

ANNE CUTLER

Stress and Accent in Language Production and Understanding¹

Introduction

The central thesis of this paper is that the psycholinguistic evidence on the perception of prosodic structure in language understanding, and on the determination of prosodic structure in language production, converge to show two aspects of the same phenomenon. That is to say, the perceptual and production evidence together enable us to construct a picture of our mental representation of the role of prosody in language, and the way this knowledge is expressed in language use.

Rather than attempt to cover all aspects of prosodic structure, and all the relevant evidence on how each type of prosodic variation is produced and perceived, this chapter will concentrate on two phenomena only: stress and accent. Stress and accent each concern the relative prominence of one syllable in comparison with others; but as defined here, stress is a property of words, accent of sentences (or utterances).

The two are not independent in the utterance itself. For instance, accent is usually realised on a syllable which is marked for stress (although some exceptions to this generalisation will be discussed below). However, at a more abstract level of linguistic processing the two phenomena are quite distinct and are driven by totally independent processes. (For a comprehensive discussion of the independence yet interaction of accent and stress, though one in a theoretical framework different from that developed in the present paper, see Jassem & Gibbon, 1980.) The evidence to be cited below, and hence the theoretical conclusions to be drawn, refer exclusively to English; and the mental representations of prosodic structure which are inferred are therefore presumably those of English speakers only and are by no means necessarily shared by speakers of other languages in which word stress and sentence accent are differently expressed or not expressed at all.

¹ This research was supported by a grant from the Science and Engineering Research Council, U. K., to the University of Sussex.

Stress

Word stress patterns are an integral part of the phonological representation of words in the mental lexicon; they are not generated by rule. Although it can be shown that speakers possess general knowledge of the stress patterns of their language - they can assign appropriate stress patterns to new derivations (*splendidify*) or nonsense words (*porpitude*), for instance, by analogy to other words they know - nevertheless there is adequate evidence that in the process of language production, stress patterns are not assigned to each word by application of general rules, but are retrieved along with the rest of the pronunciation of the word when the word is looked up in the mental lexicon.

This evidence is provided, for example, by the guesses which speakers offer when they can't remember a word but have it on the tip of their tongue (see e.g. Brown & McNeill, 1966). A speaker searching for the name *Ghirardelli*, for instance, produced the guesses *Garibaldi*, *Gabrielli* and *Granatelli* (Browman, 1978) - all of them words with some sounds in common with the target word, chiefly initial and terminal sounds; but crucially, all of them words with the same number of syllables and stress pattern as *Ghirardelli*. Brown and McNeill proposed that the lexical entries of infrequently used words could become faint with disuse, so that only parts could be clearly read - perhaps the beginning and the end, but often the number of syllables and the location of primary stress. This argument presupposes that stress patterns are listed in the lexicon.

Evidence from slips of the tongue in spontaneous speech provides a similar picture. For instance, it has been argued by Fay & Cuder (1977) that semantically unrelated word substitution errors (e.g. *confession* for *convention*) arise when instead of the intended word a near neighbour of it in the mental lexicon is mistakenly selected. Such errors show an obvious similarity of sound to the word which the speaker intended to say, on the basis of which Fay and Cutler argued that the lexicon used in language production is arranged by *sound* properties (that is, since such a lexicon is obviously adapted for use in comprehension, the comprehension and production lexicons are the same - there is only one mental lexicon). The sound similarities in this kind of slip of the tongue include stress pattern: almost without exception the error and the intended word have the same number of syllables, with the same syllable carrying the primary stress. Again, the lexical explanation of these errors as offered by Fay and Cutler presupposes lexical representation of word stress.

A second variety of speech error which provides evidence pointing in the same direction is the misapplication of *stress* itself - e.g. saying *superfluous* for *superfluous*. Such errors are not uncommon; and they show a consistent pattern: the stress falls wrongly on a syllable which bears stress in a related word (e.g. *superfluity*). Cutler (1980) argued that words de-

rived from the same root morpheme are stored together in the mental lexicon, and that stress errors arise when the root and the correct ending are chosen, but the primary stress is applied to a syllable marked for stress not in the intended derivative, but in another member of the lexical cluster. This account also relies upon the lexical representation of stress information. A variety of speech production evidence, therefore, converges to indicate that lexical stress pattern forms part of the representation of words in the mental lexicon.

Accordingly one would expect that identification of lexical stress pattern would play a large part in word recognition during language comprehension. And indeed it does. For instance, when words are misheard, it is the stress pattern and usually the nature of the stressed syllable which determines what listeners *think* they hear (see e.g. Garnes & Bond, 1975). Typical hearing errors include *her peas oyster* for *herpes zoster*, *testicle* for *testable*, *your purse* for *reverse*, *are you using paint remover?* for *are you gonna paint your ruler?* (all examples from Browman 1978). In each case at least the steady state portions of the most highly stressed syllables have been correctly perceived - not surprisingly, since stressed syllables are acoustically clearer than unstressed syllables. But importantly, the stressed syllable information has been used to reconstruct a message, in which number of syllables and stress pattern are the same as in the original, but precious little else is preserved. Only semantic incongruity (of the perceived message with the context, or of the interlocutor's response based on an incorrect perception) alerts participants in a conversation to the fact that a slip of the ear has occurred. One may assume that reconstruction of an utterance on the basis of partial information in this manner is not confined to those cases where it produces an incorrect result; if it did not often produce acceptable results it would presumably be abandoned as a speech perception strategy. That is to say, it would seem that drawing heavily on information about stress pattern and the nature of the stressed syllable is a reasonably usual and efficient way of perceiving speech.

What happens, then, when stress pattern information is incorrect? Not surprisingly, this often precipitates an error of interpretation. Puns, reports Lagerquist (1980), fail to work when they involve a stress shift. Cutler (1980) reports that a hearer who heard the word *perfectionist* stressed on the first syllable, with the second syllable reduced, parsed it as *a perfect shnist*, and only became aware of the error when no meaning could be given to *shnist*. Bansal (1966) presented listeners with English spoken by Indian speakers, who often applied word stress in an unorthodox manner, and found that the listeners tended to interpret what they heard to conform with the stress pattern, often in conflict with the segmental information. For example, when words with initial stress were uttered with second-syllable stress, *atmosphere* was heard as *must fear*, *yesterday* as *or study*, *character* as *director*, and *written* as *retain*. Similarly, when two-syllable

words with stress on the second syllable were uttered with initial stress, hearers perceived *prefer* as *fearful*, *correct* as *carried*, and *about* as *come out*.

Robinson (1977) conducted an experimental investigation of the importance of stress pattern in word recognition. Subjects heard lists of two-syllable nonsense sequences with either initial or final stress. In a false recognition test they were then presented with two-syllable items which were made up of the same syllables they had already heard although never in the same combinations which they had heard. Subjects tended to accept these items (erroneously) if the stress levels of the syllables were the same as they had been in the original presentation. Similarly, interference effects in free recall of both nonsense items and short phrases were found as a result of stress pattern similarity; in other words, stress pattern identity can precipitate false recognition, often in defiance of segmental evidence.

As one would suspect, it is not only the case that false stress information leads to difficulty of word recognition; prior knowledge of stress pattern can facilitate correct word recognition. Engdahl (1978) found that when listeners were given a sentence complete but for the last word (e. g. 'Laura tried all the keys but the door wouldn't ---'), and were asked to supply an appropriate continuation as quickly as possible, they could do the task well on the basis of contextual cues alone, but responded significantly faster when the stress pattern of the required word was presented (as a pattern of tones) as well.

Even in the absence of context, stress pattern information can facilitate lexical access. Subjects in a simple visual lexical decision experiment run by the present author at Sussex University were presented with words and non-words in one of two conditions: mixed randomly, or blocked uniformly so that a block of 40 items all had the same number of syllables and stress pattern. Responses in the blocked condition were faster than in the mixed condition, insignificantly so for the words but significantly for the non-words. Interestingly, Hirst and Pynte (1978) proposed lexical stress as one of several arbitrary features which could be incorporated in a language and which served the function of providing 'extra' word identification cues. One of the other such features which Hirst and Pynte proposed was noun gender, and in an analogous experiment to the stress pattern one just described, they presented subjects with French words and non-words mixed or blocked as to gender; prior knowledge of gender, as of stress pattern, facilitated performance to a significant extent in the non-word condition, though not in the word condition. Hirst and Pynte concluded that prior information about an arbitrary lexical feature such as gender or stress allows a subcategorisation of the lexicon, so that only the relevant entries need be consulted; in the case of non-words, the number of items to be fruitlessly searched is thus significantly reduced by the appropriate information. An alternative explanation, involving not partition-

ing of the entire lexical space but access from each entry of simply the stress pattern information alone, is also possible - such a procedure would also greatly increase the speed with which nonwords could be checked against potential entries. But whichever is the case, the implication is that stress is not merely information which becomes available on access of a word's lexical entry, but is of use to *guide* lexical access, i.e. enable only those entries with appropriate stress patterns to be fully accessed. This explanation again depends upon the assumption that stress is a feature of the lexical entries for words.

It might be argued, of course, that the phenomenon of vowel reduction in unstressed syllables makes the interpretation of much of the evidence cited above somewhat doubtful. Since changes of stress pattern usually entail changes of vowel quality, the apparent perceptual effects of lexical stress may in fact not be exercised directly, but only indirectly via their segmental side-effects. However, a recent experiment by Cutler and Clifton (1983) demonstrates that when vowel quality is controlled, lexical stress information itself can indeed be shown to play a part in the word recognition process. The experiment was motivated by a prior study by Ganong (1980), who found that the typical stop consonant identification function for synthetic stimuli varying in voice onset time (VOT) could be affected by lexical factors. If, for example, the same [t]-[d] continuum is prefaced to the syllables [ik] and [ip], in one case the [t] version forms a word (*teak*) while the [d] version does not, while in the other case the [d] version is a word (*deep*) whereas the [t] version is not. Using many such pairs, Ganong found that subjects characteristically shifted the crossover point of their identification function towards the short-lag end on the VOT continuum (i. e. reported more voiceless than voiced stops) when the voiceless stop made a word while the voiced stop did not, and shifted it towards the long-lag end (i. e. reported more voiced than voiceless stops) when the voiced stop made a word but the voiceless stop made a nonword. Cutler and Clifton prepared an analogous set of stimuli based on the words *tigress* and *digress*, which contain identical segments from the second segment on, but differ in stress pattern. Using synthesised versions of these words in which the initial consonants varied in VOT, Cutler and Clifton found a similar effect of lexical status to that found by Ganong: when stress fell on the first syllable, subjects shifted their identification function crossover so that they reported more [t] than [d], whereas they reported more [d] than [t] when stress fell on the second syllable. Cutler and Clifton interpreted this result as indicating that lexical stress alone - independent of its effects upon vowel quality - can be of primary importance in word recognition.

Thus the production and comprehension evidence are in full agreement: lexical stress is an important part of word pronunciations as listed in the mental lexicon. Moreover, it is, both directly and indirectly via its segmen-

tal repercussions, of great importance to the language processor in the operation of word recognition.

Accent

In any utterance at least one word is accorded a higher level of emphasis than the others. The accent patterns of sentences are not simply a function of the lexical stress patterns of the words which comprise them - or even of the major lexical items which comprise them, ignoring 'function words' - but depend upon additional semantic and pragmatic factors. The process of accent placement in the production of an utterance was described by Cutler and Isard (1980) as operating on a string of words with stressed syllables marked (and if compound nouns occur in the string, with the most prominent syllable in the compound marked); the semantic and pragmatic effects expressed in the placement of accent are (1) the assignment of focus or emphasis; (2) the expression of contrast; and (3) the deaccentuation of words which would otherwise be accented twice. In the normal case the effect of these operations will be to allot accent to a word or words (and, again in the normal case, these words will be major lexical items — open class words such as nouns, verbs or adjectives, rather than words from the closed 'function' classes); the accent will then actually be realised on whatever syllable in the word is marked for lexical stress. In exceptional cases, however, the semantic and pragmatic accent-assignment operations can override lexical stress (and compound stress) placement and result in accent falling on a syllable which is not normally marked for stress, or on a closed-class word such as a preposition, copula, conjunction or article.

An example sentence will illustrate the multiplicity of possibilities with respect to discourse context and its influence upon accent pattern. The context - including both preceding utterances of the present speaker and of other speakers, and the speaker's intentions - determines the placement of accent. In (1), for example, there are exactly three major lexical items: a noun, a verb and a nominal compound.

(1) This paper was prepared on the word processor.

There are therefore three primary candidates for the most prominent syllable in the sentence: the first syllable of *paper*, the second syllable of *prepared*, and the word *word* which is the stress-marked part of the compound *word processor*. Any of these three words can bear accent if they are the focus of the speaker's message, i. e. if the speaker wishes to express or imply contrast with, or lay emphasis upon, that particular part of his utter-

ance. Accent on *paper*, for instance, could imply contrast as a reply to (2), or express emphasis as a reply to (3):

(2) You've never prepared anything on the word processor.

(3) What did you say was prepared on the word processor?

The reader will have no difficulty constructing appropriate contexts for emphatic or contrastive accent on the other lexical items. But the same mechanisms can also result in accent falling on the non-lexical words of the sentence; for instance, accent could be applied to the copula *was* if the speaker wished to contrast his utterance with another's statement to opposite effect; accent on *the* could result from the speaker's intention to set off the particular word processor on which this manuscript was prepared from other, more ordinary, word processors, and so on. Contrast can even accentuate a syllable not marked for lexical stress - for instance, one might accent the first syllable of *prepared* to correct a hearer's impression that the word had been, say, *compared*. Deaccenting could similarly have a variety of effects. Occurrence of *word processor* in a preceding utterance could result in accent falling on the verb even though the verb itself was not focussed; or if all the lexical items had already occurred, accent could even fall on the preposition:

(4) What do you mean, the word processor speeds things up? This paper took five days to prepare, and this paper was prepared on the word processor.

See Ladd (1980) and Cutler and Isard (1980) for further examples of deaccenting.

If none of the lexical items is individually marked for focus, then accent must be assigned by default. The default case, in which no word is singled out for particular emphasis, and contrast and deaccenting are not involved, is equivalent to focus on the clause as a whole (see Ladd, 1980, for a good discussion of this), in which case the accent falls on the rightmost lexical item - in our example, on *word*, in its capacity as the stressed syllable of *word processor*. If *word processor* has been marked for deaccenting, the default accent shifts back one and falls on the verb. That is to say, the default location for accent is the rightmost lexical item not deaccented. (It is even possible to contrive a case in which only the word *word* had previously occurred in the context, not the whole compound *word processor*; in this case only *word* by itself would be marked for deaccenting, and *processor* would still be available to the right of it to receive accent:

- (5) This paper about stress on words was prepared on the word processor.

More natural examples may be found in Cutler and Isard, 1980.)

This account of accent assignment, it will be noted, gives little role to the syntactic structure of the sentence, in contrast to many linguistic models. In the sentence production process, it is claimed, accent is assigned primarily on the basis of semantic and pragmatic factors. Evidence from speech errors supports this interpretation. For instance, when speakers correct their accent placement, it is to rectify a false impression given by the first attempt:

- (6) Now if it only occurred — if it *only* occurred in free recall...
- (7) Downes has to do something tricky to generate reflexives in his base - to generate reflexives in his base structure.

Similarly, the way a hearer recognises an inappropriate accent placement when one occurs is by semantic/pragmatic incongruity rather than syntactic:

- (8) She had a lot of cups but the one she gave me leaked.
- (9) The only other place I've seen that kind of thing is in Rogers Park - there's nothing like it right around where we live - where we live.

In (8), for instance, the accent should indeed have been placed on a pronoun, but the error consisted in assigning it to the wrong pronoun. Again, in (9) the assignment of accent to *live* in 'There's nothing like it right around where we live' is syntactically perfectly acceptable, but was semantically anomalous in the context.

A corollary of this is that erroneous accent placement is *only ever* detected by the hearer when it results in semantic anomaly. If it doesn't, the hearer will simply assume that focus was placed where the speaker intended to place it, with the accented item representing what the speaker considers to be most important. Thus it is up to the speaker to correct accent placement if it is important to him to avoid giving a wrong impression; and correction of accent placement is in fact quite common in everyday speech.

Again the evidence from sentence understanding complements the production evidence: hearers pay great attention to where sentence accent falls when they are understanding a sentence. This is clear from studies in which the processing of sentence accent has been explicitly investigated. For instance, experiments using the phoneme-monitoring task show that

listeners respond faster to accented than to unaccented words. In a phoneme-monitoring experiment people are asked to listen to a sentence and to press a response key as fast as possible as soon as they hear a particular word-initial sound. Responses to this sound (the 'target') are faster if it begins an accented syllable (Shields, McHugh & Martin, 1974), irrespective of the form class of the word bearing accent (Cutler & Foss, 1977). Moreover, this response time advantage for accented syllables is not due solely to the (indubitable) fact that accented syllables are acoustically more distinct - and hence presumably easier to make sense of - than unaccented syllables. This is demonstrated by a further experiment (Cutler, 1976) in which the acoustic cues to accent on the target-bearing word itself were removed, leaving only the cues provided by the prosody of the sentence context. To accomplish this, sentences like (10) were recorded twice, once with accent on the target-bearing word (in this case *code*), and once with accent falling elsewhere.

(10) The top experts were all unable to break the code the spy had used.

The target-bearing word itself was then spliced out of each recording and replaced in all versions by identical copies of the same word excised from a third, 'neutral', rendition of the sentence. The result of this manipulation was two versions of each sentence, each version with acoustically identical target-bearing words, but with differing prosodic contexts; in one case the prosodic contour surrounding the target-bearing word was consistent with accent falling on the target-bearing word, in the other it was consistent with the target-bearing word being unaccented. Under these conditions the 'accented' targets still elicited faster responses than the 'unaccented', and since the only differences between the two versions of each sentence lay in the overall prosodic contour, it was concluded that the listeners must have used cues in the prosody to direct their attention to the sentence accent.

Subsequent experiments investigated the nature of these cues; the predicted accent effect was found to be unaffected by cues to stress contained in the duration of closure of the target stop consonant (Cutler & Darwin, 1981), indicating that the effect is not localised in the tenth of a second or so immediately preceding onset of the target word. Cuder and Darwin also found that removing pitch cues - i. e. monotonising the sentences - did not do away with the accent effect; in monotonised spliced sentences like (10) the 'accented' targets were still responded to faster than the 'unaccented' targets. In other words, fundamental frequency variation is not a necessary component of the prosodic information pattern on which subjects can base their search for sentence accent. Other cues have proven sufficient; in the present experiment the available cues included both durational and amplitude information. As Cutler and Darwin pointed out,

however, this does not imply that either durational or amplitude cues must be necessarily present for the accent effect to be found. There is ample evidence from studies of prosodic cues to the perception of lexical stress and to the perception of syntactic structure that the human speech processor can derive a given piece of information from any of a wide range of alternative cues. For instance, the location of a syntactic boundary in a syntactically ambiguous sentence can be identified on the basis of fundamental frequency variation (Lea, 1973; Collier & 't Hart, 1975) or durational variation (Lehiste, Olive & Streeter, 1976; Scott, 1980). Likewise both fundamental frequency (e.g. Cheung, Holden & Minifie, 1977) and duration (e.g. Nakatani & Aston, 1978) serve as effective cues for the perception of lexical stress.

Thus the perception of sentence accent most probably has in common with the perception of lexical stress and the prosodically guided location of syntactic boundaries the fact that they can all be achieved by the use of quite a variety of cues. The question which must be asked at this point is why prosodic cues to sentence accent are so efficiently employed. That is to say, we have already seen that lexical stress is an intrinsic part of the lexical representation of words, and that stress information therefore serves to aid word identification. Word identification is obviously the most crucially important part of language understanding. Similarly, syntax is a vital part of understanding a sentence, and it is not surprising that any prosodic cues to syntactic structure should be exploited without hesitation. Is sentence accent, however, in the same league as lexical identity and syntax when it comes to intrinsic importance within the sentence, and hence usefulness to the sentence comprehension process?

Consider the written representation of language. Each word has an orthographic identity and word boundaries are marked with spaces; word identification is comparatively easy. Syntax is explicitly represented where necessary by marks of one kind or another. Sentence accent, however, is usually not represented at all - in rare cases, usually in more casual writing, words may be underlined or capitalised for emphasis, but there is no explicit orthographic convention which signals the location of primary accent in the way that, for instance, a comma signals the location of a syntactic boundary.

Sentence accent is a property of the spoken sentence only. In the utterance it communicates information structure, as we have seen - focus or contrast. There are other devices for expressing focus, it is true. For example, certain syntactic constructions - e. g. clefting, pseudo-clefting, topicalisation - serve to bring elements of the sentence into the foreground. Their use is, however, comparatively rare. The information structure of a sentence is also affected by the structure of the discourse in which the sentence is uttered. However, the important thing to note is that other devices are subordinate to prosodic focussing; accent overrides both dis-

course cues to what might be most important in the sentence, and syntactic cues. To take a simple example, in the cleft sentence (11) the focus of the sentence, and hence the location of sentence accent, would in the default case be assumed to be *Sandy*.

(11) It was Sandy who started it.

But there is nothing unusual in using a cleft construction in which the clefted item is old information and the accent falls elsewhere:

(12) A: Don't tell me Sandy got into that fight.
B: It was Sandy who started it!

This is not a major point; it is only to emphasise that syntactic cues to focus cannot override accent — accent always determines information structure. Thus the new information in (12) is about starting the fight.

Given that accent is the primary cue to what the speaker considers the most important part of his utterance, then, it is clear that using cues in the prosodic contour to direct one's attention to the accented words as speedily as possible would be an effective way of getting quickly to the most important information. Thus it is no surprise to find that one can mimic the accent effect in phoneme-monitoring by manipulating information structure alone without changing the accent. Cutler and Fodor (1979) demonstrated this by having subjects listen to sentences which were preceded by questions focussing on one or other part of the sentence. Thus sentence (13), for instance, could be preceded either by question (14) or (15):

(13) The author of the bestseller refused to go to the congressman's party.

(14) Which author refused to go to the party?

(15) Which party did the author refuse to go to?

Half the subjects in the experiment heard (13) preceded by (14), and half heard it preceded by (15). The sentences were recorded only once, and no strong accent was placed on any item. That is, the speaker who recorded (13), for instance, endeavoured to assign approximately equal accent to each of the six content words in the sentence. It is nevertheless the case, as we have seen, that in English in the default case accent is stronger towards the end of the sentence, so that it is possible that accent was perceived to fall more strongly at the end of the sentence than elsewhere. However, the important fact is that subjects who heard the first question and subjects

who heard the second question each heard acoustically identical versions of the sentence which followed. Within each group half the subjects were listening for a target in the early part of the sentence, focussed on by the first question, while half listened for a target in the later part of the sentence, focussed on by the other question. In (13), for instance, the targets were /b/ - on *bestseller*- and /k/ - on *congressman*. Responses to the early target were faster if subjects had heard the question which focussed on the early part of the sentence, but responses to the late target were faster if subjects had heard the question which focussed on the end of the sentence; that is, focussed targets were responded to faster.

An overall effect of perceived accent is presumably responsible for the further finding that responses to the later targets were generally faster than responses to the early targets. However, the interesting result is that focussing on a particular part of the sentence leads to faster responses to targets at that point, just as accenting a particular part of the sentence produces faster responses to targets on the accented words. Focus behaves analogously to accent with respect to its effect on phoneme-monitoring reaction time. This allows us to conjecture that the accent effect may in fact be a focus effect; in making use of the prosody to direct their attention towards accented words, listeners are actually doing this because the accented words are focussed words. Listeners appear to exploit whatever cues are available - discourse cues (as in the focus experiment) where they exist; prosodic cues (as in the accent experiments) where these are there to be used. In other words, sentence accent perception directly decodes the information which was encoded in the production of accent; accent represents focus, and perception of accent is perception of focus.

Supporting evidence can be found in the way the ability to use prosodic cues to accent is developed. Cutler and Swinney (1980) reported two experiments investigating the perception of sentence accent and sentence focus in young children. These experiments were similar in design to the perception experiments described above, except that the children monitored for whole words rather than individual phonemes. In the first of these experiments it was found that young children (aged between four and six) did not respond significantly faster to accented than to unaccented words, although older children showed an accent effect exactly analogous to the effect in adults. The second experiment tested only four- to six-year-olds and found that among these, only the older children showed a focus effect. Although the development of the accent and focus effects has yet to be monitored in the same children, the results so far seem to imply that the development of the accent effect is dependent on the development of the focus effect. That is, until children have learnt that it is a good idea to listen within sentences for the new, focussed, most important information, they are not going to be able to develop the relatively sophisticated techniques which adults use to zero in as quickly as possible

on sentence focus - e. g. tracking the prosodic contour for the cues it gives to where accent, and hence focus, is going to fall.

In the children, however, we do find a dissociation between the perceptual and productive function of accent. Interestingly, it is a dissociation in the reverse direction to that usually found in children's (or any other) language performance, in that for once productive abilities seem to be ahead of perceptual. That is to say, the very children who cannot respond faster to accented words, i. e. do not show the adult effect of directing special attention to accented words and *anticipating* where they will come, nevertheless correctly assign sentence accent to new information and produce prosodic contours which embody all the information adults need to predict where accent will fall.

Conclusion

The picture that emerges, then, is that the complementary role of prosodic perception and prosodic production develops comparatively slowly. Once adult language competence has been attained, however, the role of prosody in production and in perception is reciprocal: two sides of one coin. Word stress patterns are part of the lexical identity of words, not arbitrarily assigned by rule; thus in language production lexical stress patterns are part of the information about each word which is stored in the mental lexicon and retrieved when the word is looked up as a sentence is spoken. Similarly, identification of stress pattern is part of word identification and is used in the process of looking up a word in the mental lexicon during the understanding of a sentence. Sentence accent, on the other hand, expresses the information structure of a sentence; when a sentence is produced the speaker assigns accent according to what he considers to be the more and less important parts of what he is saying. A listener hearing a sentence finds it important to identify the location of accent and uses all available cues to assist him in his search; and the reason why accent is so keenly sought appears to be precisely because it expresses focus - thus the perception of accent is as intimately connected with the information structure of the sentence as is accent production.

References

- Bansal, R. K. (1966). *The Intelligibility of Indian English*. Ph. D. Thesis, London University.
- Browman**, C. P. (1978). *Tip of the Tongue and Slip of the Ear: Implications for Language Processing*. *UCLA Working Papers in Phonetics* 42.
- Brown**, R. & D. McNeill (1966). The "tip of the tongue" phenomenon. *Journal of Verbal Learning & Verbal Behavior* 5: 325-337.

- Cheung, J. Y., A. D. C. Holden & F. D. Minifie (1977). Computer recognition of linguistic stress patterns in connected speech. *IEEE Transactions on Acoustics, Speech & Signal Processing* 25: 252-256.
- Collier, R. & J. 't Hart (1975). The role of intonation in speech perception. In A. Cohen & S. G. Nooteboom (eds.), *Structure and Process in Speech Perception*. Heidelberg: Springer, 1975. 107-121.
- Cutler, A. (1976). Phoneme-monitoring reaction time as a function of preceding intonation contour. *Perception & Psychophysics* 20: 55-60.
- Cutler, A. (1980). Errors of stress and intonation. In V. A. Fromkin (ed.) *Errors in Linguistic Performance: Slips of the Tongue, Ear, Pen and Hand*. New York: Academic Press, 1980. 67-80.
- Cutler, A. & Clifton, C. E. (1983). Lexical stress effects on phonetic categorization in auditory word perception. Paper presented to the Tenth International Congress of Phonetic Sciences, Utrecht.
- Cutler, A. & C. J. Darwin (1981). Phoneme-monitoring reaction time and preceding prosody: Effects of stop closure duration and of fundamental frequency. *Perception & Psychophysics* 29: 217-224.
- Cutler, A. & J. A. Fodor (1979). Semantic focus and sentence comprehension. *Cognition* 7: 49-59.
- Cutler, A. & D. J. Foss (1977). On the role of sentence stress in sentence processing. *Language & Speech* 20: 1-10.
- Cutler, A. & S. D. Isard (1980). The production of prosody. In B. Butterworth (ed.) *Language Production*. London: Academic Press. 245-269.
- Cutler, A. & D. A. Swinney (1980). Development of the comprehension of semantic focus in young children. Paper presented to the Fifth Boston University Conference on Language Development, Boston.
- Engdahl, E. (1978). Word stress as an organizing principle for the lexicon. *Papers from the Fourteenth Regional Meeting, Chicago Linguistic Society*.
- Fay, D. A. & A. Cutler (1977). Malapropisms and the structure of the mental lexicon. *Linguistic Inquiry* 8: 505-520.
- Ganong, W. F. (1980). Phonetic categorization in auditory word perception. *Journal of Experimental Psychology: Human Perception & Performance*, 6, 110-125.
- Games, S. & 2. S. Bond (1975). Slips of the ear: errors in perception of casual speech. *Papers from the Eleventh Regional Meeting, Chicago Linguistic Society*. 214-225.
- Hirst, D. J. & J. Pynte (1978). Gender, stress and tone: arbitrary features in the organisation of the lexicon. *Sigma* 3: 73-87.
- Jassem, W. & D. Gibbon (1980). Re-defining English accent and stress. *Journal of the International Phonetic Association* 10: 2-16.
- Ladd, D. R. (1980). *The Structure of Intonational Meaning*. Bloomington: Indiana University Press.
- Lagerquist, L. M. (1980). Linguistic evidence from paronomasia. *Papers from the Sixteenth Regional Meeting, Chicago Linguistic Society*. 185-191.
- Lea, W. A. (1973). *Prosodic Aids to Speech Recognition II: Syntactic Segmentation and Stressed Syllable Location*. Sperry Univac Technical Report No. PX 10232.
- Lehiste, I., J. Olive, & L. A. Streeter (1976). The role of duration in disambiguating syntactically ambiguous sentences. *Journal of the Acoustical Society of America* 60: 1199-1202.
- Nakatani, L. H. & C. H. Aston (1978). Perceiving stress patterns of words in sentences. *Journal of the Acoustical Society of America* 63: S5.
- Robinson, G. M. (1977). Rhythmic organization in speech processing. *Journal of Experimental Psychology: Human Perception & Performance*, 3: 83-91.
- Scott, D. R. (1980). *Perception of Phrase Boundaries*. Ph. D. Thesis, University of Sussex.
- Shields, J. L., A. McHugh & J. G. Martin (1974). Reaction time to phoneme targets as a function of rhythmic cues in continuous speech. *Journal of Experimental Psychology* 102: 250-255.