant relation to stress.

In view of the overwhelming evidence against it, it is clear that the subjective (or objective) effort view must be supplanted by a different approach. Before outlining a phonologically motivated alternative, the conception of stress used in generative phonology will be examined.

**2.5. Stress as a derivative construct.** With respect to the treatment of stress, two main stages in the development of generative theory may be discerned: (1) the 'explicit transcription' stage represented by the early study of Chomsky, Halle and Lukoff (1956) and in a few respects also in the considerably more comprehensive study of Bierwisch (1966), where the primary aim was not to describe new data so much as to explicate the notions and systems provided already by previous informal descriptions; (2) the 'interpretive' stage (Chomsky & Halle, 1968, and many others), where the main aim was to integrate suprasegmentals formally and methodologically into a comprehensive generative grammar. The classical approach has undergone two main 'conservative' modifications: (a) Bresnan (1971, 1972) integrated the stress rule application cycle into the syntactic transformational cycle in order to account for some apparent anomalies in the application of the nuclear stress rule in complex sentences; (b) Liberman (1975; Liberman & Prince, 1977) rejected the earlier integer notation for the greater/smaller stress relation and replaced it by a purely relational notation *s(trong)-w(eak)*, in effect replacing an unrealistically rigid full ordering by a more realistic partial ordering in terms of the stress relation.

All the variants of the interpretive approach have the same fundamental properties:

(1) A single parameter [ $\alpha$  stress] with ' $\alpha$ ' interpreted variously as '+', '-', integer values, or relational specifications of the values of this parameter.

(2) Assignment rules which associate values of the stress parameter to words and simple constructions (especially the 'compound' and 'nuclear' stress rules).

(3) A recursive definition of stress value assignments to complex words and locutions, i.e. the cyclical rule application principle (equivalently, in Liberman's version, the direct interpretation of sister relations in phrase markers as stress relations) for the assignment rules.

(4) A low-level principle of rhythm adjustment, either as a readjustment rule (Chomsky & Halle; Bresnan) or as a 'metrical grid' (Liberman) which may be seen as a kind of phonological output filter.

One of the main criticisms of these approaches has turned on the lack of a clear empirical basis for the predicted stress patterns. A major reason for this weakness lies in the fact that the nuclear stress rule and the cyclic application principle are in themselves nothing more than an algorithm for re-coding syntactic phrase-markers into a different, structure-reduced notation, namely integer sequences or relationally labelled trees, and are thus neither intrinsically phonological nor adequate for capturing the variety of relations between accentuation and locutions.<sup>2</sup>

In order to overcome this extreme idealization and to ensure empirical interpretability in principle, two assumptions were made: (1) that the intonation described is in some sense 'normal intonation' (sc. 'stress placement'), which in this context brings with it the danger of circular argumentation: if 'normal intonation' is 'intonation determined by syntactic factors alone', then it is not legitimate to define the latter in terms of the former;<sup>3</sup> (2) that the stress parameter is an abstract articulatory 'input' feature, a system-internal assumption which has no additional evidential value without a detailed theory of articulation-perception relations and which is open to criticisms similar to those levelled above at the

<sup>2</sup> This algorithm may perhaps be seen as an attempt to explicate one aspect of the Prague School notion of 'configurative' intonational function; it ignores other potential explicanda such as anaphora, deixis, contrast, relative semantic weight within collocations, or dialogue patterning and emphasis.

<sup>3</sup> Circularity would be avoided if (a) the definition were embedded in an explanatory theory whose evaluation metric preferred some 'normal' case to other specifiable cases; or (b) it could be shown that more significant generalizations over the domain were possible using a distinction between 'normal' and other 'stress' assignments; or (c) accentual structures were initially defined independently of locutionary structures. None of these conditions hold for classical generative phonology. The authors believe that at least the third of these strategies is necessary. Cf. also fn. 6.

'subjective effort' theory.<sup>4</sup> This conception of stress is both under-determined from the phonetic point of view and over-determined by syntactic structure at the expense of other descriptive components; use of a single parameter of stress results in an extreme degree of idealization and remoteness from observation. The extreme degree of idealization is, of course, the reason why a readjustment rule or filter has to be proposed; the postulation of such readjustment principles may be regarded as indications of the necessity for explicitly recognizing structural autonomy in accentuation and rhythm.<sup>5</sup> This is the view taken by the present writers and is, in fact, the traditional conception of intonation-locution relations.

### 3. Toward a re-definition of accent and stress

**3.1. The methodological premises.** The first step in the attempt to re-define English accent and stress consists in formulating some of the major methodological premises. Those relevant here are the following.

*Premise I:* The phonological (and grammatical) description of a language begins with the analysis of concrete (spoken) texts.

*Premise II:* Abstract entities are arrived at mainly by induction supported by empirical testing of hypotheses.

*Premise III:* Phonological analysis is independent of grammar.

A corollary of the last premise is that since 'word' and 'sentence' name grammatical categories, the terms 'sentence stress' and 'word stress' should be avoided in order to reduce the danger of circular argumentation and question-begging. Any such correspondences must be shown and not assumed to exist. This premise has been a major tenet of traditional European and some American work in intonation, and has come in for considerable discussion in the last few years.<sup>6</sup>

**3.2. Definitions of terms.** The main distinction to be made is between accent as a textual, concrete, observable category and stress

<sup>4</sup> The main source for the concept of 'nuclear stress' was Newman (1946), who held the 'force of articulation' view.

<sup>5</sup> In this rhythm adjustment resembles other readjustment rule types postulated in generative phonology. See especially Chomsky & Halle (1968: *passim*).

<sup>6</sup> Cf. Lehiste (1979: 241); Gibbon (1975); Ladd (1978); and the 'autosegmental phonologists' Goldsmith (1975), Leben (1973) and Huckin (1977). It should be noted that the autonomy thesis has been an explicit feature of many descriptions, especially Pike (1945), Jassem (1952) and Crystal (1969) as well as Bolinger's numerous contributions to the field. Until relatively recently the notion of autonomy of levels has been strongly attacked within the generative approach; it has outlived these attacks, however, and is re-emerging both in the various aspects of phonology and elsewhere in generative grammars under the heading of 'modular approach'. Cf. also Gibbon (1979).

as an abstract, possibly lexical, analytic category; it is very similar to the distinction between accent and stress made by Bolinger.

Accent is a purely phonological concept and is definable after utterances, i.e. speech stretches between successive silences, have been analysed into tone-groups (cf. Jassem, 1978: 368-9). It will become clear below that accent and rhythm are inextricably connected; they are not categories which can be seen separately from each other.

There are different degrees (and kinds) of accent. Primary accent and secondary accent are defined phonologically in terms of relations within a tone-group. An English tone-group has one, or in specific cases two primary accents directly related to nuclear tunes.<sup>7</sup> It may also include one or more secondary accents directly related to strong pre-nuclear tunes.<sup>8</sup> This implies that secondary accents cannot come after primary accents. The pre-nuclear tune would, in a precise version of the model, be recursively defined since, unlike the nuclear tune, it is not associated with a fixed sequence of accents.<sup>9</sup>

Tertiary accent is purely a matter of rhythm, i.e. timing; unlike the other two types, which are categorically identified pitch accents, it is a 'fuzzy', gradient category; in English, rhythm is itself only tendentially, and not absolutely, present, as a tendency to isochronicity modified by the numbers of syllables involved.<sup>10</sup> In the

<sup>7</sup> A tone-group may be analysed as containing two nuclear tunes if it ends with a (rise-)fall to low pitch followed by a (low) rise. This is O'Connor & Arnold's (1973) 'High Dive' and Halliday's (1970) '13' and '53'. Note, however, that some examples of '13' and '53' are better analysed as consisting of two tone-groups each. E.g. (p. 87) 'He's a good speaker' is one tone-group with two nuclei (F + R), but 'Rosemary can have it if it suits her', which is also given as one tone-group with a F + R, is better analysed as representing a concatenation of two tone-groups, the first with an F, and the second with an R. Cf. O'Connor & Arnold's 'You can have it / if you like' (1973: 156). For further criticism on these lines cf. also Gibbon (1975: §§ 3.1.2.5, 4.2.2).

<sup>8</sup> A strong pre-nuclear tune begins with an accented syllable. It is approximately equivalent to O'Connor & Arnold's 'head'. A weak pre-nuclear tune begins with an unaccented syllable and is approximately equivalent to their 'prehead'. The appropriate levels of analysis for weak syllables will not be considered here.

<sup>9</sup> This condition has been explicated by one of the present writers in terms of simple autonomous grammars for the accentual factors in intonation (Gibbon, 1979). Apparent exceptions to the principle may easily be found in recordings of spontaneous speech and require a more highly structured account of accentual hierarchies and contextual determinants of accent to account for them; they may be regarded as 'marked' accentuations. The analysis of compound nuclei (cf. fn. 7) falls into the same general problem area.

<sup>10</sup> Gradience in isochronicity appears to vary with a stylistic formality feature: highly formal, stylized modes of speech such as oratory, foreign language practice drills, reading linguistic examples aloud, etc., tend to have perceptibly higher degrees of isochronicity. This applies primarily to so-called 'stress-timed' languages. Cf. Gibbon (1968).





or as an idiosyncratic property is not at issue here, nor is the question of its precise phonological (e.g. 'distinctive') status. The stress-accent relations depicted in Fig. 1 also exclude reference to the specialized contextual determinants of what Bolinger (1961) refers to as 'contrastive stress' (vs. contrastive accent), e.g. *This whisky was DEported from Ireland, not EXported*, which cannot be satisfactorily accounted for in models which do not make a consistent categorial distinction between accent and stress. The question of contextual determinants of accentuation will be mentioned briefly below, but will otherwise not be considered in this paper.

Whereas any given word<sup>12</sup> has its own fixed accent potential or stress pattern, any given locution may have several possible context-determined accentuations; what is associated even with isolated words in citation contexts is of course a particular accentuation pattern, which is in general congruent with the stress pattern. Some possible accent assignments for the locution *John remembers the boarding house* are shown in Fig. 2. The lexical stress patterns

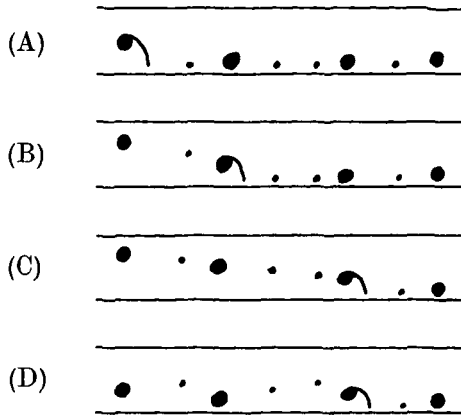
Locution :	<i>John remembers the boarding-house</i>						
Accentuations :							
(A)	<u>1</u>	—	<u>3</u>	—	—	<u>3</u>	<u>3</u>
(B)	<u>2</u>	—	<u>1</u>	—	—	<u>3</u>	<u>3</u>
(C)	<u>2</u>	—	<u>3</u>	—	—	<u>1</u>	<u>3</u>
(D)	<u>2</u>	—	<u>2</u>	—	—	<u>1</u>	<u>3</u>
(Word) stress :	/1/	/	<u>1</u>	/ /	/	/1	3/

FIG. 2. Possible accent assignments to a locution, and stress as a property of its constituents.

<sup>12</sup> To what extent there are phrasal analogues to lexical stress in a strict sense is a moot point. It seems likely that there are abstract properties of phrasal structures (associated more with linear properties of locutions than the constituent structures of classical generative phonology) which may make it necessary to invoke some kind of syntactic 'stress' as opposed to accentuation. These, like some other determinants of accent, may be constant under transformation (cf. Bresnan, 1971); since the relevant transformational relations may be dealt with lexically in recent generative models, no essential conflict with or within the present model arises from such considerations.

associated with these accent assignments are indicated in the last line.

With a low falling nuclear tune, some possible pitch patterns for the locution are :



Each of the accentual patterns in Fig. 2 may, of course, be realized in other ways in intonational terms, i.e. with other nuclear and pre-nuclear tunes. The relation between accentual and rhythmic patterning and the local and global properties of the pitch curve involves a further step in the analysis and cannot be treated here.

Although stress is primarily to be regarded as a lexical category, it may be extrapolated to syntactic phrases and possibly to higher-level constructions without destroying the stress vs. accent distinction. Stress is, for instance, a phonological feature of phrases as well as individual words, as shown by well-known distinctive pairs like (a) 'moving van' = 'a van that is moving' vs. (b) 'moving van' = 'a van used for removals'. It is very important to note that the contrast is not primarily accentual, but one of stress: 101 vs. 103. It is not necessarily a contrast of accent, since both can be realized as 103 in appropriate contexts without being contrastive, becoming potentially ambiguous, as in the following context: *The 1moving 3van 1skidded*. But whereas (a) can also be realized as 301 without a contrastive reading, as in a context such as *I can't 1see the 3moving 1van*, this is not the case with (b). If such an accentuation for (b) does occur, producing another example of potential ambiguity due to unlike stress patterns being realized as like accent patterns, then it is interpreted as part of the kind of specialized contrastive context already mentioned. The same applies to a possible 101 accentuation. The fundamental distinction between (a) and (b) types is thus one of stress; in appropriate contrastive

contexts the possible accentual distinctions may be neutralized. It should also be noted that phrasal ambiguities of the *Flying planes can be dangerous* type are not open to accentual disambiguation in the absence of further contextualization since both the participial and the gerund readings of the subject have the 101 stress pattern, both differing from the nominal compound in this respect.

Other cases of similar nominal/phrasal stress distinctions can be found, for instance /prɒpə geɪt/ (<sup>1</sup>*propagate*) vs. /prɒpə geɪt/ (<sup>1</sup>*proper gate*). The range of ambiguous cases cited by Esser (1975: 67 ff.) may be dealt with in similar terms.

Whereas treatment of primary stress is quite constant in the handbooks, treatment of the other degrees, particularly the tertiary stress primarily associated with the 'fuzzy' tertiary accent, varies. Kenyon and Knott (1944) and the various Webster's dictionaries indicate words such as *propagate, imbecile, telephone, materialize, etc.*, as bearing 'secondary' stress on the last syllable (we would interpret it as tertiary), whilst there is no corresponding stress mark in any edition of the English Pronouncing Dictionary. We believe that this is a notational variation, not a genuine difference between British and American English. In fact Kingdon (1958) has a 'low static' stress mark in such cases.

Referring to cases where a given stress assignment is associated with a lower accentual value as 'reduction' and to the reverse cases as 'amplification' (the unmarked case being congruence of stress and accent) the following generalizations may be made. Reduction may be either rhythmical (in medial contexts) or a mark of some form of dependency with respect to functionally defined contexts (on the latter possibility, cf. Fuchs, 1975; Ladd, 1978). Amplification, on the other hand, is always a mark of a contextually determined contrast (except perhaps in otherwise heavily marked contexts such as *doggerel*). Both accentual reduction and accentual amplification may, of course, result in apparent ambiguities if the context is not specified.

The major distinctions postulated within the present approach are illustrated visually in Fig. 3, with the accentuation 2313 and the locution *John remembers the boarding-house*. The 'lowest' level associated with the locution is that of the syllabic sequence, which is determined by lexical syllabification and contextual reduction factors. The syllables are associated with a particular rhythmic pattern of accented and unaccented syllables; the unaccented syllables fall into two categories: those following accents, and anacrusis or proclitic syllables, i.e. arhythmic sequences of syllables in pre-accentual position (marked with 'o' and 'v' respectively in the figure). The primary and secondary accents in the rhythmic

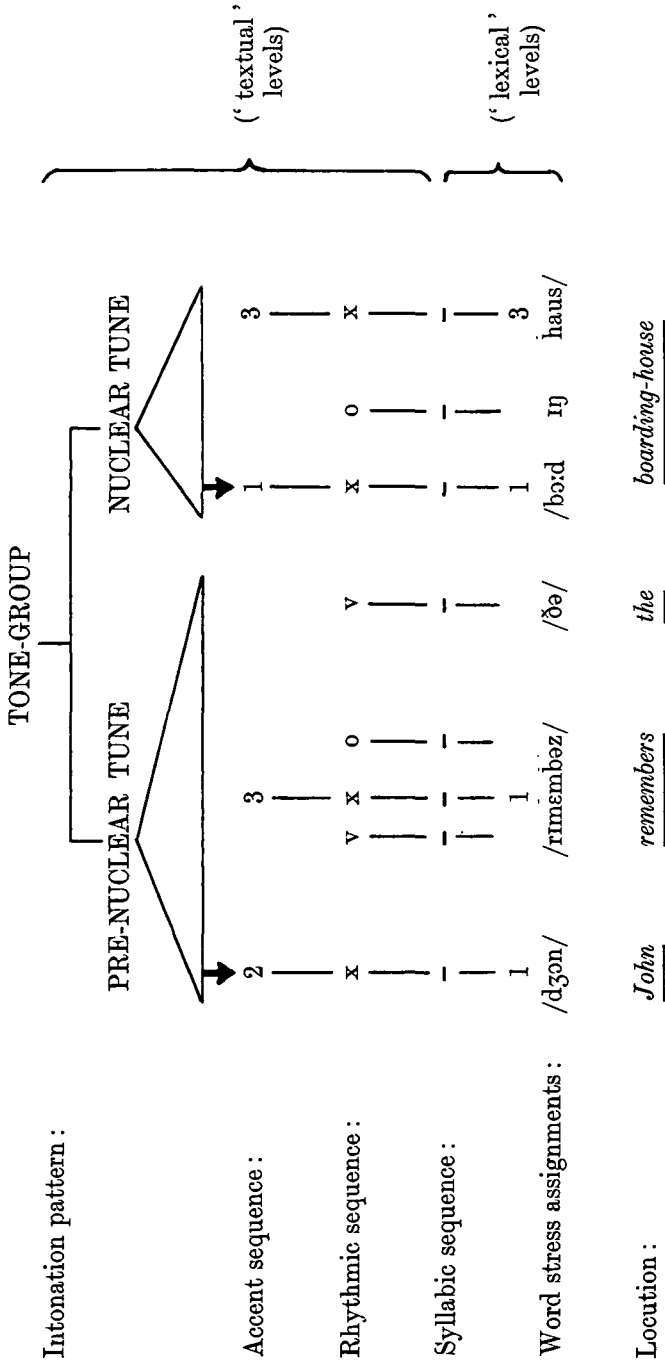


FIG. 3. Application of the model to the description of a particular locution with a given accentuation.

pattern are subject to the ordering constraints noted above and are in turn associated with local and global properties of the overall pitch contour in the tone group at the intonational level of analysis.

#### 4. Conclusion

A number of previous attempts to define the notion of stress were surveyed in the initial sections of this paper and found wanting in various ways; in the final section, an outline was given of an approach which explicitly attempts to avoid the pitfalls which have previously been encountered. The main descriptive strategy involved is to distinguish between and define systematically distinct categories, termed 'accent' and 'stress' respectively, the former being a partly rhythmical, partly intonational category, and the latter being an abstract morpho-syntactic property. This provides a sufficiently differentiated framework for capturing on the one hand the relative autonomy of suprasegmental systems, and on the other their relation to other aspects of phonology and syntax without circularity of argument and without rigid bonding of suprasegmental patterning to patterning in other parts of the language system. This study has not attempted to describe the use of accent patterns in relation to locutions and the contexts in which they are used, or the close relation between accentuation and the details of pitch patterning; the basic framework does, however, appear to be flexible enough to accommodate both these areas without oversimplification.

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