

# *Paralinguistic Behavior as Continuity Between Animal and Human Communication*

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To both layman and scholar, that area of nonverbal vocal behavior generally if vaguely referred to as "tone of voice" is held to be a significant point of overlap between human and animal communicative systems. One does not need a batch of references to support the assertion that factors such as pitch, loudness, and speed of speaking are relevant in the elicitation of differentiated responses by many domestic pets; and the implication that this is accordingly an area of communicative behavior that animals and man share is widely found in the literature on zoosemiotics and communication. Sturtevant, for example, expressed the general view (1947: 45) that "the exclamatory parts of language, like many animal cries, are characterized by extreme variations of pitch and loudness . . . . There is abundant proof that other animals of the same species respond to these calls roughly as men respond to the highly emotional features of languages."

Following Trager (1958), Hockett (1960), and others, this area is generally labelled as PARALANGUAGE in the context of human communication and considered analogous to the expressive vocalizations of various animal species. Abe (1967: 55), for instance, talks of "the universality of animals' use of symptomatic signs which belong to the field of paralanguage," and Thorpe uses the term PARALINGUISTIC to refer to both human and animal communication (1972: 27, 33). In the search for continuities between animal and human communication, then, it would seem that paralinguistic phenomena provide evidence of a particularly compelling kind. The author suggests, however, that positive conclusions on this topic are probably false and at best premature.

The term "paralanguage" has in many ways been more of a hindrance

than a help to progress in our understanding of nonverbal vocal behavior. The appealing simplicity of the dualism "language-paralanguage" led very early on within linguistics to an interpretation of paralanguage as a communicational residue; whatever features of vocal behavior could not be coped with by one's model of language were labelled paralinguistic. Paralanguage came to be used as a convenient cover term for a miscellany of unanalyzed phenomena, whose theoretical homogeneity was uncritically assumed. The dualism became institutionalized when paralanguage was classed along with nonvocal modes of communication under the general heading of "semiotics" (see Sebeok, Hayes, and Bateson 1964).

The reasons for this state of affairs would lead us into detailed consideration of the history of ideas in linguistics, and cannot be considered here (a fully referenced discussion can be found in Crystal 1974); but, briefly, what seems to have happened is the following. Trager's influential characterization (1958) of paralanguage was a part of his overall descriptive framework, and the term received its definition and status from its relationships with other categories of the theory, in particular from the view that only phonemic and morphemic analysis was the domain of linguistics proper. As soon as alternative accounts of linguistic structure developed, in the mid-sixties, the status of paralanguage inevitably became unclear. Fields such as psychotherapy, anthropology, and language teaching took over and developed many of the DESCRIPTIVE insights of the approach, and found the notations and *ad hoc* classifications of great value. But there was little examination of the theoretical basis of the description, and no discussion of how a notion of "paralanguage" could be made to fit in with the new concepts of language which were developing at this time.

One thus finds the development of a situation in which a widely used descriptive framework rests on a largely implicit theoretical foundation. And in the absence of explicit analytic criteria, one naturally finds arbitrary descriptive decisions, ambiguous cases being forced into one or another of the set of choices provided by the framework, and, following this, inconsistency in the use of terms by various scholars.

It is possible to distinguish seven main viewpoints as to the range of phenomena which might be subsumed under the heading of paralanguage, and I list them briefly here (for a referenced discussion, see Crystal 1974):

1. including both nonhuman and human vocalization;
2. human communication only, but including nonvocal (kinesic) as well as vocal;

3. vocal communication only, but including some segmental phonation as well as nonsegmental;
4. nonsegmental phonation only, including voice quality ("voice set," in the sense of Trager [1958] — the nonlinguistic, background, person-identifying characteristic);
5. nonsegmental phonation, excluding voice quality;
6. nonsegmental phonation, excluding voice quality and the prosodic phonemes (of intonation, stress, and juncture) found in the approach of Trager and others; and
7. a small subset of (6).

I propose to use a broad linguistic definition as the basis for discussion, as in sense (5). In other words, paralanguage is defined as meaningfully contrastive, institutionalized, nonsegmental phonation. This therefore excludes kinesic and other nonvocal phenomena — a desirable distinction, in my view, until such time as it can be shown that there are sufficient parallels between paralinguistic and kinesic structures to warrant a conflation. Likewise, this sense postpones any discussion of whether intonation and related features are sufficiently different from other types of nonsegmental linguistic behavior to warrant their being given a totally different theoretical status. The point at issue is whether sense (1) is a legitimate conflation and it is this which I hope to throw some light upon.

From an operational point of view, paralanguage is defined with reference to one or more of the following parameters: pitch, loudness, speed, pause, and rhythm (all these sometimes being classified separately as "prosodic features"); and laryngeal, pharyngeal, oral, and nasal articulations. All of these effects are classed as nonsegmental when they cannot be described with reference to a single segment, or phoneme, in the sound system of the language but continue over a stretch of utterance to segments in different parts of an utterance that are all affected by a single configuration of the vocal organs (e.g. when the labialization of adult "baby talk" produces a cumulative impression and interpretation that affects the whole of the utterance).

Each articulatory variable produces a range of effects that can be studied in terms of a system of contrasts, of varying degrees of discreteness and systematicity of function. Examples include contrasts in articulatory tension, degrees of resonance, types of whispered or breathy articulation, spasmodic articulations (as in giggled speech), degrees of nasalization or labialization, variations in the center of gravity of the tongue (advancement or retraction, as in palatalization and velarization respectively), register contrasts (e.g. falsetto versus chest voice), types of

pharyngeal constriction (such as huskiness), contrasts in pitch direction and pitch range, and gradual or sudden changes in loudness or speed of speaking.

The question is: given this range of phenomena in man, to what extent is it a major area of overlap with animal vocal behavior? Certainly, while we are speaking in operational terms, there does seem to be an overlap. While accepting that there is an absence of comprehensive descriptive studies (cf. the lament of Sebeok, Altmann, and others, e.g. Altmann 1968: 501), the partial accounts we do have are couched in terms that are remarkably similar to those used for the study of human paralinguistic behavior. Brief examples are the tentative functional classification of neighing in terms of height, loudness, and length (Tembrock 1968: 379), and later in the same paper, the identification of a wide range of vocalizations in terms of pitch direction and range, loudness, rhythm, tonal quality, and various laryngeal, spasmodic, and other contrasts (see especially the discussion of Felidae, Tembrock 1968: 367); and of course there are the classical analyses of bird vocalization by Thorpe (1961, and elsewhere).

In this area, as in human paralinguistic studies, a great deal of effort has been expended on the problem of terminology, both for formal labelling (e.g. croak, grunt, hiss, shout) and its semantic interpretation (e.g. happy, surprised, intention to frighten), though it is strange that such "human-oriented" terms as "intonation" and "paralanguage" receive no attention at all in the otherwise admirably full terminological preamble and index in Busnel (1963). From a functional point of view, the threefold classification of paralinguistic phenomena into emotional, social, and grammatical roles also has parallels in zoosemiotics (the first two are obvious; by grammatical, I am referring to the view — held, for example, by Thorpe [1972: 33, 54] — that certain animal vocalizations display a definite "syntax"). For such reasons, then, one might expect the notion of paralanguage to be readily applicable to both human and animal vocalization and a conclusion about continuity made accordingly.

But I think we would be wrong to draw such a conclusion, at least, for the present. I wish to argue that any suggestion of a real similarity between human paralinguistic phenomena and animal vocalization is premature and, in the present state of our knowledge, misleading. The essence of the argument is that paralanguage was given an inadequate analysis when the question of its potential relevance for the study of animal communication was first raised, namely, in the design-feature approach to language of Hockett (1960; see also Hockett 1968; Altmann

1968). In terms of the criteria used there, paralanguage did seem to be intermediate between human language (in the sense of phonemes, morphemes, syntax, etc.) and the various kinds of animal communication illustrated. Now that a great deal more paralinguistic study has taken place, it is possible to reevaluate its status *vis-à-vis* human and animal communication and to conclude that paralanguage is much closer to the rest of language than was originally anticipated. The overlap with animal communication is minimal and trivial.

In terms of the sixteen design features of human language recognized by Hockett, paralanguage emerged as follows:

#### CLEARLY POSITIVE

1. Broadcast transmission and directional reception
2. Rapid fading
3. Openness (new linguistic messages are coined freely and easily)
4. Tradition (language conventions are passed down by teaching and learning)
5. Prevarication (ability to lie or be meaningless)
6. Learnability (possibility of foreign language learning)

#### QUERY POSITIVE

7. Specialization (the direct-energetic consequences of linguistic signals are biologically unimportant; only the triggering consequences are important)
8. Semanticity (the existence of a denotative relationship between signals and features in the world)

#### PARTIALLY POSITIVE

9. Vocal-auditory channel
10. Interchangeability (adult speakers are both transmitters and receivers)
11. Complete feedback (speaker is able to perceive everything relevant to his signal production)
12. Arbitrariness (no dependent physical interrelationship between signals and referents)
13. Discreteness (repertoire not continuous)
14. Displacement (can refer to things remote in time and space)

#### NEGATIVE

15. Duality of patterning (meaningless signal elements combine into meaningful arrangements)

16. Reflectiveness, or reflexivity (ability to communicate about the system itself).

The design feature listing has its weaknesses, as is readily admitted (Altmann 1968: 64). In particular, not all the features have the same degree of importance, and thus it becomes difficult to establish the status of a type of behavior such as paralanguage. But there are certain specific problems with this characterization of paralanguage as it stands, such that it is possible to argue that of most the negative points (9-16) arise from an inadequate understanding of the formal complexity and functional significance of paralinguistic effect. This is very clear in relation to points 15 and 16.

Of all the design-features, duality of structure (or "double articulation") seems to be the most important with regard to the specificity of its claims about linguistic structure (cf. Lyons 1970: 12). This is the property whereby a set of signal elements, themselves meaningless, produce meaningful results when used in patterned combinations. Language, therefore, has duality of patterning, and the same is said of various animals, including primates, Canidae, and birds.

But paralanguage is said to have no duality. This seems unreasonable. Whatever definition of paralanguage one takes, Thorpe's comment about birds would seem to be equally applicable to it: "A bird's song may . . . be made up of anything from half-a-dozen to several hundred 'notes' . . . . Most of these 'notes' are quite meaningless if sounded alone; but grouped in the correct pattern of the song they can convey a great deal of information both as to the species and the individual involved" (1972: 33). For example, it is well known that the nonsegmental characteristics of a single syllable (e.g. a pitch, a stress, a duration, an instance of nasalization, a whisper) are uninterpretable until they are put into sequences and related to the voice norms of individuals in specific contexts.

In intonation, the fundamental concept of a "contour" or "tone unit" is recognition of the fact that, characteristically, semantic interpretations can only be assigned to "complete" syllable sequences; and the same applies to variations in tempo, loudness, rhythm, and other effects. In each case, the minimal variable element is generally meaningless. (The qualification "generally" is important, because there are usually a few cases within a language where, assuming a known speaker, there are effects which can be interpreted semantically on the basis of minimal occurrence: in other words, the signal elements are meaningful and their sequential combinations do not produce a different kind of meaning.

Examples would be the "voice qualifications" of Crystal and Quirk [1964]: laugh, giggle, tremulousness, sob, and cry. But there are not many examples of this kind in language.) The need to take into account rules of sequence and of hierarchical structure is well recognized in intonational studies (e.g. Halliday 1967; Pike 1945); and one needs to adopt a similar point of view in accounting for the meaningfulness of most other paralinguistic phenomena.

"Reflectiveness" is the property of language by which we can communicate about the system in which we are communicating. (It is a better term than "metacommunication," used for instance by Altmann [1967], as this is readily confusable with the linguists' and philosophers' use of the term "metalanguage.") (Reflectiveness is in effect the recognition of context-dependence in language, the fact that certain signals alter the significance of other signals. In their recent discussion, Hockett and Altmann illustrate "metacommunication" in the following way: it is

. . . communication that is some sort of commentary on other communication. . . . In human speech we can have "primary" communication and metacommunication in the same system, as when we interrupt what we are saying with "You're not listening!" or with "I guess I expressed that badly." But we also carry on, in paralinguistic and kinesic form, a virtually uninterrupted running commentary on what we are saying in words. Something much like this seems to be the case with many other animals: virtually all social messages are accompanied by contextual or "framing" cues that affect the interpretation or response (Altmann 1968: 67).

But this approach gives rise to problems. I do not wish to go into the question of whether reflectiveness operates in animals, about which there is a difference of opinion (e.g. Thorpe, following Hockett, says there is not [1972: 33], whereas Cullen cites cases to the contrary [1972: 108]). Purely on the human side, one must ask: How valid is this notion of "commentary"? To what extent is it possible to take an utterance in a given situation and determine what within it is "central" and what "modulation"? As Birdwhistell says (1970: 86, and see further, 188-189): "It is all too easy to assure ourselves that there is in any social interchange a CENTRAL, a PRIMARY or a REAL meaning which is only modified by a redundant environment . . . . Our temptation to classify certain aspects of a transaction as the central message and other aspects as serving only as modifiers rests upon untested assumptions about communication." I would agree. To say that X changes Y to Z presupposes that we have criteria for isolating X as "basic" or "primary." And how does one make such a distinction in practice?

The more one examines speech in its full interactional context (and

not simply in its written representation), the more one finds examples of utterances in which the primary determinants of the speaker's identity and purpose and of the listener's response are paralinguistic ("Say it as if you mean it," "You don't SOUND as if you're a clergyman," and the unavoidable "It wasn't what he said, but the way that he said it . . ."). In such cases, paralanguage has played a central, not a peripheral role. Another example would be the phonological exponent of emphasis. The emphasized word in "He NEVER said that" may be produced in a variety of ways — with very high pitch range, very low pitch range, fortissimo loudness, pianissimo loudness, extra-long duration, whisper, husky, or creaky voice — and it is difficult to see how any of these effects in this context can be said to be "merely modulating" in function (this phrase being taken from the discussion of Cullen's paper in Hinde [1972: 124]).

If we grant paralanguage a communicative status in its own right, it follows that we must alter our opinion about its ability to display reflectiveness. But we must first take account of the objection of Lyons (1972: 54), who considers it debatable whether intonation has this property "since the repetition by the listener of some part of what the speaker has just said with a different and distinctive intonation (and stress) may have the effect of querying, not what has been said, but the appropriateness of the words chosen to describe it." This ambiguity does exist, but it can be avoided, with the contrastive intonation involved having a clearly reflective function.

One example is in the use of high pitch range plus rising tone to express echo-utterances (Quirk, et al. 1972: 408 ff.), as in:

- (A) It's JÖHN on the phone. (B) *h* JÖHN?

Another example is the intonation which indicates the use of a "softened" connecting phrase, such as "you know," "I mean," "you see," "sort of," where the phrase in the appropriate intonation conditions the stylistic force of the accompanying sentence and contrasts with the "literal" meaning of the words, as in:

you *h* KNOW/I think he's RIGHT (= let me tell you, I think . . .)  
you KNOW I think he's right (= you are aware that I think . . .)

Examples using other paralinguistic effects would be the use of husky or whispered voice on the word "not" in the following:

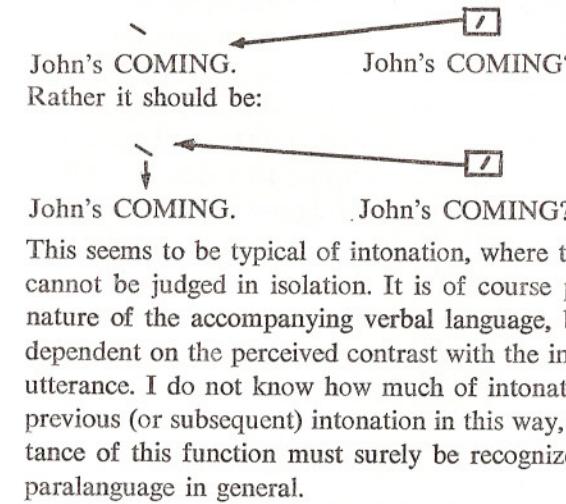
- (A) John's coming to the meeting. (B) He's not

On grammatical words, it seems unlikely for anything other than reflective function of paralinguistic effects to be present. And as

final example, there is the allegro tempo used on a phrase to indicate that the preceding structure was an error, as in the emphasized phrase following:

You're not getting the bus GETTING THE TRAIN are you?

Now given such examples, I think we must argue that the reflectiveness involved is a property of the paralinguistic system itself. It would be misleading to relate the marked intonational or speed contrasts involved directly to the verbal context preceding, as the "commentary" notion suggests, viz.,



If we now move on to the design-features which are said to be PARTIALLY positive in respect to paralanguage, it also seems possible to indicate a rather more central role for the phenomenon than in the original analysis. The question of VOCAL-AUDITORY CHANNEL is clearly a matter of definition, which I have excluded from consideration by the definition adopted in this paper. (A comparison of the structural differences between paralinguistic and kinesics warrants a separate study.) INTERCHANGEABILITY, whereby adult speakers are transmitters and receivers of the same range of linguistic signals, would seem to apply almost totally to paralanguage, as long as we realize that by linguistic signals here we are referring to relative, and not absolute, contrasts. The fact that a female voice is higher in terms of fundamental frequency than that of a male is not a relevant consideration; the point is that the relative differences between, say, high and low pitch contours or between normal and allegro speed are isomorphic between men and women (cf. Crystal 1971b for further discussion). COMPLETE FEEDBACK states

that the speaker is able to perceive everything relevant to his signal production. If the emphasis is on ABLE, I can see no difference between paralanguage and language here.

DISPLACEMENT is the ability to refer to things remote in time and space. This property, as Hockett and Altmann accept (Hockett 1968: 64), is not clear, as it is not an all-or-none matter but one of degree. "Just how far away from the site of a communicative transaction must the topic of the message be before we will speak of displacement? And... do we measure the distance of the topic from the transmitter or the receiver?" There is no intrinsic reason, of course, why pitch, and the other variables, should not be used with a displaced, cognitive role: witness the use of tone in some languages to distinguish between present and past tense, for example (as in Twi). But even with respect to paralanguage in general, it is perfectly possible — and perhaps even normal — if someone has been frightened, for instance, for the vocal indications of the fright (e.g. tremulousness, high pitch range, short tone-units) to remain for some time after the event. *Contra* Lyons (1972: 54), then, it would seem that intonation, and probably paralanguage as whole, is in principle capable of displacement. We are therefore left with DISCRETENESS and ARBITRARINESS as partially positive design features, and these are more debatable.

The question of the arbitrariness of paralinguistic features is nowhere near solution, but one thing is clear: there can be no total dependency of paralinguistic effect on the nervous state of the organism. The view that there is an endogenous basis derives from the widely held assumptions that the sole function of paralanguage is emotional and that such features are, as Bastian puts it, "linguistically insignificant" (1964: 144). But the existence of numerous "structural" or "cognitive" uses of paralanguage, especially of pitch, loudness, and speed, demonstrates the opposite (see above, and Crystal 1969: Chapter 6), as does the range of social or stylistic "roles," where paralanguage is introduced into a discourse in a controlled manner (as when one "adopts" a persuasive tone of voice or an authoritative voice: see the classification of social roles in Crystal 1971a).

But even in relation to the purely emotional role, there are considerable differences between the paralinguistic norms of various languages and the function of the formal contrasts found. Comments about the "liveliness," "monotony," or "speed" of different languages suggest the former; misinterpretations of abruptness or sarcasm in learning a foreign language suggest the latter. There are, of course, cases where the paralinguistic effect is certainly correlated with nervous tension, e.g. degrees

of increasing intensity of excitement correlating with increased pitch height, degrees of increasing intensity of disparagement correlating with increased pitch depth or huskiness. But to what extent these are universal remains unclear. Certainly, when one considers the range of functions which paralinguistic effect enters into and the range of differences which cross-linguistic comparisons have already indicated (e.g. in Sebeok, Hayes, and Bateson 1964), it would seem premature to be talking of universals. Referring to paralanguage as "partially positive" in respect to the design feature of arbitrariness thus seems to be reasonable, though it is perhaps something of an understatement, as there is far more arbitrariness involved in paralanguage than in other modes of semiotic behavior.

The issues concerning discreteness have been clouded somewhat by a tendency to confuse physical and linguistic notions of discreteness. As Altmann points out (1967: 341), it is not enough to claim that a communication takes place analogically rather than digitally by showing a continuous gradation in a signal; there must also be functional continuity — a one-to-one mapping of the signals onto a continuous array of denotata — and the difficulty lies in demonstrating this. Thus to say that a falling and a rising tone are at opposite ends of a continuously graded scale is true in a trivial, physical, or perceptual sense, but by no means self-evidently true in a semantic sense, and it is in fact extremely difficult to state the "meaning" of the contrasts in terms which demonstrate a continuous semantic gradation.

Even with examples in context, judges tend to give semantic interpretations of paralinguistic features using a wide range of labels (e.g. a rise in pitch may be understood as "sympathetic," "interested," "puzzled," "ironic" . . .), and these labels often have little in common with those used for the interpretation of the other features with which they are supposed to be in continuous gradation (e.g. a drop in pitch MAY be interpreted as "unsympathetic," "uninterested," etc., but one will also find a fresh set of labels used, such as "serious," "matter-of-fact," "sad" . . .). It is clearly a complicated situation, which will only be sorted out once the semantics of the various labels have been given some separate clarification, for instance, establishing the meaning-relations (of antonymy, hyponymy, etc.) which operate between them. And meanwhile, all one can safely say about paralanguage, from the point of view of discreteness, is that whereas it is obviously not discrete in the same sense as the phonemic and morphemic systems of verbal language, it is not at all obvious that it is analogic either, in Altmann's sense.

My own view is that the amount of discreteness to be found in para-

language has been seriously underestimated, as a result of the assumption that the only kind of discreteness which matters is that associated with phonemes and morphemes. This was the assumption which permitted certain aspects of nonsegmental phonation to be given a linguistic description (as "pitch-phonemes," etc.), related aspects being classed as "extra-" or "metalinguistic." The arbitrariness of this demarcation is but one criticism among many which have been made of the phonemic model of intonation (e.g. by Bolinger 1949, 1951), and the dangers of defining significant contrastivity in language solely in terms of a model set up for the analysis of one kind of linguistic patterning only (i.e. the phonemic kind) has been criticized by others (e.g. Sebeok 1968: 9).

The point is that to show that paralinguistic features lack phonemic-type discreteness is not to say that they have no discreteness at all. Discreteness is itself a "more-less" phenomenon: some contrasts, even within phonemics, are more discrete than others. In paralanguage, one may show that certain features are highly discrete, others not, and between them one may plot a gradient of linguistic contrastivity, along which the various systems of paralinguistic features can be placed. This, at least, is the approach of Crystal (1969).

But whether this approach as a whole is valid or not, what is important here is the recognition of the existence of a wide range of paralinguistic contrasts that are quite comparable to the morphemic or syntactic discreteness operating elsewhere in language. The grammatical contrastivity expounded by intonation, between restrictive and non-restrictive clauses in English, would provide one example; the variations in tonicity which alter the "presuppositions" of an utterance provide another; and many other "grammatical" uses of pitch have been noted (e.g. in Crystal 1969: Chapter 6; in Bolinger 1972).

I am not denying the difficulty of setting up discrete units in the area of paralanguage, of course (cf. Diebold 1968: 544-545); rather, I am admitting that this is very different from denying paralanguage any discreteness at all. It might be, then, that future discussion of this issue would fare better if more attention were paid to our techniques of measurement, and other aspects of our research design. If, as Saussure said, it is the point of view which creates the object, then it is about time we looked more closely and critically at the former. (See Sebeok [1962], especially on the questions of gradience and expressiveness in language.)

On the basis of these remarks, it seems that at best paralanguage can be disassociated from language only with respect to a partial difference under the headings of discreteness, arbitrariness, and duality. There are therefore few grounds for considering it to be "midway" between

human language and other modes of communication, human or animal. It may be that with further study a comparable structuring will emerge in animal vocalization; but in the meantime I would agree with Marler (1961: 303) that the notion of paralanguage is not readily applicable to animals. It is as potentially misleading to talk about animal vocalizations in terms of pitch tunes, etc. as it is to talk about vowels and consonants, unless it is made clear that the descriptive terminology has a quite different status. (An identical problem faces the student of infant "prelinguistic" vocalization, see Crystal i.p.).

There seems to have been a pendulum swing in comparative studies, whereby an original emphasis which attempted to make a complete differentiation between language and animal communication (e.g. Hebb and Thompson 1954) has now moved to one in which there is a desire to show as much in common as possible. To go into the relative merits of these approaches is hardly a matter for linguists; but it is important that in any such discussions, for instance those concerning paralanguage, we should keep the limitations of our theoretical constructs clearly in mind.

## REFERENCES

- ABE, I.  
1967 On bio-phonetics. *Bulletin of the Tokyo Institute of Technology* 79:53-57.
- ALTMANN, S. A.  
1967 "The structure of primate social communication," in *Social communication among primates*. Edited by S. A. Altmann, 325-362. Chicago: University of Chicago Press.
- 1968 "Primates," in *Animal communication*. Edited by T. A. Sebeok, 466-522. Bloomington: Indiana University Press.
- BASTIAN, J.  
1964 "The biological background of man's languages," in *Georgetown round table on languages and linguistics 15*. Edited by C.I.J.M. Stuart, 141-148. Washington, D.C.: Georgetown University Press.
- BIRDWHISTELL, R. L.  
1970 *Kinesics and context: essays on body-motion communication*. Philadelphia: University of Pennsylvania Press.
- BOLINGER, D. L.  
1949 Intonation and analysis. *Word* 5:248-254.  
1951 Intonation — levels v. configurations. *Word* 7:199-210.
- BOLINGER, D. L., editor  
1972 *Intonation*. Harmondsworth: Penguin.

- BUSNEL, R.-G., editor  
1963 *Acoustic behaviour of animals*. Amsterdam: Elsevier.
- CRYSTAL, D.  
1969 *Prosodic systems and intonation in English*. London: Cambridge University Press.  
1971a "Prosodic and paralinguistic correlates of social categories," in *Social anthropology and language*. Edited by E. Ardener, 185–206. London: Tavistock.  
1971b Absolute and relative in intonation analysis. *Journal of the International Phonetic Association* 1:17–28.  
1974 "Paralinguistics," in *Linguistics and adjacent arts and sciences*, 265–295. Current Trends in Linguistics 12. Edited by T. A. Sebeok, et al. The Hague: Mouton.  
n.d. "Non-segmental phonology in language acquisition: a review of the issues."
- CRYSTAL, D., R. QUIRK  
1964 *Systems of prosodic and paralinguistic features in English*. The Hague: Mouton.
- CULLEN, J. M.  
1972 "Some principles of animal communication," in *Non-verbal communication*. Edited by R. A. Hinde, 101–122. London: Cambridge University Press.
- DIEBOLD, A. R.  
1968 "Anthropological perspectives," in *Animal communication*. Edited by T. A. Sebeok, 525–571. Bloomington: Indiana University Press.
- HALLIDAY, M. A. K.  
1967 *Intonation and grammar in British English*. The Hague: Mouton.
- HEBB, D. O., W. R. THOMPSON  
1954 "The social significance of animal studies," in *Handbook of social psychology*. Edited by G. Lindzey, 532–561. Reading, Mass.: Addison-Wesley.
- HINDE, R. A., editor  
1972 *Non-verbal communication*. London: Cambridge University Press.
- HOCKETT, C. F.  
1960 The origin of speech. *Scientific American* 203:89–96.  
1968 "A note on design features," in *Animal communication*. Edited by T. A. Sebeok, 61–72. Bloomington: Indiana University Press.
- LYONS, J.  
1970 *Chomsky*. London: Fontana.  
1972 "Human language," in *Non-verbal communication*. Edited by R. A. Hinde, 49–85. London: Cambridge University Press.
- MARLER, P.  
1961 The logical analysis of animal communication. *Journal of Theoretical Biology* 1:295–317.
- PIKE, K. L.  
1945 *The intonation of American English*. Ann Arbor: University of Michigan Press.
- QUIRK, R., S. GREENBAUM, G. LEECH, J. SVARTVIK  
1972 *A grammar of contemporary English*. London: Longman.
- SEBEOK, T. A.  
1962 Coding in the evolution of signalling behavior. *Behavioral Science* 7:430–442.
- SEBEOK, T. A., editor  
1968 *Animal communication: techniques of study and results of research*. Bloomington: Indiana University Press.
- SEBEOK, T. A., A. S. HAYES, M. C. BATESON  
1964 *Approaches to semiotics*. The Hague: Mouton.
- STURTEVANT, E. H.  
1947 *An introduction to linguistic science*. New Haven: Yale University Press.
- TEM BROCK, G.  
1968 "Land mammals," in *Animal communication*. Edited by T. A. Sebeok, 338–404. Bloomington: Indiana University Press.
- THORPE, W. H.  
1961 *Bird song: the biology of vocal communication and expression in birds*. London: Cambridge University Press.  
1972 "The comparison of vocal communication in animals and man," in *Non-verbal communication*. Edited by R. A. Hinde, 27–47. London: Cambridge University Press.
- TRAGER, G. L.  
1958 Paralanguage: a first approximation. *Studies in Linguistics* 13:1–12.