

**The role of speech in language.** Edited by JAMES F. KAVANAGH and JAMES E. CUTTING. Cambridge, MA: MIT Press, 1975. Pp. xiii, 335. \$15.00.

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Since 1964, the National Institute of Child Health and Human Development has sponsored a series of conferences dealing with biological and behavioral research in communication. The series has been unusually successful—not only for the intrinsic excitement of the subject matter, but also because of the logical progression in which the series has been arranged, and because of the consistently high quality of its participants. The proceedings of some of these conferences have been published by the MIT Press, including some volumes that have become quite well-known: *The genesis of language* (2nd conference), *Language by ear and by eye: the relationships between speech and reading* (4th conference), and *Speech and language in the laboratory, school and clinic* (6th conference).

This volume is based on the 5th conference, held in October 1973. One editor, Kavanagh of NICHD, is the guiding hand behind the series, and has co-edited most of the proceedings. The other editor, Cutting, is at the Department of Psychology of Wesleyan University, and has contributed extensively on problems of perception. This conference was organized by Kavanagh and A. M. Liberman. The twenty-some participants come primarily from linguistics and psychology; but anthropology, physiology, and zoology are also represented.

The volume is put into focus at the outset by Liberman's elegant introduction (3–7), in which he asks (3): 'Do we increase our understanding of language when we take into account that it is spoken?' Many kinds of expertise would be required to give these essays a comprehensive critique, and some kinds are beyond my control. So my remarks here will be primarily on a few selected points, in the hope that other parts of the book will be taken up by others elsewhere.

The essays are organized into four parts. Part I, 'The development of speech in man and child', begins with a comparative framework provided by Peter Marler (11–37), who discusses the origin of speech from animal sounds, especially primate calls and bird-song. He is followed by David Premack (46–61), who explores the claim that linguistic and non-linguistic symbols share basic processes, and brings in interesting results from chimpanzee experiments. There are also contributions from I. G. Mattingly, P. Lieberman, J. F. Bosma, P. Reynolds, G. Hewes, M. Studdert-Kennedy, J. E. Cutting & P. D. Eimas, D. S. Palermo, J. J. Jenkins, and R. E. Shaw. These contributions concentrate mostly on language—more specifically, on speech.

Several intertwining questions recur in Part I that concern the human speech apparatus. Lieberman's work in this area has been widely discussed in the literature, and embodies two claims: (1) The absence of speech in early hominids and contemporary apes has a single cause; i.e., the larynx is positioned too high for the production of a viable phonetic repertoire. (2) The phylogenetic lowering of the larynx in man is an 'anatomical specialization for human speech' (89).

The first claim has been subjected to various objections; many of these were discussed, for instance, at the 1975 Conference on the Origins and Evolution of Language and Speech (see Harnad et al. 1976, Hill & Most 1978). Doubt has been expressed regarding the reliability that can be obtained in the reconstruction of soft structures of the vocal tract on the basis of

incomplete fossil remains. Others have noted that much compensation can be achieved by alternative mechanisms; thus, in the present volume, Bosma states, 'Those of us who work with subjects whose motor effector performance is distorted by malfunction often marvel at the acoustically normal or near normal speech which can be accomplished by seemingly inappropriate anatomical structures' (107). 'I would expect', Bosma adds, 'that a hominid having the social orientation and the integrative competencies requisite to complex communication would be able to phonate or "speak" in an adequate variety of sounds with any approximately humanoid pharyngeal and oral effector system' (108).

In other words, (a) early hominids may not have had the vocal tract which Lieberman reconstructs for them; and (b) even if they did, it would not have prevented them from producing an adequate phonetic repertoire. If (a) and (b) are correct, then clearly we are looking at too peripheral a level for clues to speech emergence. In speech production, the mouth is but the end-point of a long chain of processes, beginning with neural impulses in the brain. In apes and pre-speech hominids, what appears to be lacking is not the superficial anatomy (which allows wide structural variations in speech), but the higher neural programs which control the anatomy.

One could always say that these organisms never had the adaptive pressures or social needs to evolve speech—but that is an escapist position to which we should not have to resort. Recent work with apes, like that reported by Premack in this volume, has shown them to have cognitive capabilities remarkably similar to ours, which are only beginning to surface in language-learning experiments. Such capacities would not have evolved if their adaptive pressures had been very different from those that shaped our own development.

So we appear to be gradually zeroing in on the emergence riddle. The missing ingredient is not cognitive capacities, and it is not the shape of the vocal tract; most likely it is somewhere in between.

Gestures probably emerged earliest among the communicative devices, as Gordon Hewes has forcefully argued; and they persist to this day for man and apes, as well for a host of other animals. Less universal and perhaps somewhat later in emergence is some system of calls, based on the acoustic parameters of frequency, duration, and intensity: these survive in speech as suprasegmentals. But the production of these suprasegmental signals is typically accompanied by segmental sounds, simultaneously and as onsets and offsets.

The critical step was the realization that the segmental sounds of vowels and consonants can build into a much richer set of signals. Admittedly, they do not carry as much acoustic power for alarm calls, or for communicating over long distances. But this consideration became less vital when communication grew to be an increasingly sustained activity in much closer settings. Through the millennia, the segmental phonology elaborated—surpassing the parallel channels of suprasegmentals and gestures both in richness and in importance, exploiting and perhaps even extending the available structures of digestion and respiration. In this case, structure and function must have reinforced each other phylogenetically in a spiral manner. The more the structure was used, the more refined it became, and the richer the phonology it could support; rich phonologies in turn led to the elaboration of the supporting structures. The solution of the emergence riddle lies in the discovery of those elaborations induced by the segmental phonology, at a level more central than the surface anatomy.

In very broad outline, then, we can speculate that the evolution of speech (and thus the evolution of the language built upon it) proceeded in three intergraded stages, adding on a more powerful channel with each stage: (1) primarily gestures; (2) gestures + suprasegmentals; and (3) gestures + suprasegmentals + segmentals.

Throughout the course of this development, more intensive usage led finally to the subtle and rich language that we have today, together with the supporting neural mechanisms. These mechanisms, whose development originated in and was spurred on by the elaboration of spoken language, have been generalized for certain aspects of other cognitive systems (as in music and mathematics, which closely resemble linguistic structures). They have also been transferred to support other derived forms of communication such as writing—and, much more indirectly of course, various forms of sign language.

Critical in the above scenario was the erect posture that hominids assumed several million years ago. The evolution of hands relieved the mouth from the tasks of carrying and fighting

(and increased its opportunities for communicating); the neural growth for hand dexterity must have stimulated corresponding (correlated?) neural elaboration for speech production.

But the erect posture also brought about numerous anatomical changes, largely because the body is now differently aligned with respect to gravitational pull. The respiratory structures (lungs, bronchi etc.) now exert a more direct downward pull on the larynx. The head is drawn back to balance on the spinal column, and the jaw structures are considerably shortened and reduced. These purely mechanical responses to erect posture may well have been the primary factors that sculpted the shape of our mouth and throat, which now serves us so well for speech.

So Lieberman's phrase, in referring to the lowering of the larynx as 'anatomical specialization for human speech' could be misleading; probably the lowering was not to help us speak better, but would have taken place whether or not speech evolved. In his study on orchids, Darwin (1862) wrote: 'Although an organ may not have been originally formed for some special purpose, if it now serves for this end we are justified in saying that it is especially contrived for it. On the same principle, if a man were to make a machine for some special purpose, but were to use old wheels, springs and pulleys, only slightly altered, the whole machine, with all its parts, might be said to be specially contrived for that purpose.' I think it is only in this 'contrived' sense that the vocal tract might be called an 'anatomical specialization'.

The second part of this volume, entitled 'Language with speech', contains three descriptive studies of sign language, by U. Bellugi & E. S. Klima, W. Stokoe, and J. Huttenlocher. The effort of Bellugi & Klima (171-203) to apply the methods of linguistic analysis to ASL seems quite successful, suggesting that sign language (or at least ASL) shares much of the cognitive underpinnings of spoken language.

Bellugi & Klima also present some tantalizing results of a preliminary comparison of ASL with Chinese sign language. (For further work on Chinese, there is now a new dictionary of signs, Yau 1977.) I don't know how many sign languages exist for which adequate information is available; but it strikes me that such comparative analysis, incorporating a historical perspective like that of Frishberg 1975, can greatly illuminate the cognitive basis of language, just as the search for universals has long done for spoken language.

Consider a simple example. At the end of Part II, Bellugi's comment emphasizes the 'mapping property' of signs, by referring to how time is expressed (246): 'It is tacitly understood by the sign receiver that time advances forward from the body of the signer, so that the future is far to the front and the immediate past is just to the rear.' Now it has often been noted that spatial adjectives are frequently extended to take on temporal meanings in spoken language. This may well turn out to have a physiological basis (cf. the suggestive discussion in the classic article of Lashley 1951). But at least in Chinese and English, future is to the rear, while past is to the front (cf. *day AFTER tomorrow* and *day BEFORE yesterday*, and similarly, Chinese *HOU tian* and *QIAN tian*). So the polarity is reversed from that of ASL. Although polarity reversal is not uncommon in the semantic development of spoken language, it is interesting that we should find it here. Whether such reversals are to be expected in sign languages in general can only be answered by more comparative studies of the sort exemplified by that of Bellugi & Klima.

Part III, 'Phonology and language', contains contributions by E. S. Klima, P. Kiparsky, J. R. Ross, and J. A. Fodor. Klima (249-70), addressing himself directly to the question Liberman raised in the introduction, compares the number of signs of ASL, based on its organizational constraints as presently understood, with the number of morphemes in spoken language, specifically English. From the comparison, it emerges that 'English, with its relatively full utilization of phonological segments, represents a much richer system' than ASL (259). However, Klima cautions us against favoring spoken language too quickly, since the logical resources of ASL are 'conspicuously under-utilized', and since parameters such as 'the ease, rate and methods of processing signals' also need to be compared. These two considerations are obviously important. They may very well be related, in the

sense that the primary reason for the under-utilization in sign language may be precisely that increasing the message-set would place additional demands on the transmission channel (i.e. the ease, rate, and method of processing), increasing inefficiency for the total system.

In a paper written for a different kind of audience (Wang 1974:84-5), I suggested that, 'while it is true that a class of concepts can be associated with a class of symbols of any medium or make, human language derives its tremendous wealth by having evolved along phonetic lines'. Klima (259) quotes this remark and takes issue with it. Granted, such a phonetic hypothesis has not yet been studied in a systematic way; but no one who has examined the details of the neurophysiology and acoustics of speech can fail to be awed by the tremendous intricacy and subtlety of the process. Mattingly, in the present volume, gives an excellent characterization of some of the special features of this process—including one that he calls 'encodedness' (65), which I find quite compelling. At any rate, the very useful comparative results that Klima himself presents here are in fact supportive of the phonetic hypothesis.

In this same essay, Klima argues that, even if one grants that acoustic signals are better than gestural ones for language, speech sounds are 'certainly very far from ideal' (268). His argument is built upon the case of the phonology of Li Jiang, a western dialect of Chinese. (Although Klima's account is admirably lucid, the discussion of it reflected in the comments, 281, is unfortunately quite garbled—as if there can be a real language with 'no phonological constraints'!) Since the language has thousands of morphemes, but only some 500 syllables to support them, and since morphemes are typically monosyllabic, one inevitably concludes that a syllable must on the average represent many morphemes. But the next two steps of the argument cannot be accepted so easily: that this situation leads to an undesirable amount of homophony, and that such is the ultimate consequence of speech sounds.

The undesirable homophony would arise only if people spoke in isolated syllables without any context, which of course they never do. Once we get beyond the confines of the monosyllable, there are already over 250,000 distinct shapes to accommodate bimorphemic words—more than enough to service any linguistic need. Sapir once likened the richness of language to that of a dynamo servicing a single light bulb. It is difficult to imagine a case where a language can in fact be uncomfortably impoverished and irremediably compromised simply by natural processes of phonological change.

Some of the dynamics of a language's response to various pressures of historical change and to the differing needs of speaker, hearer, and learner are discussed with great clarity by P. Kiparsky in the next essay. (271-80). He is surely correct in the observation that 'language evolves as a self-correcting system, without ever reaching a state of equilibrium, but also without ever deteriorating to a point where it cannot function as a fully adequate means of expression' (279).

The last part of the volume is a summary statement (315-22) by Ira Hirsh, who succeeds remarkably well in weaving the several themes of the volume into a coherent perspective. 'To reflect on the contributions to this reference,' he says, 'and on the relations among them is to reflect on almost all of communication' (315). Indeed, given how knowledge here has mushroomed, not many scholars can move across the several disparate disciplines with as much ease as he does. 'Since the issues raised outnumber the problems answered, we still have much work to do', he concludes. With this, one can only agree.

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