

## PROSODIC SYSTEMS AND LANGUAGE ACQUISITION

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### — Summary —

The study of prosodic features — of intonation, in particular — has received but sporadic mention in the context of research into first language acquisition. In this paper, I propose to discuss one aspect of the relevance of a theory of prosodic features for such research, namely, the relationship between “intonation” and “grammar” in the period of language development preceding twelve months. After discussion of whether prosodic features have an “affective” or a “grammatical” function during this period, the question as to whether intonation or grammar is ontogenetically prior is raised (with special reference to Lieberman’s article on the perception of intonation by linguists) and dismissed as a pseudo-problem which has arisen due to an oversimplification of the nature of intonation. It is suggested that a theory of prosodic features provides a much-needed perspective for understanding language development in the first year.

### — Résumé —

*L'étude des traits prosodiques — de l'intonation, en particulier — n'a été entreprise que d'une manière sporadique dans le domaine des recherches sur l'acquisition de la langue maternelle. Dans cet article, on se propose de discuter d'un des aspects de la pertinence d'une théorie sur les faits prosodiques, à savoir, la relation entre «intonation» et «grammaire» dans la période de développement linguistique précédant l'âge de douze mois. Après avoir discuté si les traits prosodiques ont une fonction «affective» ou «grammaticale» pendant cette période, on soulève la question de savoir laquelle des deux, intonation ou grammaire, apparaît ontogénétiquement d'abord — (en se référant particulièrement à l'article de Lieberman sur la perception de l'intonation par les linguistes) — et on l'écarte comme un faux problème soulevé par une simplification excessive de la nature de l'intonation. On suggère qu'une théorie des traits prosodiques offre une perspective bien plus utile pour la compréhension de l'acquisition du langage dans la première année.*

By prosodic systems I am referring to sets of mutually defining phonological features which have an essentially variable relationship to the segmental/verbal items of an utterance as opposed to those features (e.g. the vowels, consonants, syllabic structure, or lexical meaning) which have a direct and identifying relationship (cf. Crystal, 1969, p. 3 ff.). The features which the analysis organises into systems contrast auditorily in terms of pitch, loudness, duration, and silence, either singly or in combination; and they expound contrasts in meaning of an attitudinal, grammatical, or social kind. The prosodic systems recognized are pitch-direction, pitch-range, loudness, tempo, rhythmicality, and pause. Intonation, in this view, is seen not as a single system of contours or levels, but as a complex of features from different prosodic systems, primarily pitch-range and direction, and loudness. Other vocal effects, similar in their variability and distribution I refer to as paralinguistic features (e.g. variations in nasalization, labialization, supraglottal tension), and some systemicness can be shown to be present there also, though the formal and semantic contrasts are not as discrete as in the case of prosodic features. The description of the prosodic and paralinguistic features and systems of language comprises the non-segmental component of a phonological analysis.

So far, this model (which is explained in detail in Crystal, 1969, apart from the notion of "social meaning", which is discussed in Crystal, 1970) has been exclusively used for adult language study. The question I want to raise here is in what way non-segmental phonological contrastivity in general, and the more specific notions of prosodic systems and intonation, should be related to the other areas of language normally studied in the context of first language acquisition. Most child language studies ignore non-segmental phonology, concentrating almost exclusively on segmental and verbal matters, such as form-class frequency and distribution, sentence length, the development of segmental phonemes, vocabulary, morphology, and (more recently) the system of rules which needs to be specified in order to account for syntactic behaviour. It is possible to collect a few references to non-segmental features in this literature. For example, there are occasional references to "speech-melody" in the early biographical case-studies (e.g. Taine, 1877, Darwin, 1877); there have been some accounts of children's responses to isolated adult intonations (see the surveys in Lewis, 1936, and McCarthy, 1946); and, more recently, various categories of non-segmental contrastivity have been cited in parametric studies of infant vocalization (see Wasz-Höckert, et al, 1968, and other references there). But the methodological weaknesses and lack of precise information about the form of the intonation patterns used or responded to vitiates much of the work within the first two areas, and

the latter research is restricted to prelinguistic vocalization; hence little of the information is of direct value to the linguist interested in studying non-segmental phonology in the first few months of language acquisition. (For amplification of this point, see Crystal, forthcoming). This is unfortunate, as I would argue that without some reference to non-segmental patterns in children at this age, it is not possible to understand the earliest stages of the development of grammatical competence.

Any reference at all to grammar is fairly unusual in this context. Most of the literature that recognizes the existence of non-segmental patterns assumes that the earliest patterns should be given an interpretation wholly in terms of attitudinal, or "affective" meaning. Bridges (1932) presents a fairly typical approach to the progressive differentiation of affect in children: out of an initial state of "excitement" he states there develops a distinction between delight, distress, and excitement (by 3 months), distress dividing into fear, disgust, and anger by 6 months, elation and affection being added by twelve months, and so on. Lewis (1936) also in his survey, considers intonation patterns to be either expressive (*sc* "Of the speaker's affective state", p. 115) or representative (*sc* onomatopoeic), and makes no mention of grammatical function. I am not now concerned with general criticisms which might be made of these approaches, but rather with the specific issue of the inadequacy of such work when viewed in the context of grammatical development. The point may be introduced with a quotation from Fry (1966), who states (after mentioning that the reproduction of intonation patterns is learned early) that this is "not because rises and falls in pitch are particularly easy to imitate but rather because intonation is closely linked with the affective side of speech; its use grows naturally out of the expressive sounds the child has been making..." (p. 191). Now this position — and it is a fairly typical one — does contain a certain amount of truth, and I would not wish to deny that there are close links between intonation and affect; but this account is quite inadequate as a view about the place of intonation in language acquisition, for two reasons. It is an oversimplified account of intonational form, considering pitch-direction only (*cf.* "rises and falls" above), and ignoring other parameters; and it is by no means clear on what grounds intonational phenomena have been singled out from the totality of prosodic and paralinguistic features. It takes very little observation (*cf.* below) to show that pitch contrastivity itself is quite complex in character in this early period, involving features of range as well as direction, and that other variables than pitch expound contrasts (loudness, tempo, and pause, in particular). There is also evidence that, if a more comprehensive study of non-segmental features is made, the

patterns which emerge in this earliest period of language acquisition have a major grammatical function, i.e. the substitution of one non-segmental pattern for another would cause one to assign a different structural description to the utterance, the terms of the description being provided by some already available grammatical model. I shall develop this point below.

Preliminary observations of a few children indicate a pattern of development for non-segmental phenomena which is clearly more complex than that suggested in the previous paragraph. There is a prelinguistic stage, consisting of two periods: a period of undifferentiated, biologically determined vocalization, including for example Wolff's "basic cry" (see Wolff, 1969, p. 82); and a period of largely innately determined, differentiated vocalizations with an affective interpretation only. These latter have essentially the same physical characteristics and affective function for all languages studied; they are difficult to interpret in anything other than very vague, general, attitudinal terms, e.g. "pleasure", "recognition", and they display the phonetic instability characteristic of infant vocalization (and pointed out by, e.g. Lynip, 1951, p. 226; Lenneberg, 1967, p. 277). This stage is discussed in greater detail in Crystal, forthcoming.

The second stage is the development of shorter and more stable, discrete vocalizations, normally between 7 and 10 months (cf. Luchsinger & Arnold, 1965, p. 349; Benda, 1967; Van Riper, 1963; Siegel, 1967, p. 4), which give the impression of being more controlled, and which suggest specific interpretations, e.g. "We think he's saying —", "Listen to him telling us to —". Two examples were of an [a] — type vowel with a low-mid rising tone (apparently equatable with "ta", i.e. "thank-you"), and a disyllabic item, roughly [ɔ:d ɔ:] (but with varying plosive articulations) on two level pitches, the first being higher than the second (apparently equatable with "all gone"). These "primitive lexical items" have both a segmental and a non-segmental character, but it is the latter which is the more stable, and the more readily elicited. They are the first evidence of language-specific patterns<sup>1</sup>. This is a relatively short stage, and indeed it may not be essential to distinguish it from the third stage following.

At the third stage, one can point to the occurrence of "primitive sentences" with confidence, any specific definition of "sentence" here

1. Lenneberg (1967, p. 279): "The first feature of natural language to be discernible in a child's babbling is contour of intonation. Short sound sequences are produced that may have neither any determinable meaning nor definable phoneme structure, but they can be proffered with recognizable intonation such as occurs in questions, exclamations, or affirmations. The linguistic development of utterance does not seem to begin with a composition of individual, independently movable items but as a whole tonal pattern. With further development, this whole becomes differentiated into component parts..."

being identical with that required for adult grammar. In general, when a child's utterance displays some formal and functional independence, in that it can be consistently assigned a specific semantic interpretation, is no longer wholly affective in character, and has a stable phonological form, then I would call it a sentence. Between stages two and three, one might hypothesize the following development. The "primitive lexical items" are presumably the result of a process of imitation of adult forms, which the child perceives as units with a beginning, an end, and a specific phonological shape, which is primarily non-segmental in character. For a while, these words are used as units with the segmental and non-segmental characteristics "fused": the pattern on "ta" is never used for "all gone" and vice versa. Then, as the child becomes aware of a number of "lexical items" of this kind, many having a similar general non-segmental phonological shape, he develops an awareness of a primitive prosodic unit, which provides a frame for any independent contrastive utterance (i.e. sentences). Initially this unit is definable quite simply as a prosodic contour surrounded by silence, the prosodic contour being expounded by any one of the patterns which the child has been able to produce in a babbling way for some months as part of his infant vocalization — and which may of course include other vocal effects as well as pitch (e.g. huskiness), though a pitch feature is usually the dominant one.

Simultaneously, the child begins to develop the range of non-segmental contrasts which can operate as exponents of the prosodic contour, and his phonemic oppositions. The phonemic character of his various "words" clarifies, along lines which are fairly familiar. The range of exponents of the prosodic unit fairly rapidly extends to include contrasts in loudness, pitch-range, duration, tension, and rhythmicity. Between nine and twelve months, I have noted contrasts between high and low pitched, loud and soft, drawled and short, tense and lax, and rhythmic and arrhythmic sentences. Contrastivity involving two or more non-segmental parameters simultaneously (e.g. an opposition between a high long and a low short utterance) and most paralinguistic effect does not develop until later, as more "sophisticated" attitudes develop, e.g. the low, tense, soft, husky voice associated with a "dirty snigger"<sup>2</sup>. Before long (details are unclear), some of the parameters split, e.g. there develop two forms of pitch-range contrast, wide v. narrow, and high v. low; pitch-direction as

2. Carlson and Anisfeld (1969) note a joking tone of voice in their 2-yr-old subject, which was seldom used in imaginative play; and they refer to a style of speech which the child developed in situations in which he was trying to persuade someone to permit something normally forbidden, which they describe as "fuzzy enunciation, very soft voice, and twisting of the head" (p. 575). I have heard paralinguistic exponents for role-play as early as 13 months — in this case, a switch to a falsetto register when talking as the child supposed (under an older brother's influence) a rabbit did.

a system begins with an initial contrast between falling and rising-type tones (i.e. falling subsumes high fall, low fall, rise-fall, etc.), the opposition usually distinguishing statement from query.

Four things should be noted during this period (say, 9-18 months). First, some of these vocal effects may be superficially similar to the vocalizations of the earlier periods, but there is a distinct acoustic and usually auditory difference between, say, the rising tone of query, when this develops, and the rising vocalizations common in the babbling stage. Secondly, some of the parameters relevant for the study of neonate vocalizations have ceased to be used by this period, e.g. nasalization in British English. Thirdly, some non-segmental effects are used around this time which are not retained by adults (unless adopting baby-talk), e.g. marked labialisation, use of falsetto voice for whole utterances, some spasmodic articulations (lip trills, raspberries, etc). Fourthly, during this period of simultaneous development of phonemic and non-segmental systems, the child may at times be uncertain as to what the basis of word identification is, whether segmental or non-segmental. (Presumably tone-language children make a different set of decisions at this stage from those in atonal languages). The uncertainty rapidly disappears, as the number of phonemic contrasts increases, and the importance of communicating referential meanings becomes apparent; but one should note that the function of non-segmental features may be misinterpreted, even quite late on, as being the dominant cue. I have come across a case in English, for example, where the child (in this case of 18 months) referred consistently to all four-wheeled vehicles that made an engine noise as "bus", with a low falling tone; but when a real bus went by, he would say "bus", with a wide rising-falling tone. Granted the original reason for the distinction is probably ultimately affective in character, the fact remains that for a period of some two months, this child was using English as a tone-language, in this single respect.

The next stage covers the period (around eighteen months) when a child begins to group together his primitive sentences, to produce the first evidence of form-classes. (This is the point at which most studies of grammatical development begin, but even if the above hypothesis is wildly incorrect, it should be clear that a great deal of grammatical relevance has taken place hitherto). Each sentence still has its phonological character, and at this time there is evidence of the child playing intonational "substitution-games"<sup>3</sup>.

3. Carlson & Anisfeld (1969) note this at about 22 months: they distinguish listing, question and statement intonations, loud and soft tones, staccato and drawled articulation as well as a number of "styles of speaking" (see p. 118). Eisonson et al (1963) refer to frequent experiments in pitch at 18 months, and note the variety of the child's "vocal overflow".

As sentences get more complex syntagmatically, and develop into the so-called "two-word" sentences, two things happen non-segmentally. The first and most important development is the use of tonicity to control the distribution of emphasis. Secondly, the range of sequential non-segmental patterns increases, e.g. rhythmic contrasts, pause contrasts, speed contrasts (though it should be pointed out that some reduplicative effects are heard from earlier on with monosyllabic "lexical items", e.g. a rhythmic glissando effect on an [o] type vowel was used by one child when asking to be tickled, at nine months). Then, as the range of sentence-types increases, and the amount of functional load for any one prosodic feature increases, there develops the situation of grammatical structure selecting specific prosodic interpretations; e.g. a rising tone, originally only a query-indicator, but later usable as an indication of grammatical subordination, or as a calling intonation, is interpreted accordingly in the light of the grammatical structure with which it co-occurs. The affective information of the prosodic patterns, also, becomes influenced by other factors, e.g. the vocabulary, the kinesics, and the environment in general. At this stage, normally arrived at between the age of two and two-and-a-half for British English children, the non-segmental system seems sufficiently close to the adult system to pose no further major problem for the researcher. Subsequent patterns of development, such as the extent to which intonations are appropriately used in increasingly complex syntactic constructions (e.g. apposition, types of relative clause, and subordinate clauses) do not seem to require the definition of additional non-segmental categories. The issue is largely an empirical one, and is dependent on the prior study of syntactic development in older children in its own terms.

I outline this hypothesis about the development of non-segmental phenomena in order to introduce a point of theoretical interest concerning the implied relationship between the non-segmental features and syntax. To what extent can these features be studied independently of, and be said to contribute to, the development of a grammatical framework? Two theoretical positions seem to be taken regarding this point in the recent literature. First, there is a view which sees intonation, and presumably other prosodic features, as being ontogenetically prior to any period of grammatical acquisition. Weir, for example, (1966, p. 153) argues that early intonation patterns (it is not clear how early) are the means of "segmenting utterance into sentencelike chunks, regardless of the intelligibility of the utterance to an adult listener", and in her 1962 book, she makes use of a phonological sentence defined with reference to pitch-direction and pause. Similarly, Braine (1963, p. 252), in his discussion of how a child learns segmentation, claims that intonation is one means of indicating phrase boundaries. He cites Trager and Smith, claiming that

the progressive segmentation of an utterance is almost completely specified by intonation, i.e. the utterance contains boundary information, though he is not sure exactly how much help intonation is in assigning grammatical structure. As evidence for this, he describes an experiment with a 5-word nonsense sentence, in which the "primary stress" was varied from 12345 to 12345, which showed that the boundary assigned followed the stress on each occasion (p. 248). There is insufficient information given about the other prosodic variables to be able to interpret this experiment properly, but it is clear that his general position, and that of many other scholars, is that intonation is the vehicle on which children arrive at the rudiments of syntax (cf. McNeill, 1966, p. 53).

Bever et al (1963) take a generally opposite position, though they attribute more to Braine in this matter than he claimed. The grounds for their reply are not wholly clear, partly because they take a rather different definition of intonation from Braine<sup>4</sup>, and partly because they confuse issues which should be kept apart<sup>5</sup>; however the following points emerge. They admit that intonation can induce structure in a random sequence, but argue that this is not the issue: "the correct interpretation may not be that the perceived location of pause, stress, and intonation are the child's clue to the analysis of structure, but rather that the prior analysis of structure is what determines where the child learns to hear pause, stress, and intonation. Nor is the possibility of some intermediate position excluded" (p. 270). On the face of it, this is rather unlikely, at least for the earliest period of language acquisition, in view of the large amount of evidence already accumulated showing that children respond to prosodic parameters from a very early age at the expense of structural information (cf. Tappolet (1907), Schäfer (1922), and the literature reviewed in Lewis (1936), including his own position (pp. 115-116), or, more recently, Benda (1967) and Kaplan (1969)). But the main reason why Bever et al's position is not very convincing is because the only evidence they cite in favour of the argument that one needs prior knowledge of syntactic structure in order to analyse intonation is derived from Lieberman's experiment (1965). A great deal of significance has been placed on this

4. In Braine (1963, see 1967, p. 248) intonation is "defined" as "the variety of phenomena referred to by such terms as stress, pitch, juncture, off-glide, on-glide, contour, superfix, intonation-pattern". It is also "certain specifiable properties of the speech signal", and sometimes stress is distinguished (e.g. primary stress is isolated in his fifth experiment, cf. also p. 278 n.). In their reply, however, Bever et al (1963, see 1967, p. 270) talk about "pause, stress, and intonation".

5. They argue at one point that the physical cues for non-segmental contrasts are ambiguous, saying, for example, that physical intensity is relevant to the specification of stress only in cases of special emphasis. This is in any case an overstatement (cf. Fry, 1958, for example), but it is by no means clear how the absence of any one-for-one correlation between attribute and dimension of sound affects the argument. There may be a point here for a theory of perceptual development in relation to learning, but this is quite irrelevant to the syntactic argument, where the precise constitution of the physical cues is beside the point. Intonation is a linguistic category, not a physical one, and the question which has to be answered is whether there are intonational cues for structure (whatever their physical basis) in utterances.



experiment in this context, by other scholars also. McNeill (1966, p. 53), for example, cites it in support of the same view, that syntactic information is prior to intonation in language acquisition, and it is considered an important issue in the discussion which follows Weir's paper at this conference (see Smith and Miller, 1966, p. 170 ff.). McNeill's summary will suffice as a basis for comment.

*Lieberman (1965) compared the ability of linguists to transcribe the intonation contours of real speech with their ability to transcribe physically identical contours of simulated speech that consisted of a single prolonged vowel sound. He found that linguists' transcriptions matched the actual physical contour only of the simulated speech. When the linguists transcribed real speech, the actual and the perceived intonation contours often differed strikingly, which suggests that structure is an important source of information about perceived intonation but not vice versa. A pre-lingual child listening to adult speech is in a position comparable to Lieberman's linguists transcribing a simulated vowel. He is not comparable to Lieberman's linguists transcribing real speech. Infants could note only the physical contour in parental speech, not the perceived contour that is correlated with grammatical structure. It is difficult, therefore, to see how intonation could guide a child to syntax; for no matter how strong the tendency is for children to imitate speech they receive from their parents, they will not imitate the appropriate feature unless important parts of the syntax have already been acquired.*

But it is fallacious to apply the results of Lieberman's experiment to child language in this way. Lieberman's experiment was an extremely specific one: it was designed "to ascertain what aspects of the acoustic signal linguists actually note when they make *Trager-Smith* transcriptions" (1965, p. 40, my italics). It shows quite conclusively that the *Trager-Smith* system conditions linguists to react to real speech in the way McNeill outlines, but what must be pointed out is that the *Trager-Smith* system is an extremely restrictive one — the number of intonational contrasts permitted to appear (as Bolinger pointed out years ago) is relatively small, and omits a great deal. If Lieberman's linguists had been trained exclusively in a system which recognized more contrasts and avoided a phonemic orientation, then it could be argued, there would have been better results. Lieberman does in fact bring a tonetic transcriptional system into the experiment, and finds that the results were much more consistent (the linguist changing only 25% of his notation, compared with the 60% changed when *Trager-Smith* was used). This suggests that Lieberman's conclusions are only relevant for those people who have mastered a specific transcriptional system of intonation — or, one might generalize,

for people who have mastered some transcriptional system. Now there is no evidence whatsoever that the prelingual child has mastered a Trageremic transcriptional system, or any other; consequently Lieberman's conclusions do not apply, and his experiment should not be cited.<sup>6</sup>

What seems to have happened in recent discussions of this problem is that a pseudo-problem has been created, i.e. a problem which is solely an artifact of some specific linguistic model, which vanishes when an alternative model is used. In the present case, children's utterances have been studied in the light of a model which requires a clear formal and functional distinction to be made between intonation and syntax, as such phrases as "intonation guiding one to syntax" implies. But while the analyst may find it convenient to describe the speech signal presented to the child in terms of functionally distinct segmental and non-segmental components, there are no grounds at all for assuming that the child perceives this in any other way than as a single functionally undifferentiated event. Whether a particular syntactic category or meaning-relation is expounded phonologically by segmental-verbal or by prosodic markers is a language-specific question, and clearly the child cannot know this in advance. Consequently, it is misleading to say that syntax guides a child to the use of intonation. But it is also misleading to say the reverse, without careful qualification. All one can say is that there is evidence that the dominant perceptual component of the speech signal is non-segmental, and that some non-segmental patterns are understood and produced prior to anything conventionally syntactic. The details of this process (cf. above), suggest, if they suggest anything, that the child's ability to discriminate non-segmental contrasts at the expense of segmental, in the earliest period, allows him to develop a prosodic frame which organises his utterance into — as Weir put it — sentencelike chunks. But this is not enough to substantiate a hypothesis that "intonation guides a child to syntax", as the notion of intonation implicit in this phrase is very much an oversimplification. The implication is that "intonation" is a single "feature" (or "parameter") which is "acquired" all at once, and, once acquired, retains the same function while the rest of language develops. But (a) intonation is not a single feature, but a complex of features; (b) these features are not acquired simultaneously; and (c) their function is complex, involving grammatical, attitudinal, and social factors, the relative importance of which varies considerably with increasing complexity of

6. An identical conclusion on this point has been reached independently in a very useful thesis by Kaplan (1969, p. 16), as part of a more general argument that "the prior detection of supra-segmental information by the child can lead to the discovery of more basic kinds of language patterns" (p. 4). Unfortunately, I did not see this thesis until it was too late for its detailed reasoning to be considered in relation to the argument of this paper.

the rest of language, and while some aspects of intonation presuppose syntactic competence, other aspects do not.

Concerning the first point, the various systems underlying intonation have been presented elsewhere (Crystal, 1969; Ch. 5), but a highly relevant aspect of this approach needs to be stated here, namely, the point that the adult prosodic system — and to a lesser extent, that of the child — is hierarchical in character. A hierarchical approach is implicit in most models of intonation, and experimental evidence for it is presented in Quirk and Crystal (1966). There is also some evidence of a hierarchical ordering of prosodic features and categories in children. It is clear that some types of prosodic contrasts are more important for comprehension than others. Tonicity is a particularly clear case. For example, there are the phenomena noted by Brown and Bellugi (1964, 141-142), amongst others, that differential stress may be the cause of the child's reduction of adult language in his telegraphic speech, and that children tend to delete the initial unstressed element of polysyllables (e.g. "*tend* for *pretend*"). Also, the notion of "pivot word" only makes sense in my data when seen in connection with intonational emphasis. If this point is considered, along with the view that intonation is not to be considered as a single feature of speech, but rather a complex of parameters and systems, then it immediately becomes apparent that a "compromise" position (cf. Bever et al's remark, above) is not only feasible but probably the only realistic way of resolving the controversy within the terms of the model people have been using. Some aspects of intonation (and other prosodic features) help one to assign structure, *especially in the early period*; other aspects require grammatical cues (of the conventional kind) in order to be analysed, *especially in the later period*. (Cf. Fodor, in Smith and Miller (1966, p. 171), who argues in favour of a simultaneity of cues).

Such a theory would be quite compatible with a theory required for the adult system. Here too one finds many examples of a "grammatical" function of intonation, i.e. cases where one has to be aware of the intonation before one can assign a complete structural description to a sentence, such as the distinction between restrictive and non-restrictive relative clauses (cf. Crystal, 1969, Ch. 6, for further examples), or the use of tonicity to control the nature of the "presuppositions" which would be part of the complete semantic analysis of a sentence (cf. Fillmore, 1968, Chomsky, 1969); and there are also many cases where one is unable to analyse the intonation without some reference to grammatical boundaries (e.g. when unstressed syllables at the end of one tone-unit and at the beginning of the next are at the same pitch-level and not

separated by any pause). In any event, what is evidently needed is a more comprehensive account of the range of non-segmental features which come to be acquired, as, in the absence of this, the more interesting question of the expression of grammatical competence cannot be precisely answered. It is with this end in view that I would emphasise the importance of developing a theory of non-segmental phonology as a perspective for understanding the first stages of language acquisition.

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## QUESTIONS

### Question:

(P. Lieberman, University of Connecticut and Haskins Laboratories)

- I'd be happy to report an agreement with you on the results of the Word experiment, entitled "On the perception of intonation by linguists": my view was that the Trager-Smith pitch notation was essentially a gloss for semantic information which was derived from the underlying deep phrase marker; in fact many of these so-called morphemes had no physical basis in the acoustic signal. Indeed this is what the experiment showed. The second point is this: children certainly do seem to be developing, in a pre-babbling stage (the first six or eight months of life), not only perhaps semantic information, syntactic constraints, but also the phonetic apparatus. They seem to start with fairly simple intonational contrasts. In some papers which will appear later this year it is apparent that they even seem to start with a very simple vowel repertoire: they can't even produce the range of human vowels because their vocal tract resembles more closely that of the great apes than of adult humans. There are all sorts of changes, and I think the reasonable view is that the child is developing, simultaneously, syntax, output phonology, and so on.

### Answer:

- I think the important point in connection with this last issue you raised is that people tend to underestimate the amount of phonetic, and potentially phonological, variability that can go on in the first few months. When looking for intonational contours in these children a return to a more general approach is necessary.

### Question:

(K. Pike, University of Michigan)

- There is a paper describing an experiment we conducted some years ago, in which we controlled the intonation of a baby (we were in a little Aztec Indian community), and my wife insisted that we speak to the child exclusively

in falling intonation, and also that we teach the child contrastive intonation, deliberately as one would teach a foreign student vocabulary, before the child had any identifiable word whatever. The results showed that one can, if one chooses, control intonation to be heard by a child and distinguish contrastive, calling and other intonations produced by a child. Unfortunately, we had to leave the child in question with other people for a few weeks, and on our return the baby was a normal American baby, saying "horse", "flowers", and other words, with rising intonation.

**Answer:**

- That was a fascinating experience. More recently, I have come across one or two cases of people in a sense replicating this experiment, using some of the more modern techniques not just for production but also for reception. E. Kaplan, for her doctoral thesis at Cornell (on child discrimination of intonational contours), presented children with falling contours and rising contours; using various criteria — for example, the change in cardiac rate and other orientating behaviour — she was able to demonstrate that at the age of eight months the children were able to discriminate between the two kinds of contour, particularly when the contours had the addition of stress. And there is some evidence to suggest that this discrimination occurs at an even earlier age.