

# ON LANGUAGE

---

Roman Jakobson

EDITED BY

*Linda R. Waugh*

AND

*Monique Monville-Burston*

Harvard University Press

Cambridge, Massachusetts

London, England 1990

## Linguistics in Relation to Other Sciences

---

### EDITORS' NOTE

For Jakobson, language is a structured system of signs whose purpose is social communication. As such, it is linked both with all the similarly structured means by which we humans communicate and with our biosocial nature. Starting from this structural-functional viewpoint, Jakobson elaborates an interdisciplinary model that has linguistics at the center and that expands outward to the other communication sciences and eventually to the natural sciences. (Cf. Figure I.4 in the Introduction.)

In the first part of this chapter, Jakobson shows that linguistics is encompassed by the wider human and social sciences. The first layer is that of semiotics, including the study of written language, formalized languages, mathematics, and gestures. Semiotics is itself but a subset of the wider science of communication, which embraces as well social anthropology, sociology, and economics. Psychology overlaps only partially with these essentially social disciplines by concentrating on the individual.

In the second part, Jakobson extends his vision still further to include biology and physics. The major themes studied are the differentiation of language from animal communication, the relation between the biological and cultural aspects of language (including the issue of innateness versus learning), communalities between the structure of language and the genetic code, and means-ends relations (teleology).

This essay was first presented in 1967. The version given here is the last updated one, published in 1974. The editors are responsible for the section headings.

---

I believe that as the scope of science broadens further and with increasing speed, confrontations between disciplines become more necessary than ever.

JACQUES MONOD  
*From Biology to Ethics*

## The Place of Linguistics among the Sciences of Man

### *The Relative Autonomy of Linguistics*

The autonomy of linguistics was the catchword launched and propagated by Antoine Meillet at the First Congress of Linguists in 1928, and the concluding report of its secretary, the noted Dutch linguist J. Schrijnen, with reference to Meillet's standpoint, viewed the entire historic assembly as a solemn "act of emancipation": "It was a trial shot, a first attempt . . . in the open and before the eyes of the whole world, linguistics has pleaded its own case" (1928:97).

This was a pertinent and timely program which, throughout the subsequent decades, deepened and enhanced the methods and tasks of our science. At present, however, we are faced with an urgent need for interdisciplinary teamwork to be pursued diligently by savants of different branches. In particular, the relationship between linguistics and the adjacent sciences awaits an attentive examination.

The necessity of combining the internal consolidation of linguistics with a substantial widening of its horizon was enunciated lucidly by Edward Sapir shortly after the Hague Congress and most probably as an immediate lucid response to the latter's platform. He argued that linguists, whether they like it or not, "must become increasingly concerned with the many anthropological, sociological, and psychological problems which invade the field of language" because "it is difficult for a modern linguist to confine himself to this traditional subject matter. Unless he is somewhat unimaginative, he cannot but share in some or all of the mutual interests which link linguistics with anthropology and the history of culture, with sociology, with psychology, with philosophy, and, more remotely, with physics and physiology" (1929:166; 1949a:161).

Let us add that unless these two complementary notions—autonomy and integration—are linked intimately with each other, our endeavor becomes diverted to a wrong end: either the salutary idea of autonomy degenerates into an isolationist bias, as noxious as any parochialism, separatism, and apartheid—or one takes the opposite path and compromises the sound principle of integration by substituting a meddlesome

other words, equal attention must be paid to the specifics in the structure and in the development of any given province of knowledge and, furthermore, to their common foundations and developmental lines as well as to their mutual dependence.

Recently the interdisciplinary rally of the law-seeking (nomothetic) sciences of man<sup>1</sup>—whether labeled "social sciences" or "humanities") has been brought forward by the Panel of Special Consultants drawn together by the Department of Social Sciences at UNESCO, and the modalities of such a cooperation underwent a stimulating discussion (see Friedman 1970). The spontaneous and many-sided interest manifested by the Tenth International Congress of Linguists (Bucharest, 1967) for the links between the science of language and the various adjacent disciplines is likewise significant (see Filin 1969). The problem of the interrelations between the sciences of man appears to be centered upon linguistics. That fact is due primarily to the unusually regular and self-contained patterning of language and to the basic role which it plays in the framework of culture; and, on the other hand, linguistics is recognized both by anthropologists and psychologists as the most progressive and precise among the sciences of man and, hence, as a methodological model for the remainder of those disciplines (see Lévi-Strauss 1958a:37, 66, Hymes 1962:9). As Piaget states, "Linguistics is without doubt the most advanced of the social sciences, because of both its theoretical structuration and its well-defined task, and it maintains with other disciplines most important relations" (1966:25). Already at the threshold of our century Peirce assigned to "the vast and splendidly developed science of linguistics" a privileged position among the "studies of mental performances and products" (1931:\$271).

In contradistinction to all other sciences of man and to some natural sciences of relatively recent, modern origin, the study of language belongs to the few earliest branches of knowledge. A keen outline of Sumerian, the most archaic among the extant grammatical writings, is separated from us by almost four thousand years; both linguistic theory and empirical research have displayed a varied and continuous tradition from ancient India and Greece through the momentous achievements of the Middle Ages, the Renaissance, the era of rationalism and Enlightenment, and, finally, the manifold scholarly trends of the last two centuries.

It is precisely the rich and many-sided scientific experience of linguistics which impels us to raise the questions: what place does it occupy among the sciences of man and what is the outlook for interdisciplinary cooperation, on a strictly reciprocal basis and without violation of the intrinsic needs and properties of any domain involved? Some doubts arose as to whether the "admirable interdisciplinary collaboration" which

ties together the natural sciences could actually be matched by the sciences of man, in view of the fact that a firm, logical filiation and a hierarchical order of underlying concepts in respect to relative generality and complexity are manifestly present in the interconnection of natural sciences but seem to be missing among the sciences of man (Piaget 1966:2). Apparently, this uncertainty goes back to those early classificatory attempts which did not take into account the science of language. If, however, precisely linguistics is deliberately chosen and used as the point of departure for a tentative ordering of the sciences of man, such a system based "on the principal affinities of the objects classified" proves to find its solid theoretical grounds.

### *Semiotics: Types of Semiotic Systems*

The internal logic inherent in the sciences of man, in turn, demands their serial arrangement paralleling the linkage and concatenation of the natural sciences. Language as one of the sign systems, and linguistics as the science of verbal signs, is but a part of *semiotics*,<sup>2</sup> the general science of signs which was foreseen, named, and delineated in John Locke's essay "semeiotike," or the "'doctrine of signs,' the most usual whereof being words" (1690:book 4, chap. 21, §4). Coseriu (1969b) cites J. de São Tomas (1589–1644) as a predecessor of Locke in the field of semiotics, where he proves to be closely linked to the Scholastic tradition. One finds an echo of Locke's thought and nomenclature (*Sémio-tique*), in the philosophy of the Pole J. Hoëne Wroński, at the beginning of the nineteenth century (1879). Charles Sanders Peirce (1839–1914), convinced that many passages of the *Essay concerning Human Understanding* "make the first steps in profound analyses which are not further developed," took over Locke's term "semiotic (semeiotike)," which he redefined as the "doctrine of signs" (1932:§§227, 649). This pioneer and "backwoodsman" in the work of clearing and opening up the new discipline issued the first of his numerous attempts at a classification of signs in 1867 (1931: §§545–567) and devoted a "lifelong study" to "the doctrine of the essential nature and fundamental varieties of possible semiosis" (1934:§488). Since his drafts of the nineties, where the name "semiotic" was first introduced for the new branch of knowledge, were published only in the posthumous edition of Peirce's legacy, they could hardly have been known to Ferdinand de Saussure when, like his American precursor, the Swiss linguist in turn conceived the need for a general science of signs which he tentatively named "sémiologie" and which he considered indispensable for the interpretation of language and all other systems of signs in their interrelation with language.

Since the science does not yet exist, no one can say what it would be; but it has a right to existence, a place staked out in advance. Linguistics is only a part of this general science . . . the linguistic problem is first and foremost semiological. . . . This procedure will do more than clarify the linguistic problem. By studying rites, customs, etc. as signs, I believe that we shall shed new light on the facts and point up the need for including them in a science of semiology and for explaining them by its laws. (1966:16–17)

The first, highly interesting version of Saussure's views on the prospective science of signs was recorded by his Geneva colleague A. Naville.

Ferdinand de Saussure insists on the importance of a very general science, which he calls *semiology* and whose object would be the laws of creation and transformation of signs and their meanings. Semiology is an essential part of sociology [RJ: since social life, as Naville comments, is not conceivable without the existence of communicative signs]. Since the most important sign system is the conventional language of human beings, the most advanced semiological science is linguistics, or the sciences of laws governing the life of language . . . Linguistics is, or at least tends to become, more and more, a science of laws. (1901)

We have witnessed a spontaneous and rapid international development of the new discipline which encompasses a general theory of signs, a description of the different sign systems, their comparative analysis and classification (see Trudy 1964, Meletinskij and Segal 1971, Eco 1972, and the journal *Semiotica*). Unquestionably, Locke and Saussure were right: language is the central and most important among all human semiotic systems. On these grounds "linguistics is the chief contributor to semiotics," as Leonard Bloomfield stated (1939a:55). Yet, on the other hand, any confrontation of language with the structure of different sign patterns is of vital significance for linguistics, since it shows what properties are shared by verbal signs with some or all other semiotic systems and what the specific features of language are (see RJ 1970d:697–708).

The relationship between the verbal pattern and the other types of signs may be taken as a starting principle for their grouping. One variety of semiotic systems consists of diverse substitutes for spoken language. Such is writing, which is—both ontogenetically and phylogenetically—a secondary and optional acquisition as compared with the all-human oral speech, though sometimes the graphic and phonic aspects of language are taken by scholars for two tantamount "substances" (for example Hjelmslev 1961). However, in the relation between graphic and phonological entities, the former always functions as a *signans* and the latter as a *signatum*. On the other hand, written language, often underrated by

linguists, deserves an autonomous scientific analysis with due respect to the particular characters of writing and reading (see Derrida 1967, 1968). The transfer of speech into whistles or drumbeats offers another example of a substitutive system, while Morse code exhibits a second-order substitution: its dots and dashes are a *signans* which stands for the ordinary alphabet as their *signatum* (see Sapir 1921:20, 1949a:7).

More or less formalized languages used as artificial constructs for various scientific or technical purposes may be termed transforms of natural language (see Pilch et al. 1965). The comparative study of formalized and natural languages is of great interest for the elicitation of their convergent and divergent characters and requires a close cooperation of linguists with logicians as experts in formalized languages. According to Bloomfield's reminder, which is still opportune, logic "is a branch of science closely related to linguistics" (1939a:55). Such mutual assistance helps linguists to determine the specificity of natural languages with ever greater precision and explicitness. On the other hand, the logician's analysis of formalized superstructures requires a systematic collation with their natural fundament, subject to a strictly linguistic interpretation. A serious impediment in such a joint comparative study is the still persistent and obsessive view of natural language as a secondary symbolic system accused of a constitutional bias toward imprecision, vagueness, ambiguity, and opacity. As Chomsky succinctly stated, the high approximation of formalized, "artificial" languages to context freedom—and, conversely, the context sensitivity of natural languages—substantially differentiate these two semiotic classes (1963, 1967a:441, 1967b). The variability of meanings, their manifold and far-reaching figurative shifts, and an incalculable aptitude for multiple paraphrases are just those properties of natural language which induce its creativity and endow not only poetic but even scientific activities with a continuously inventive sweep. Here, indefiniteness and creative power appear to be wholly interrelated. One of the chief pioneers in the mathematical discussion of the finiteness problem, Emil Post, pointed to the decisive role which "language of the ordinary kind" plays in the "birth of new ideas," their rise "above the sea of the unconscious," and the subsequent mutation of vaguer, intuitive processes "into connections between precise ideas" (1965:430). The Freudian concept "id" was certainly prompted by the impersonal sentences beginning with *it* (*es-Sätze*); the German conspicuous derivative *Gestalt* favored the kneading of a new trend in psychology (see Ehrenfels 1890, Cassirer 1942). As Hutton remarks, the inventive "technical discourse cannot do without metaphorical language," and such figurative terms as "field" and "flow" left their sensible imprint on physical thought (1956:84). It is just natural language that offers a mighty and indispensable support to "the ability to invent problems,

capacity for imaginative or creative thinking," a gift viewed by the explorer of human evolution as "the most significant characteristic of intelligence" (Herrick 1956:359).

The functional difference between formalized and natural languages must be respected by the experts in the one or the other variety (see Pilch et al. 1965, Pelc 1967). Andersen's tale about the ugly duckling is not to be reenacted, and the logician's contempt for the synonymy and the homonymy of natural language is as misplaced as the linguist's bewilderment over the tautologous propositions of logic (see Hjelmslev 1959). Throughout the long history of linguistics, criteria peculiar to technical constructs have been imposed arbitrarily upon natural language not only by logicians but sometimes also by linguists themselves. For example, we run up against heteronomous and forced attempts to reduce natural language to declarative statements and to view requisitive (interrogative and imperative) forms as alterations or paraphrases of declarative propositions.<sup>3</sup>

Whatever verbal problems are treated, the fundamental concepts used by logicians are based on formalized languages, whereas pure linguistics can proceed only from a consistently intrinsic analysis of natural languages. As a consequence, the entire approach to such problems as meaning and reference, intension and extension, or the existential propositions and the universe of discourse is quite different; but these distinct views may be interpreted as two true, while partial, modes of description which face each other in a relation safely defined as "complementarity" by Niels Bohr (1961).

The formalized language of highest refinement is attained in mathematics (see Bohr 1962:68), and at the same time its deep embeddedness in ordinary language is emphasized repeatedly by mathematicians. Thus, for Borel, calculus necessarily rests upon the postulate of the existence of ordinary language (1914:160), or in Waismann's formulation, it "has to be supplemented by the disclosure of the dependence that exists between the mathematical symbols and the meanings of words in the colloquial language" (1951:118). For the science of language, the adequate conclusion from this relation was made by Bloomfield (1939a:55) when he stated that "since mathematics is a verbal activity," this discipline naturally presupposes linguistics.

In the relation between context-free and context-sensitive structures, mathematics and customary language are the two polar systems, and each of them proves to be the most appropriate metalanguage for the structural analysis of the other (see Marcus 1967). So-called mathematical linguistics has to meet both linguistic and mathematical scientific criteria and, therefore, requires a systematic mutual control on the side of experts in each of the two disciplines. The diverse aspects of mathematics—set

theory, Boolean algebra, topology (see Thom 1975), statistics, calculus of probability, theory of games, and information theory (see Ungeheuer 1967, Mackay 1969)—find a fruitful application to a reinterpretable inquiry into the structure of human languages in their variables as well as their universal invariants. All these mathematical facets offer an appropriate multiform metalanguage into which linguistic data may be efficiently translated. Zellig Harris' book (1968), which gives a transcription of grammar into terms of set theory, with a subsequent comparison of natural language and formalized constructs, may be cited as an eloquent example (see also 1970).

A further area of semiotics embraces a wide range of *idiomorphic* systems which are but indirectly related to language. Gesture accompanying speech is defined by Sapir as an “excessively supplementary” class of signs (1949a:7). Despite the usual concomitance of gesticulation with verbal utterances, there is no one-to-one equivalence between the two systems of communication. There are, moreover, semiotic patterns of bodily motions disjoined from speech. These patterns, in general like all sign systems independent in their structure from language and performable also out of touch with verbal means, must be subjected to a comparative analysis with special regard for the convergences and divergences between any given semiotic structure and language.

The classification of human sign systems may resort to several criteria, as, for instance: the relation between the *signans* and *signatum* (in accordance with Peirce's triadic division of signs into indices, icons, and symbols with the transitional varieties—see 1932); discrimination between sign production and mere semiotic display of ready-made objects (see Ruesch and Kees 1961, Osolsobé 1967); difference between merely bodily and instrumental production of signs; distinction between pure and applied semiotic structures; visual or auditory, spatial or temporal semiosis; homogeneous and syncretic formations; diverse relations between the addresser and addressee, in particular intrapersonal, interpersonal, or pluripersonal communication. Each of these divisions must obviously take into account diverse intermediate and hybrid forms.<sup>4</sup>

The question of presence and hierarchy of those basic functions which we observe in language—fixation upon the referent, code, addresser, addressee, their contact or, finally, upon the message itself (see RJ 1960c and Chapter 4 here)—must be applied also to the other semiotic systems. In particular, a comparative analysis of structures determined by a predominant fixation upon the message (artistic function) or, in other words, a parallel investigation of verbal, musical, pictorial, choreographic, theatrical, and cinematographic arts belongs to the most imperative and fruitful duties of semiotic science. Of course the analysis of verbal art lies within the immediate range of the linguist's vital interests and tasks

and imposes upon him a strained attention to the intricacies of poetry and poetics. The latter may be depicted as the inquiry into the poetic function of language and into verbal art with respect to the poetic function of language as well as to the artistic function of semiotic systems in general. The comparative study of poetry and other arts as a teamwork of linguists and experts in such fields as musicology, visual arts, and so forth stands on the agenda, especially in view of the speech ingredient in such hybrid formations as vocal music, dramatic performances, and sound film. (On the relevance of written language in painting, see Butor 1969.)

Despite an indubitable structural autonomy of those human sign systems which we have defined as idiomorphic, they, too, like the other varieties of semiotic patterns, fall under the significant conclusions drawn by two eminent linguists: Sapir realized that “phonetic language takes precedence over all other kinds of communicative symbolism” (1949a:7), and in Benveniste's view, “Language is the symbolic expression par excellence,” and all other systems of communication “are derived from it and presuppose it” (1966:28). The antecedence of verbal signs in regard to all other deliberately semiotic activities is confirmed by studies of children's development. The “communicative symbolism” of child's gestures after the rudiments of language have been mastered is noticeably distinct from the reflex movements of the speechless infant.

In brief, the subject matter of semiotics is the communication of any messages whatever, whereas the field of linguistics is confined to the communication of verbal messages. Hence, of these two sciences of man, the latter has a narrower scope, yet, on the other hand, any human communication of nonverbal messages presupposes a circuit of verbal messages, without a reverse implication.

#### *Linguistics and Other Communication Disciplines: Social Anthropology, Economics, Sociology*

If the cycle of semiotic disciplines is the nearest one to encompass linguistics, the next, wider concentric circle is the totality of communication disciplines. When we say that language or any other sign system serves as a medium of communication, we must caution at the same time against any restrictive conception of communicative means and ends. In particular, it was often overlooked that besides the more palpable, interpersonal face of communication, its intrapersonal aspect is equally important. Thus, for instance, inner speech, astutely conceived by Peirce as an “internal dialogue” and until recently rather disregarded in linguistic literature, is a cardinal factor in the network of language and serves as a connection with the self's past and future (1933:§6: “a dialogue between

different phases of the *ego*"; 1934:§421: "One is saying to that other self that is just coming into life in the flow time"; 1932:§334: "The problematical 'listener' may be within the same person as the 'speaker'; as when we mentally register a judgment to be remembered later").<sup>5</sup>

The natural task of linguistics was to bring forward the primordial significance of the concept "communication" for social sciences. In Sapir's formulation, "Every cultural pattern and every single act of social behavior involves communication in either an explicit or an implicit sense." Far from being "a static structure," society appears as "a highly intricate network of partial or complete understandings between the members of organizational units of every degree of size and complexity," and it is being "creatively reaffirmed by particular acts of a communicative nature" (1949a:104; see also Braga 1961). While realizing that "language is the most explicit type of communicative behavior," Sapir saw both the significance of the other ways and systems of communication and their multifarious connections with verbal intercourse.

It was Lévi-Strauss who gave the clearest delineation of this subject matter and who launched the most promising attempt "to interpret society as a whole in terms of a theory of communication" (1958a:95 and especially 1953, 1958a:chap. 15). He strives toward an integrated science of communication which would embrace social anthropology, economics, and linguistics, or let us replace the latter term by a wider designation—semiotics. One can but follow Lévi-Strauss's triadic conception that in any society communication operates on three different levels: exchange of messages, exchange of commodities (namely goods and services), and exchange of women (or, perhaps, in a more generalizing formulation, exchange of mates). Therefore, linguistics (jointly with the other semiotic disciplines), economics, and finally, kinship and marriage studies "approach the same kinds of problems on different strategic levels and really pertain to the same field."

All these levels of communication assign a fundamental role to language. First, both ontogenetically and phylogenetically, they imply the preexistence of language. Second, all forms of communication mentioned are accompanied by some verbal and/or other semiotic performances. Third, if nonverbalized, all of them are verbalizable, i.e. translatable into verbal messages in uttered or at least inner speech.

Here we do not dwell at length on the still controversial question of delimiting social anthropology and sociology (see Lévi-Strauss 1958a:396), and we treat both of them as two aspects of one and the same discipline. According to an epigrammatic formula (Goody and Watt 1963, advocated by Stein Rokkan 1970), social anthropology is the science of man as a *talking* animal, and sociology is the science of man as a *writing* animal. This division demonstrates the relevance of the two

distinct verbal levels for the whole network of social communication.

If one envisages the two spheres of linguistic investigation, the analysis of coded verbal units on the one hand, and of discourse on the other (see Harris 1963, Benveniste 1966:130), the necessity for a primarily linguistic inquiry into the structure of myths and other kinds of oral tradition becomes obvious. They are not only higher units of discourse but a specific variety of discourse, namely, these texts are coded, their composition is ready-made. The phraseological cliché and especially the proverb, which occupies an intermediate position between the structures of verbal code and discourse, attract the attention of investigators (see Permjakov 1970).

It was Saussure who, in his notes on the *Nibelungen*, perspicuously advocated the semiotic interpretation of myths: "It is true that in going to the bottom of things, one realizes that in this domain, as in the related domain of linguistics, all the incongruities of thought come from insufficiently reflecting on the nature of identity or the characteristics of identity, when what it involves is the identity of nonexistent beings, like words or mythical persons or letters of the alphabet, all of which are but different forms of the SIGN in the philosophical sense" (Godel 1957:136). The verbal aspect of religious patterns becomes a timely and gratifying field of research (see Burke 1961, Uspenskij 1969), and a consistently linguistic inquiry into the myths and particularly into their syntactic and semantic structure not only lays down the foundations of a thoroughly scientific approach to mythology but may also give efficient cues to the linguistic attempts at the analysis of discourse. (Cf. Lévi-Strauss's experiments [1958a:chap. 11, 1958b, 1964a] and their confrontation with the new tasks which face the science of language [see Buchler and Selby 1968] and of folklore [see Maranda and Maranda 1971a,b, Maranda 1972].)

Ritual usually combines speech and pantomimic components, and as noted by Leach 1967a, there occur in these ceremonial customs certain kinds of information which are never verbalized by the performers but are expressed only in action. This semiotic tradition is, however, always dependent, at least on a framing verbal pattern which passes between generations.

Evidently, language is a constituent of culture, but in the ensemble of cultural phenomena it functions as their substructure, groundwork, and universal medium. Therefore, "it is obviously easier to abstract linguistics from the remainder of culture and define it separately than the reverse" (Kroeber and Kluckhohn 1952:124; also Voegelin 1950). Certain peculiar features of language are connected with this particular position of language in relation to culture, especially the early acquisition of language by children and the fact that neither the ancient nor the contemporary

languages of the world which are known to the linguist show any difference whatsoever in their phonological and grammatical structure between more primitive and more progressive stages.

Whorf's acute search (1965) hints at a tangled and creative interplay between the array of our grammatical concepts and our habitual, subliminal, mythological, and poetic imagery, but without authorizing us to imply some foremost compulsory relation between this verbal pattern and our purely ideational operations, or to derive our system of grammatical categories from an ancestral worldview.

The linguistic framework of courtship, marriage, and kinship rules and taboos is their indispensable implement. The careful and exhaustive observations of Geneviève Calame-Griaule on the pragmatics of language in the erotic, societal, and religious life of a community is a telling illustration of the decisive role of verbal behavior in the entire domain of social anthropology (1965).

In the century-old history of economics and linguistics, questions uniting both disciplines have arisen repeatedly. One may recall that economists of the Enlightenment period used to attack linguistic problems (see Foucault 1966:chap. 3): as, for example, Anne-Robert-Jacques Turgot, who compiled a study on etymology for the *Encyclopédie* (1756), or Adam Smith, who wrote on the origin of language (1970). G. Tarde's influence upon Saussure's doctrine in such matters as circuit, exchange, value, output-input, and producer-consumer is well known. Many common topics, as, for instance, "dynamic synchrony," contradictions within the system, and its continual motion, undergo similar developments in both fields. Fundamental economic concepts were repeatedly subjected to tentative semiotic interpretations. In the early eighteenth century, the Russian economist Ivan Posoškov coined the catchphrase "a ruble is not silver, a ruble is the ruler's word," and John Law taught that money was only the wealth of a sign based on the prince's signature. At present, Talcott Parsons (in 1967 and 1968) systematically treats money as "a very highly specialized language," economic transactions as "certain types of conversations," the circulation of money as "the sending of messages," and the monetary system as "a code in the grammatical-syntactical sense." He avowedly applies to the economic interchange the theory of code and message developed in linguistics. Or, according to the formulation of Ferruccio Rossi-Landi, "Economics in its basic sense is the study of that sector of nonverbal communication which consists in the circulation of a particular type of message usually called 'commodities.' More briefly, in a formula: *economics is the study of commodity messages*" (1968:62). In order to avoid a metaphoric extension of the term "language," it is, perhaps, preferable to interpret money as a semiotic system with a particular destination. A semiotic interpre-

tation of the processes and concepts involved is necessary for the exact scrutiny of this medium of communication. Since, however, "the most general matrix" of symbolic systems, as Parsons rightly points out, "is language," linguistics actually appears to offer the most helpful model for such an analysis. Yet there are further reasons for connecting economics with linguistic studies: the exchange of utilities "converted" into words (1967:358), the direct concomitant role of language in all monetary transactions, and the translatability of money into purely verbal messages, such as checks or other obligations (see Hockett 1948:568).

Thus, communication of mates and goods or services proves to be, to a high degree, an interchange of auxiliary messages, and the integrated science of communication incorporates semiotics proper, i.e. the study of sheer messages and their underlying codes, plus those disciplines wherein messages play a relevant yet solely accessory role. In any event, semiotics occupies a central position within the total science of communication and underlies all other provinces of this science, while semiotics, in turn, comprises linguistics as its central section which influences all other semiotic provinces. Three integrated sciences encompass each other and present three gradually increasing degrees of generality:

1. study in communication of verbal messages = linguistics;
2. study in communication of any messages = semiotics  
(communication of verbal messages implied);
3. study in communication = social anthropology jointly with  
economics (communication of messages implied).

Studies developing at present under such overlapping labels as sociolinguistics, ethnolinguistics or folk linguistics, and anthropological linguistics represent a sound reaction against some still frequent survivals of the Saussurian tendency to curtail the tasks and aims of linguistic research. Yet all such constraints of aims and purposes superimposed by individual linguists or linguistic teams on their own investigatory program should not be labeled "pernicious"; any particular emphasis upon some limited sections of linguistic science or any degree of self-restriction and rigorous specialization is perfectly legitimate. What would be, however, erroneous and pernicious is any degradation of all the other facets of language as supposedly residual, second-rate linguistic questions and, especially, any attempt to expel these topics from linguistics proper. Linguistic experimentation may deliberately cut off certain inherent properties of language. Such were, for example, experiments in American linguistics with the exclusion of meaning, first from linguistic analysis in general, and later at least from grammatical analysis [see Chapter 1 in this volume]. Such have been, also, the recently revived Saussurian propensities to confine analysis merely to the code (*langue*, competence

[see Chomsky 1965, 1968]) in spite of the indissoluble dialectic unity *langue-parole* (code-message, competence-performance).

None of such eliminative experiments, however useful and instructive they are, can be viewed as a compulsory narrowing of the total scope of linguistic science. The various tasks and questions recently advanced and discussed under such labels as sociolinguistics all deserve a thorough study, and, one must add, many of these topics have behind them a long history of international research, and their local oblivion is of short duration. All these items, however, form an integral part of linguistics and require the same structural analysis as any other intrinsic constituent of language.

The domain of ethnolinguistics and sociolinguistics—we can but agree with a farsighted promoter of their program, Dell Hymes—must and, finally, will be simply incorporated into linguistics (1964b), because the latter cannot be separated and isolated from “questions of the actual functioning and role of language in human life” (1964a:13).

Any verbal code is convertible and necessarily comprises a set of distinct subcodes, or in other words, functional varieties of language. Any speech community has at its disposal (1) more explicit and more elliptic patterns, with an orderly scale of transitions from a maximal explicitness to an extreme ellipsis; (2) a purposive alternation of more archaic and newfangled diction; and (3) a patent difference between rules of ceremonial, formal speech and informal, slovenly speech. The really distinct and manifold sets of rules permitting, prescribing, or prohibiting talk and silence are destined to serve as a natural preface to any veritably generative grammar. Our linguistic performance is, furthermore, governed by a competence in dialogic and monologic rules. In particular, the varied verbal relations between the addresser and the addressee build a substantial part of our linguistic code and border directly upon the grammatical categories of person and gender. The grammatical and lexical rules relating to the present or absent differences in the hierarchical standing, sex, and age of the interlocutors cannot be bypassed in a thorough and accurate scientific description of a given language, and the place of these rules in the total verbal pattern raises a challenging linguistic question.

The diversity of interlocutors and their mutual adaptability are factors of decisive importance for the multiplication and differentiation of subcodes within a speech community and within the verbal competence of its individual members. The variable “radius of communication,” according to Sapir’s felicitous term (1949a:107), involves an interdialectal and interlingual exchange of messages and usually creates multidialectal and sometimes multilingual aggregates and interactions within the verbal pattern of individuals and even of entire communities. An exact compar-

ison of the usually wider competence of the individual as hearer and his narrower competence as speaker is a pertinent but frequently overlooked linguistic task (cf. Hockett 1961; Uspenskij 1967).

Centrifugal and centripetal forces displayed by territorial and social dialects have been already for many decades a favorite subject in world linguistics. The recent application of structural analysis to fieldwork in social dialectology (Labov 1966, 1968) once more disproves the myth of homogeneous speech communities, discloses the speakers’ awareness of variations, distinctions, and changes in the verbal pattern, and hence brings new illustrations to our view of metalanguage as a crucial intralinguistic factor.

The necessity of coping with the problems of standardization and planning (see Haugen 1966, 1972, Tauli 1968) and hence to put an end to the last survivals of the neogrammarian noninterference in the life of language (*Leave Your Language Alone*—Hall 1950) belongs to the urgent linguistic tasks vitally connected with the progressively increasing radius of communication.

Our cursory survey of topics itemized in the recent programs of socio- and ethnolinguistics shows that all of these questions require a strictly and intrinsically linguistic analysis, for they are a pertinent and inalienable part of linguistics proper.<sup>6</sup> William Bright shrewdly points out the common denominator of these programs: “*Linguistic diversity* is precisely the subject matter of sociolinguistics” (1966:11; see also Hymes 1962). Yet this same diversity may be characterized as the chief target of international linguistic thought in its endeavors to overcome the Saussurian model of *langue* as a static, uniform system of mandatory rules and to supplant this oversimplified and artificial construct by the dynamic view of a diversified, convertible code with regard to the different functions of language and to the time and space factors, both of which were excluded from the Saussurian conception of the linguistic system. As far as this narrow conception finds its adepts again and again, we must repeat that any experimental reduction of linguistic reality can lead to valuable scientific conclusions so long as we do not take the deliberately narrowed artificial frame of the experiment for the unrestricted linguistic reality.

Since verbal messages analyzed by linguists are linked with communication of nonverbal messages or with exchange of commodities and mates, linguistic research is to be supplemented by a wider semiotic and anthropological investigation. As foreseen in Trubetzkoy’s letter of 1926 (1939b), the integrated science of communication is intended to show, according to Bright’s formulation, “the systematic covariance of linguistic structure and social structure” (1966:11). Or, in Benveniste’s terms: “The problem will be, rather, first to discover the common basis of language and society, the principles which govern these two structures, by defining

from the outset, the units which in both are suited to being compared; and secondly, to bring out the interdependence of the two fields" (1966:15).

Lévi-Strauss contemplates the path of such future interdisciplinary research:

We are led, indeed, to wonder if various aspects of social life (including art and religion)—the study of which we already know can be helped by methods and notions borrowed from linguistics—consist of phenomena whose very nature is alien to that of language . . . We must push the analysis of various aspects of social life far enough to reach the level where it will be possible to go from the one to the other; i.e., to elaborate a kind of universal code, capable of expressing the properties which are common to the structures specific to each aspect. The use of this code must be legitimate both for each system taken separately, and for all when they are compared. Thus, we will be in a position to know if we've gotten to their most essential nature and if they are underlain by realities of the same type, or not. (1958a:71)

He envisages a "dialogue" with linguists on relations between language and society (p. 90). One may recall Durkheim's comprehension of the ever-increasing superiority of linguistics among social sciences and his paternal admonition to build up a "linguistic sociology" (cf. Alpert 1939). Until now, however, the initial steps in this direction were taken precisely by linguists, as, for instance, in the stimulating attempts toward a correlation of language and sociocultural problems made in the Russian linguistic literature on the threshold of the 1920s and 1930s (see Vološinov 1929, Polivanov 1931, Ivanov and Jakubinskij 1932). Sociologists acknowledge "the cruel truth" that awareness of language can do more for sociology than sociology can do for linguistic studies, and that the lack of training "in formal linguistics" hinders workers in the social sciences from achieving a productive concern with language (Lieberson 1966:3–6).

The variable radius of communication, the problem of contact between communicants—"communication and transportation"—aptly advanced by Parsons as the ecological aspect of systems, prompts certain correspondences between language and society. Thus, the striking dialectal homogeneity of nomads' languages bears an obvious relation to the wide radius of nomadic roaming. In hunting tribes, for long periods hunters remain out of communication with their women but in close contact with their prey. Hence, their language undergoes a noticeable sexual dimorphism reinforced by the multiform taboo changes which hunters introduce in order not to be understood by animals.

### *Linguistics and Psychology*

The relation between psychology and linguistics or, generically, between psychology and communication sciences, differs substantially from the interrelation of the three concentric circles discussed above: communication of verbal messages, of any messages, and communication in general. Psychology of language, or, under the label current nowadays—"psycholinguistics" (which translates the inveterate German compound *Sprachpsychologie*)—enjoys a venerable tradition in spite of fashionable assertions (see Mowrer 1954) that until recently psychologists remained indifferent to language, and linguists to psychology. Blumenthal is right when he states that this current belief "belies historical facts" (1968), but he too has been unaware of the true scope and longevity of such interdisciplinary research. In the world history of science since the mid-nineteenth century one could hardly name a psychological school which did not endeavor to apply its principles and technical devices to linguistic phenomena and which did not produce representative works devoted to language. Furthermore, all of these successive doctrines left a significant imprint on contemporaneous linguistic trends. It is true, however, that strong attractions to psychology alternate in the development of modern linguistics with no less serious repulsions, and several reasons are responsible for such temporary alienations.

In the first third of our century, at the onset of the structural bent in the science of language, there arose a strong need for applying strictly and solely linguistic, intrinsic criteria to the treatment of verbal problems. Saussure, in spite of his ardent interest in a connection between these two disciplines, warned his disciples against an excessive dependence of linguistics on psychology and insisted expressly on a radical delimitation of approaches (see, e.g. Godel 1957:52). Husserlian phenomenology with its struggle against the hegemony of conventional psychologicistic explanations was another significant factor, particularly influential in the Continental thought of the interwar period. And finally, as linguists complained and as Sapir, in particular, pointed out, most of the psychologists at that time were as yet too little aware "of the fundamental importance of symbolism in behavior"; he predicted that just such an insight into the specific symbolism of language "will contribute to the enrichment of psychology" (1949a:163).

Sapir's expectation was soon fulfilled by Karl Bühler's book (1935) which still is for linguists probably the most inspiring among all the contributions to the psychology of language. Step by step, though with frequent relapses, psychologists dealing with language began to realize that mental operations connected with language and semiosis are essen-

tially different from any other psychological phenomenon. The necessity to master the foundations of linguistics became more and more evident. However, George Miller's "preliminary admonitions" to psychologists for ever deeper penetration into this intricate science remain opportune (1965, 1967). Psychologists must, however, bear in mind the equal importance of studying the signification of context and that of their components by themselves: for instance, syntactic structures and words. The wholes and parts are mutually determined. Peirce's warning has once more to be heeded and followed: "The significate outcome of a sign" (cf. Peirce 1931), i.e. its *signatum*, what Peirce proposes be called the interpretant, is defined as "all that is explicit in the sign itself apart from its context or circumstances of utterance" (Peirce 1934:\$473). In his essay of 1868, Peirce teaches that to the extent that it is not a homonym, every word has one single meaning (*significatio*), whereas its contextual meanings (*suppositiones*) are varied, and he points out the priority of the general meaning by a beautiful reference to medieval logic: "And therefore meaning is prior to supposition and they differ in this respect, namely, that meaning belongs to a word, while supposition belongs to an element already made up of a word and a meaning" (1934:\$320).

The continuously growing number of instructive publications must stimulate a lively discussion between psychologists and linguists.<sup>7</sup> Such significant questions as the inward aspects of speech, the so-called strategies of mind deployed by the interlocutors, require psychological experimentation and elucidation. Among relevant questions partly discussed by psychologists and partly awaiting an answer, one may cite speech programming and speech perception, the perceiver's attention and fatigue, redundancy as an antidote against psychological noise, immediate memory and simultaneous synthesis, retention and oblivion of verbal information, generative and perceptive memory for the verbal code, interiorization of speech, the role of different mental types in language learning, the interconnection of speechless status and language acquisition with different grades of intellectual development, and, on the other hand, relations between verbal impairments and intellectual deficits, or, finally, the significance of language for cognitive operations as compared with the prelingual status.

Mutatis mutandis, analogous psychological problems arise with respect to other forms of semiotic communication and to communication in general. In all these cases there is a clearly delimited area for psychologists' fruitful intervention, and so long as experts in psychology do not intrude in the intrinsically linguistic sphere of verbal form and meaning with specifically psychological criteria and methods, both linguistics and psychology can and must derive genuine benefit from mutual lessons. One must, however, constantly remember that verbal processes and

concepts—in short, all the *signantia* and *signata* in their interrelations—require, first and foremost, a purely linguistic analysis and interpretation. The continuous efforts to substitute a psychological treatment for indispensable linguistic operations are doomed to failure; for instance, in the voluminous and erudite *Grundriss* (Outline) by Kainz, his plan of a psychological grammar as an "explanatory and interpretative discipline" opposed to the linguistic grammar (which he believes to be merely descriptive and historical) reveals a glaring misconception of the scope and aims of linguistic analysis (1954–1962:I, 63). For instance, when claiming that from the use of conjunctions in a given language the psychologist can infer "the laws of organization of thought" (p. 62), the author demonstrates a lack of insight into the essentials of linguistic structure and analysis. Similarly, no psychological contrivances may replace a circumstantial and rigorous structural analysis of the infant's gradual, daily growing mastery of language; such an inquiry demands a careful application of a purely linguistic technique and methodology, but, of course, the psychologist is called upon to correlate the results of this linguistic expertise with the entire development of children's mentality and behavior (cf. McNeill 1966).

The science of communication on all its three levels is concerned with the multiple rules and roles of communication, the roles of its partners, and the rules of their partnership, whereas psychology is focused upon the individual partners themselves, their nature, personality, and internal status. The psychology of language is primarily a scientific characterization of language users, and, consequently, there is no overlapping but rather fruitful complementarity between both of the disciplines concerned with verbal activities.

One of the typical examples of the psychological preoccupation with performances and performers is the psychoanalytic endeavor to disclose the *privata privatissima* of language (most private of the private aspects of language) by provoking the verbalization of unverbalized, subliminal experiences, the exteriorization of inner speech, and both theory and therapeutics may be stimulated by Lacan's attempts to revise and reinterpret the correlation between *signans* and *signatum* in the mental and verbal experience of the patient (1966).

If linguistics guides the analyst, the latter's considerations on the supremacy of the *signans* may, in turn, deepen the linguist's insight into the twofold nature of verbal structures. The linguistic application of the laws of contiguity and similarity in their dichotomy and syncretisms (see Chapter 7 in this volume), deepened by psychoanalysis and by phenomenological psychology, receives new support and new vistas in the psychic and ethnic interpretation of magic (see Mauss 1968:56ff.). As to the continually recurring slogan proposing to turn linguistics into a mere

province of psychology, they sin against the tasks and methods of the two disciplines.

## Linguistics and Natural Sciences

### Biology

*Human language and animal communication.* When from the specifically anthropological sciences we go on to biology—the science of life which embraces the total organic world—the different kinds of human communication become a mere section of a much vaster field of studies. This wider range may be entitled: ways and forms of communication used by manifold living things. We are faced with a decisive dichotomy: not only language but also all the communication systems of language users (which all imply the underlying role of language) differ substantially from any communication system employed by speechless creatures, because for mankind each system of communication is correlated with language; and within the overall network of human communication, it is language that takes the dominant place.

Several essential properties notably separate verbal signs from all kinds of animal messages: the imaginative and creative power of language; its ability to handle abstractions and fictions and to deal with things and events remote in space and/or time, in contradistinction to the *hic et nunc* of animal signals; that structural hierarchy of linguistic constituents which was labeled “double articulation” in D. Bubrix’s penetrating essay of 1930 about the uniqueness and origin of human language, namely, the dichotomy of merely distinctive (phonemic) and significative (grammatical) units and a further scission of the grammatical pattern into the word and sentence levels (coded units versus coded matrices); the use of diremes, especially propositions; and, finally, the assemblage and reversible hierarchy of diverse concurrent verbal functions and operations (referential, conative, emotive, phatic, poetic, metalinguistic). The concept of double articulation goes back to the medieval doctrine of *modi significandi* with the clear-cut distinction of the two articulations—*prima et secunda*—known already to Jordanus of Saxony at the beginning of the thirteenth century. The number of distinct signals produced by an animal is quite restricted, so that the entire corpus of the different messages is tantamount to their code. The cited specificities in the structure of any human language are totally unfamiliar to animals, whereas several other properties formerly believed to be confined to human speech have been detected now also in various species of primates (Altmann 1967). As to the recent attempts to instruct individual anthropoids in the use of a visual substitute for human language, the results offer magnificent

proofs of a deep chasm between human linguistic operations and the semiotic primitivism of apes. Moreover, the use of such a “vocabulary” is imposed upon a captive animal by a trainer and is confined to direct relations between a human being and a tamed beast (Ploog and Melnichuk 1971).

The transition from “zoosemiotic” to human speech is a huge qualitative leap, in contradiction to the outdated behaviorist creed that the “language” of animals differs from the language of humans in degree but not in kind (cf. Sebeok 1968, 1972). On the other hand, we cannot share objections raised recently on the linguistic side against “studying animal communication systems within the same framework as human language” and motivated by a presumable lack “of continuity, in an evolutionary sense, between the grammars of human languages and animal communications systems” (Chomsky 1967b:73). Yet no revolution, however radical, discards evolutionary continuity; and a systematic comparison of human speech and other semiotic structures and activities with the ethological data on the communicative means of all other species promises a stricter delineation of these two distinct fields (see Žinkin 1963, 1971, Bronowski 1967) and a deeper insight into their substantial homologies and no less important differences. This comparative analysis will promote a further broadening of the general theory of signs.

For the most part, observations and descriptions of animal communication belonged until recently to the neglected tasks, and records made were usually fragmentary, unsystematic, and superficial. At present we possess much richer data, collected with greater care and skill; however, in many cases they suffer from a somewhat anthropomorphic interpretation of the valuable material stored by assiduous field work. Thus, for instance, among cicadas the communication of messages, in spite of excessive attempts to ascribe to them a high semiotic differentiation, consists solely of ticks used for distance signals and of close-range buzzes; both varieties are combined into a squawk when the call is addressed simultaneously to nearby and remote recipients (see Alexander and Moore 1958).

*Biological and cultural aspects of language.* The traditional opposition of human language and animal communication as cultural versus natural phenomena proves to be oversimplified. The nature-nurture dichotomy (see Dobzhansky 1964:55) offers an utterly entangled problem. The buildup of animal communication implies, in Thorpe’s terms, “an elaborate integration of inborn and learned components,” as proved by vocalizations of songbirds separated while in eggshells from their associates, and not only reared in total isolation but, in certain experiments, even deafened (Thorpe 1961a, b, 1963). They still perform the inborn blueprint of the song proper to the habit of their species or even to the dialect of

the subspecies, and the pattern of this song "is not fundamentally affected" and after gradual trials may undergo some corrections and ameliorations. If hearing has been left intact and the bird returns to its native environment, the quality of its performances improves and the song repertory can grow, but all this only occurs within the period of the bird's maturation—no ameliorations and additions are achievable in the warbling skill of a chaffinch when it is more than thirteen months old. The lower the organism, the more nature prevails over nurture, but even lower animals can benefit from learning (Marler 1965:316). As Galambos states, learning is common, for example "to octopus, cat, and bee despite the large differences in their neural apparatus" (1961:233).

Also in the child's acquisition of language, nature and culture are interlaced: innateness constitutes the necessary basis for acculturation. However, the hierarchy of both factors is opposite: learning for children, and heredity for fledglings, cubs, or other young animals, acts as the determining factor. The infant cannot begin to talk without any contact with speakers, but as soon as such contact is established, then whatever the environmental language is, the child will acquire it, provided he has not passed his seventh year (see Malson 1964), whereas any further language can also be learned during adolescence or maturity. All this means that learning of the initial communication system, both for birds or other animals, and for human beings can take place only between two chronological maturation limits.

This puzzling phenomenon, and the substantial fact that speech is a universally and exclusively human property, imperatively calls for an attentive inquiry into the biological prerequisites of human language. Bloomfield's reminder that among the special branches of science, linguistics "intervenes between biology, on the one hand, and ethnology, sociology, and psychology, on the other" (1939a:55) is most opportune. The complete failure of mechanistic efforts to transplant biological (e.g. Darwinian or Mendelian) theories into the science of language (Schleicher 1863; van Ginneken 1933) or to fuse linguistic and racial criteria led linguists temporarily to distrust joint designs with biology, but at present, when both the study of language and the study of life have experienced continuous progress and stand before new, crucial problems and solutions, this skepticism must be overcome. The research in question requires a cooperation of biologists and linguists which would avert premature "biological theories of language development" (as in Lenneberg 1967), enterprises familiarized neither with the properly linguistic evidence nor with the cultural aspect of language.

Language and other means of human communication in their various operations offer—*mutatis mutandis*—many instructive analogies with the transfer of information among other species of living creatures. "The

adaptive nature of communication" in its multiform varieties, which has been outlined pithily by Wallace and Srb (1964:chap. 10), involves two correlate genera—self-adjustment to the environment and the adjusting of the environment to one's own needs. Indeed, it becomes one of the "most exciting" biological problems and—again *mutatis mutandis*—it is of vital concern to present-day linguistics. The similar processes in the life of language and in animal communication merit a diligent and comprehensive exploration and juxtaposition, beneficial both for ethology and for linguistics. The interwar period witnessed the first mutual suggestions between the investigators of these two disciplines who had been concerned with the same two aspects of evolution: adaptive radiation and convergent evolution (see RJ 1929a:107 and Chapter 14 in this volume); it was in this connection that the biological concept of mimicry attracted the attention of linguists (see RJ 1929a:107), and on the other hand, diverse types of mimicry have been analyzed by biologists as displays of communication (Wallace and Srb 1964:88–91). The divergent development which is opposite to the convergent tendency in the spread of communication and which acts as a powerful counterpart of diffusion more and more preoccupies the science of language as well as biology. The usual manifestations of such a linguistic nonconformism, particularism, or "parochialism" (*esprit de clocher*, in Saussure's parlance) find remarkable ethological analogues, and biologists investigate and describe what they call "local dialects" that differentiate animals of a single species, for instance, crows or bees; thus, two neighboring and closely related subspecies of fireflies differ in their courtship flashes (p. 88). From the testimony of many observers about dissimilar vocalizations performed by one and the same bird species in different "dialect areas," Thorpe infers that "these are true dialects and are not based on genetic discontinuities."

During the last five decades many significant universals have been gradually discovered in the phonological and grammatical pattern of languages. Obviously, among the countless tongues of the world no single one displays any structural features which would conflict with children's inborn abilities to master it in the step-by-step process of language acquisition. Human language is, as biologists term it, species specified. There are, in any infant, innate dispositions, propensities to learn the language of his environment; in Goethe's terms, "Everyone learns only what he is capable of learning," and no extant philological or grammatical laws overstep tyro's capacities. How far the inherited potentiality to grasp, adjust, and appropriate the elders' language implies an innateness of linguistic universals remains an utterly speculative and sterile question. It is evident that the inherited and acquired patterns are closely linked together: they interact and complement each other.

Like any other social modeling system tending to maintain its dynamic equilibrium, language ostensibly displays its self-regulating and self-steering properties (see Ljapunov 1958, Lange 1962:73). Those implicational laws which build the bulk of phonological and grammatical universals and underlie the typology of languages are embedded to a great extent in the internal logic of linguistic structures and do not necessarily presuppose special "genetic instructions." Thus, for instance, as Korš showed long ago in his lucid contribution to comparative syntax (1877), hypotactic constructions and relative clauses in particular are far from being universal, and in many languages such clauses form a recent innovation. Nonetheless, whenever they appear, they constantly follow some identical structural rules which, as he guesses, reflect certain "general laws of thinking" or, let us add, are inherent in the self-regulation and self-movement of language.

It is particularly noteworthy that the alleged "strict limits for variations" lose their compulsion in secret jargons and in verbal plays—private or semiprivate—as well as in personal poetic experiments or invented languages. Propp's trailblazing discovery (1928), recently enforced and deepened,<sup>8</sup> has revealed the rigid structural laws which govern all the fairy tales of Russian (and any other) oral tradition and admit but a severely limited number of compositional models. These restrictive laws, however, find no application to such individual creations as Andersen's or Hoffmann's fairy stories. To a considerable degree, the rigor of general laws is due to the circumstance that both language and folklore demand a collective consensus and obey a subliminal communal censorship (RJ 1929c). Precisely the fact of belonging to a "strictly socialized type of human behavior" is, in Sapir's terms, highly responsible for "such regularities as only the natural scientist is in the habit of formulating" (1929, 1949a:166).

"The adaptive nature of communication," rightly emphasized by modern biologists, is manifest in the behavior of both higher and lower organisms adjusting themselves to their living environment or, inversely, adjusting this environment. One of the most striking examples of the ability to make persistent and intensive adjustments is the child's imitative and thereby creative learning of language from parents or other adults, notwithstanding the recent untenable surmise that nothing else is needed other than "some superficial adaptation to the structure of their behavior" (Lenneberg 1967:378).

Children's gift of acquiring any tongue whatever as their first language and, perhaps even more generally, the human, especially juvenile aptitude to command unfamiliar linguistic patterns, must arise primarily from the instructions coded in the germ cell, but this genetic assumption does not authorize us to conclude that for the little apprentice the language of

adults is nothing more than "raw material" (p. 375). For example, in the Russian verb system none of its morphological categories—persons, genders, numbers, tenses, aspects, moods, voices—belongs to linguistic universals, and children, as has been shown by abundant and precise observations and records, deploy all their gradual efforts in order to comprehend these grammatical processes and concepts and to penetrate, step-by-step, into the numerous intricacies of the adults' code. All the devices needed for its attainable mastery are used by the beginner: its initial simplification with selection of accessible components, progressive grades of approximation to the entire code, glossing metalinguistic experiments, various forms of tutor-tuttee effective relations, and insistent demands for learning and instruction (see for example Kaber 1959, Gvozdev 1961); everything positively contradicts the credulous references to the "absence of any need for teaching of language" (Lenneberg 1967:379) as it contradicts the underestimation of the role played by parents who allegedly "have no idea how to explain" language to their child. But the question of genetic endowment arises as soon as one deals with the very foundations of human language.

Since our letters are mere substitutes for the phonemic pattern of language, and the Morse alphabet is but a secondary substitute for letters, the subunits of the genetic code should be compared directly with phonemes. Hence, we may state that among all the information-carrying systems, the genetic code and the verbal code are the only ones based upon the use of discrete components which, by themselves, are devoid of inherent meaning but serve to constitute the minimal senseful units, i.e. entities endowed with their own, intrinsic meaning in the given code. Confronting the experience of linguists and geneticists, Jacob aptly stated:

In both cases, we are dealing with units which in themselves are absolutely devoid of meaning but which, when grouped in certain ways, take on a meaning, which is either the meaning of words in language, or a meaning in the biological sense of the term, that is, able to express functions which are contained, which are "written," along the genetic chemical message. (RJ 1968e)

The similarity in the structure of these two informational systems goes, however, much further. All the interrelations of phonemes are decomposable into several binary oppositions of the further-indissociable distinctive features. In an analogous way, two binary oppositions underlie the four "letters" of the nucleic code (see Freese 1958, Crick 1963:167, Monod 1967:13), thymine (T), cytosine (C), guanine (G), and adenine (A). A size relation (termed "transversion" by Freese and Crick) opposes the two pyrimidines T and C to the larger purines, G and A. On the other

hand, the two pyrimidines (T versus C) and, equally, the two purines (G versus A), stand to each other in a relation of "reflexive congruence" (Weyl 1952:43), or "transition," according to Freese's and Crick's nomenclature: namely, they present two contrary orders of the donor and acceptor. Thus T:G = C:A, and T:C = G:A. Only the twice-opposed bases prove to be compatible in the two complementary strands of the DNA molecule: T with A and C with G.

Linguists and biologists display a still clearer insight into the consistently hierarchical design of verbal and genetic messages as their fundamental integrative principle. As pointed out by Benveniste, "A linguistic entity will be understood as such only if it can be identified *within* a higher entity" (1966:123), and the same device underlies the analysis of "genetic language."

*Genetic code and language.* The spectacular discoveries of molecular genetics of the last few years are presented by the explorers themselves in terms borrowed from linguistics and communication theory. The title of the book by G. and M. Beadle, *The Language of Life*, is not a mere figurative expression, and the extraordinary degree of analogy between the systems of genetic and verbal information fully justifies the guiding statement of the volume: "The deciphering of the DNA code has revealed our possession of a language much older than hieroglyphics, a language as old as life itself, a language that is the most living language of all" (1966:207).

From the newest reports on the gradual breakthrough of the DNA code and, in particular, from F. H. C. Crick's (1962–1966) and C. Yanofsky's (1967) condensed accounts of "the four-letter language embodied in molecules of nucleic acid," we actually learn that all the detailed and specified genetic information is contained in molecular coded messages, namely in their linear sequences of "code words" or "codons." Each word comprises three coding subunits termed "nucleotide bases" or "letters" of the code "alphabet." This alphabet consists of four differing letters "used to spell out the genetic message." The "dictionary" of the genetic code encompasses sixty-four distinct words which, in regard to their components, are defined as "triplets," for each of them forms a sequence of three letters. Sixty-one of these triplets carry an individual meaning, while three are apparently used only to signal the end of a genetic message.

In his inaugural address to the Collège de France, François Jacob vividly depicted the scientists' astonishment at the discovery of this nucleic script:

The older notion of gene, an integral structure that was compared with a rosary bead, has thus been replaced by that of a sequence of

four repeated elements in permutations. Heredity is determined by a chemical message written along chromosomes. What's surprising is that genetic specificity is written, not with ideograms, as in Chinese, but with an alphabet as in French, or rather as in Morse code. The meaning of the message comes from the combination of the signs into words and from the arrangements of the words into sentences . . . A posteriori, this solution appears indeed as the only logical one. How otherwise could such a diversity of constructions be possible with such a scarcity of means? (1965:22)

The transition from lexical to syntactic units of different grades is paralleled by the ascent from codons to "cistrons" and "operons," and the latter two ranks of genetic sequences have been equated by biologists with ascending syntactic constructions (see for example Ratner 1966), and the constraints on the distribution of codons within such constructions have been called "the syntax of the DNA chain" (Eden 1967). In the genetic message the "words" are not separated from each other, whereas specific signals indicate the start and end of the operon and the limits between the cistrons within the operon. They are metaphorically described as "punctuation marks" or "commas" (Jacob 1966:1475) and actually correspond to the delimitative devices used in the phonological division of the utterance into sentences and of the latter into clauses and phrases (Trubetzkoy's boundary signals [1936b]). If, from syntax, we proceed to the hardly explored field of discourse analysis, the latter seems to offer certain correspondences with the "macro-organization" of genetic messages and with its highest constituents, "replicants" and "segregons" (Ratner 1966).

In contradistinction to the context freedom of diverse formalized languages, natural language is context sensitive, and in particular, its words display a variety of dissimilar contextual meanings. The recent observations of changes in the meanings of codons, depending on their position in the genetic message (Clark and Marcker 1968), may be cited as a further correspondence between the two patterns.

The strict "colinearity" of the time sequence in the encoding and decoding operations characterizes both verbal language and the basic phenomenon of molecular genetics, the translation of the nucleic message into "peptidic language." Here again we come across a quite natural penetration of a linguistic concept and term into the research of biologists who, by collating the original messages with their peptidic translation, detect "synonymous codons." One of the communicative functions of verbal synonyms is the avoidance of partial homonymy (for example, utterances substituting *adjust* for *adapt* to prevent the easy confusion of the latter word with its partial homonym *adopt*; see Coates 1968), and biologists question whether a similar subtle reason could not underlie the

choice between synonymous codons; "this redundancy gives a certain flexibility to the way in which heredity is written" (Jacobs 1965:25; cf. Coates 1968).

Linguistics and cognate sciences deal chiefly with the speech circuit and similar forms of intercommunication, i.e. with the alternate roles of the addresser and the addressee who gives either an overt or at least a silent reply to the interlocutor. As for the processing of genetic information, it is said to be irreversible; "The machinery of the cell can translate in one direction only" (Crick 1962–1966:56). However, the regulative circuits disclosed by the geneticists—repression and retro-inhibition<sup>9</sup>—seem to offer a slight molecular parallel to the dialogic nature of speech. While such regulative interactions within the "physiological team" of the genotype effect a control and selection of genetic instructions either accepted or rejected, the transmission of hereditary information to offspring cells and oncoming forward organisms maintains a straight, chainlike order. Linguistics of today is actually faced with closely related subjects. The varied questions connected with the exchange of verbal information in space overshadowed the problem of language as legacy; the temporal, forward-oriented, programming role of language bridging the span between the past and the future is now on the agenda. It is noteworthy that the eminent Russian expert in biomechanics N. Bernštejn, in his testamentary "Conclusion" of 1966 (1966:334), has suggestively compared the molecular codes which "reflect the processes of the forthcoming development and growth" with "language as a psycho-biological and psycho-social structure" endowed with an anticipatory "model of the future."

How should one interpret all these salient homologies between the genetic code, which "appears to be essentially the same in all organisms" (Watson 1965:386), and the architectonic model underlying the verbal codes of all human languages and, nota bene, shared by no semiotic systems other than natural language or its substitutes? The question of these isomorphic features becomes particularly instructive when we realize that they find no analogue in any system of animal communication.

The genetic code, the primary manifestation of life, and, on the other hand, language (the universal endowment of humanity) and its momentous leap from genetics to civilization, are the two fundamental stores of information transmitted from ancestry to progeny: the molecular succession, which ensures the transfer of hereditary messages from the cells of one generation to the next generation, and the verbal legacy as a necessary prerequisite of cultural tradition.

The outlined properties common to the systems of verbal and genetic information ensure both speciation and boundless individualization. Biologists maintain that the species "is the keystone of evolution," and that

without speciation there would be no diversification of the organic world and no adaptive radiation (Mayr 1963:621; see also Emerson 1958, 1962); similarly, languages, with their structural regularities, dynamic equilibrium, and cohesive power, appear as necessary corollaries of the universal laws which underlie any verbal structuration. If, furthermore, biologists realize that the indispensable diversity of all individual organisms, far from being incidental, presents "a universal and necessary phenomenon of living things" (Simpson 1963:386), linguists, in turn, recognize the creativity of language in the unlimited variability of personal speech and in the infinite diversification of verbal messages. Linguistics shares with biology the view that "stability and variability reside in the same structure" (Lwoff 1965:99) and imply each other.

Now, since "heredity, itself, is fundamentally a form of communication" (Wallace and Srb 1964:71), and since the universal architectonic design of verbal code is undoubtedly a molecular endowment of every *Homo sapiens*, one could venture the legitimate question whether the isomorphism exhibited by these two different codes, genetic and verbal, results from a mere convergence induced by similar needs, or perhaps the foundations of the overt linguistic patterns superimposed upon molecular communication have been modeled directly upon its structural principles.

The molecular heredity order has no bearing on the diverse variables in the formal and semantic makeup of different languages. There is, however, a certain facet of individual speech which permits us to presume the possibility of a genetic endowment. In addition to the multiform intentional information, our talk carries inalienable and unalterable characteristics which are generated chiefly in the inferior part of the speech apparatus, from the abdominal-diaphragmal area to the pharynx. The study of these physiognomic characteristics was inaugurated by Eduard Sievers (1924) under the label "analysis of sound" (*Schallanalyse*) and developed by him and his disciple, the ingenious musicologist Gustav Becking (1928), throughout the first third of our century. All the speakers, writers, and musicians proved to belong to one of the three basic types (with further subdivisions) expressed in the entire exteriorized behavior of any individual as specific rhythmic curves which, therefore, received the name of "general curves" (*Generalkurven*) or "personal curves" (*Personalkurven*); they were also termed "Becking curves" (*Beckingkurven*), since they were discovered by Becking during his joint research with Sievers. These three curves have been mapped as in Table 27.1 (see pp. 52–53).

If a representative of one type has to recite, sing, or play a work of a poet or composer of the same kinesthetic type, the performance appears to be reinforced by this affinity, but if the author and performer belong

Table 27.1 Rhythmic curves (General/Personal/Becking curves)

Main beat	Minor beat	Type
Sharp	Sharp	Heine-type
Sharp	Round	Goethe-type
Round	Round	Schiller-type

to two totally opposite types, the reproduction undergoes inhibitions (*Hemmungen*). It turned out that these three idiosyncratic types and their interrelations apply to all kinds of our motor activities, such as the manner of bodily, manual, and facial movements, gait, handwriting and drawing, dancing, sport, and courtship. The attractions and repulsions between different types act not only within a single motor sphere but also across the diverse spheres. Moreover, the effect of certain auditory and visual stimuli is akin to one of the three motor types, and correspondingly, these incentives may either stimulate or inhibit the response, as was experienced by readers when they faced, in alternate order, the same verses coupled with a wire figure now of a coincident and now of an opposite type.

In his notable summarizing report on these personal curves, Sievers asserts:

They are the most constant thing that exist among thinking and acting human beings: at least no case is known to me, in spite of years of searching, in which an individual made use of more than one Becking curve, during his own performance, no matter how rich it might be otherwise in tonal variability . . . It can also not be doubted that the Becking curve belongs to the *inborn* endowment of the individual (as I have been able to establish with newborns), and that in its transmission from one individual to another the usual general laws of inheritance play a large role, if not the sole determining role. Only in this way can it be understood when whole tribes, or even peoples, use one and the same Becking curve. (1924:74)

The innateness of the three "individual curves" seems rather probable but still requires careful verification.

This research, which exhibited the superb skill and penetrating intuition of the two inquirers, yet which originally lacked any theoretical foundation, unfortunately has been discontinued, but now it could and should be resumed on new methodological principles. Sievers' and Becking's tentative psycho-physical typology should be confronted with such problems as attraction and repulsion between associates and mates, the varying types in the progeny of dissimilar parents, and the presumable influence of these variations upon relations between parents and offspring. The question whether the heredity of such physiognomic, virtually

aesthetic, components of language may find a widened, phylogenetic application remains open.

*Teleology.* It was the great physicist Niels Bohr who repeatedly warned biologists against the fear of "notions like purposiveness foreign to physics but lending themselves so readily to the description of organic phenomena." He diagnosed and prognosticated that the two attitudes—one mechanistic and the other end-directed—"do not present contradictory views on biological problems but, rather, stress the mutually exclusive character of observational conditions equally indispensable in our search for an ever richer description of life" (1961:100). The programmatic paper by Rosenblueth, Wiener, and Bigelow on purpose and teleology (1943), with its scrupulous classification of purposeful behavior, would, as Campbell acknowledges (1967:5), "make a useful introduction" to the latter's book—and, one could add, to many other cardinal works on organic, especially human, evolution.

The discussion of goal-directedness in today's biology is of vital interest for all branches of knowledge relating to organismic activities, and the judgments advanced may serve to corroborate a consistent application of a means-ends model to language design, to its self-regulating maintenance of integrity and dynamic equilibrium (homeostasis), as well as to its mutations (see Cannon 1932, Emerson 1967). Although the same labels which were used in the prestructural stage of historical linguistics—"blind, haphazard, fortuitous, random changes, accidental slips, multiplied errors, happenstances"—are still tenacious in biological creeds and phraseology, nevertheless such pivotal concepts as "purposiveness," "anticipation," and "initiative and foresight" take ever deeper root (Darlington 1958:239, Thorpe 1963:chap. 1). Wallace and Srb criticize the traditional avoidance of teleological phraseology and of references to purpose as outdated, since the problems involved are no longer related to any belief in a vital force (1964:109). According to Emerson, biologists are forced "to recognize the existence of direction toward future functions in pre-mental organisms such as plants and lower animals." He sees no necessity "to put the word *purpose* in quotation marks" (1962:207) and maintains that "homeostasis and goal-seeking are the same thing" (1967:142).

For the founders of cybernetics, "teleology" was synonymous with purpose controlled by feedback (Rosenblueth, Wiener, and Bigelow 1943), and this approach has been widely developed in Waddington's (1957, 1961) and Šmal'gauzen's (1965, 1966) biological studies. As the leading Russian biologist of our time, N. A. Bernštejn, recently stated:

Numerous observations and data in all the areas of biology have shown for a long time an indisputable purposiveness in the structures and processes peculiar to the living organisms. This purposiveness

strikes one as a manifest, perhaps even decisive, difference between living systems and any objects of inorganic nature. In application to biological objects, the questions *how* and *for what reason*, exhaustively sufficient in physics or chemistry, have to be necessarily supplemented by a third, equally relevant question *for what purpose* . . . Only the two concepts introduced by biocybernetics, the code and the coded anticipatory model of the future, indicate an impeccable, materialistic way out of this seeming deadlock . . . All the observations on the formation of the organism in its embryology and ontogeny as well as on the phylogenetic scale show that the organism in its development and activities strives for the maximum of negentropy compatible with its vital stability. Such a formulation of biological "purpose" requires no psychologization . . . Biological relevance pushes the indispensable and unavoidable question *for what purpose* into first place. (1966:326–328, 331)

The discovered ability of organisms to build and integrate material codes which reflect the manifold forms of activity and extrapolative performances, from tropisms to the most complex forms of influence upon the environment, enables Bernštejn "to speak about the goal-directedness, goal-orientation, etc. of any organism whatever, perhaps starting with the protists," without any risk of sliding into a supernatural finalism (p. 309). Cf. the mathematical analysis of goal-directed biological systems in the studies of M. L. Cetlin, a Russian expert in the field of cybernetics (1969).

An even more resolute claim for the autonomous status of the science of life was expressed by the eminent Harvard biologist George Gaylord Simpson: "The physical sciences have rightly excluded teleology, the principle that the end determines the means, that the result is retroactively connected to the cause by a factor of purpose, or that usefulness is in any sense explanatory . . . But in biology it is not only legitimate but also necessary to ask and answer questions teleological in aspect concerning the function or usefulness to living organisms of everything that exists and that occurs in them" (1967:370–371). Simpson repeatedly insists that "the purposeful aspect of organisms is incontrovertible" and that the antiteleological reductionism "omits the *bios* from biology" (1962:86). In an earlier reexamination of teleology, Jonas Salk underscored that "living systems require different considerations as compared with nonliving systems; the idea of purpose in living systems is not only relevant but is essential." He explains "that it is in the nature of the organism to be oriented for the change that occurs. The intrinsic nature of the organism influences the range and direction of change that can occur; the change that occurs becomes added to others, all of which together seem to be 'causes' toward which the developing organism is

drawn, and the word 'cause' in this context obtains the philosophical meaning of 'end or purpose'" (1961).

According to François Jacob's witty comparison, "For a long time the biologist approached teleology as a woman whom he was unable to dismiss but in whose company he was unwilling to be seen in public. At present the program gives a legal status to this secret liaison" (1970:17).

Leaning upon the example of scientific astronomy, which superseded speculative astrology, Pittendrigh proposed the substitution of "teleonomy" for "teleology" in order to make it clear that "the recognition and description of end-directedness" is freed from undesirable associations with Aristotelian metaphysical dogma. The new term carried the idea that all organization recognized as being characteristic of life "is relative and end-directed" and that any randomness is "the converse of organization" (1958:394). The new term proved to be opportune (Williams 1966), and in Monod's view, "Teleonomy is the word that can be used if, because of the fear of appearing to be unobjective, one prefers to avoid the term 'finality.' However, 'everything happens' as if living beings were structured, organized, and conditioned toward an end: namely the survival of the individual, and even more so, of the species" (1967:9; cf. 1970:chap. 1). Monod describes the central nervous system as "the most evolved of teleonomic structures" and ventures to interpret the emergence of the superior, specifically human system as a sequel to the appearance of language, which changed the biosphere into "a new realm, the noosphere, the domain of ideas and consciousness." In other words, "it is language which created humans, rather than humans language" (1967:23).

If the questions of goal orientation are still under discussion in biology, any doubts are misplaced as soon as we approach human beings, lifeways, and institutions—in particular, human language. The latter, like man himself in MacKay's sagacious formulation, "is a teleonomic or goal-directed system" (1964:163; cf. Huxley 1958). The obsolete belief that "purposiveness cannot logically be the mainspring for language development" (Lenneberg 1967:378) falsifies the very nature of language and of intentional human behavior. Once again Peirce's thesis is a valuable guideline: "The being governed by a purpose or other final cause is the very essence of the psychical phenomenon" (1931:\$269). "To say that the future does not influence the present is untenable doctrine. It is as much as to say that there are no final causes, or ends. The organic world is full of refutations of that position" (1932:\$86).

Recidives of superstitious fear of a means-ends model which still torment a few linguists are the last survivals of a sterile reductionism. As a characteristic example we may cite a linguist's affirmation that "in the discussion of man's place in nature there is no place for mentalism,"

since "man is an animal and subject to all the laws of biology"; finally, "the only valid assumption is that of physicalism," since "life is part of the inorganic world and subject to all the laws of physics" (Hockett and Ascher 1964:136; see also Hockett 1948).

This quasi-biological bias of linguists is categorically rebuffed by biologists themselves. As for antimentalism, they teach us that in the evolution of human nature "intelligence integrates knowledge and gives it direction"; it is a "purposively directed mental process with awareness of means and ends" (Herrick 1956:367). As for animalism, Dobzhansky condemns the fancy cliché that man is nothing but an animal as "a specimen of 'genetic' fallacy." In regard to an all-embracing biologism, he reminds us that "human evolution cannot be understood as a purely biological process, because, beside the biological component, the other, cultural factor in turn must be taken into account" (1962:18). Simplistic physicalism has been flatly rebuked by Simpson: "Organisms do in fact have characteristics and processes that do not occur in conjunction in nonorganic materials and reactions" (1967:367). While biology has realized fully that the units of heredity are discrete and, hence, nonblending, the same linguist, faithful to the spirit of reductionism, endeavors to explain the emergence of the discrete constituents of the verbal code through the "phenomenon of blending" as "the only (!) logically (!) possible (!) way" (Hockett and Ascher 1964:142).

The ultimate phylogenetic question of linguistics, the origin of language, has been proscribed by the neogrammarian tenet, but at present the emergence of language must be brought together with the other changes which mark the transition from prehuman to human society. Such a juxtaposition can also give certain clues for a relative chronology. Thus, attempts have been made to elucidate the genetic interrelation between language and visual art (Bubrix 1930, Pumphrey 1953). Figurative art seems to imply the presence of language, and thus the earliest vestiges of representative art provide glottogony with a plausible *terminus ante quem*.

Moreover, we may connect three universals among the solely human achievements: (1) manufacture of tools to build tools; (2) rise of phonemic, purely distinctive elements, deprived of their own meaning but used to build meaningful units, namely morphemes and words; (3) incest taboo, conclusively interpreted by anthropologists as the indispensable precondition for a wider exchange of mates and hereby for an expansion of kinship and for a consequent buildup of economic, cooperative, and defensive alliances.<sup>10</sup> In brief, this device serves to create men's "solidarity transcending the family" (Parsons 1954). As a matter of fact, all of these three innovations introduce pure auxiliaries, secondary tools necessary for the foundation of human society with its material, verbal,

and spiritual culture. An abstract mediate principle lies in the idea of secondary tools, and the emergence of all their three aspects must have been the most cardinal step from "animality" toward the thoroughly human mind. The rudiments of these three fundamentally similar possessions must have emerged within the same paleontological period, and the earliest excavated specimens of tools—such as gravers or burins (Oakley 1960:95)—destined to make tools enable us to posit a conjectural glottogonic epoch. In particular, the need of articulate speech for the formulation of rules which define and prohibit incest and inaugurate exogamy (White 1959) prompts a further specification of the evolutionary sequence. As the psychologist puts it, "Distinctions between those who are permitted or favored as mates and those who are ruled out as 'incestuous' are governed by a system of naming that can be mastered only by one who can handle a human language" (Bruner 1968:75). The importance of speech for the development and diffusion of tool manufacture may be likewise assumed.

The physiology of speech production overcomes its former piecemeal, atomizing stage and acquires an ever broader interdisciplinary range. Among instructive examples one could cite Žinkin's comprehensive tabulation of speech mechanisms (1968) and the fruitful experiments going on in the various laboratories of the world. The novel biomechanical interpretation of programmed and controlled movements which has been developed by Bernštejn and his collaborators (1966) ought to be taken into account by phoneticians as well. The study of speech sounds as goal-directed motor commands and acts, with particular reference to their auditory effect and to the purpose they serve in language, requires coordinate efforts of experts in all the facets of phonic phenomena, from the biomechanical aspect of articulatory movements to the subtleties of a purely phonological analysis. As soon as such teamwork is achieved, speech analysis will obtain its thoroughly scientific foundations and will respond to the "exigencies of relativistic invariance" as the binding methodological requirement for any field of modern research (Bohr 1962:71).

The neurobiologist John Hughlings Jackson (1835–1911) was the first to discern with insistence the linguistic aspect of aphasia. In examining the different forms of the dissolution of language, he succeeded—in various studies published between 1866 and 1893—in grasping the structuration of language with a penetration which the aptest linguists and psychologists of his epoch might well have envied. Thus, for example, in the first of his articles, "On Affections of Speech from Disease of the Brain," in 1879 one finds a remarkable footnote: "The so-called *idea* of a word, in contradistinction to *the word*, is itself a word subconsciously revived, or revivable, before the conscious revival or revivability of the same word, which latter, in contradistinction to the so-called *idea* of a

word, is the so-called *word itself—the word*" (p. 168). The views of Jackson on puns, dreams, and troubles of language as diverse forms of a "mental diplopia" may be cited among his many ideas which were ahead of those times.

The deepest discernment of the relation between the human organism and its verbal abilities and activities is achieved by the mutual help of neurobiologists and linguists in a comparative inquiry into the various lesions of the cortex and the resulting aphasic impairments. An intrinsically linguistic analysis discloses three dichotomies underlying those six types of aphasia which have been delineated by Luria (1966) and corroborated by observations of other contemporary neurobiologists (see Hécaen 1967). The classification of aphasic impairments based on this analysis yields a patently coherent and symmetrical relational pattern, and when we confront this strictly linguistic framework with the anatomical data, it proves to coincide with the topography of the cerebral lesions responsible for the diverse impairments (RJ 1964b, 1966c, Pribram 1971). The prospective development of such interdisciplinary "neurolinguistic" research in aphasic and psychotic speech will undoubtedly open new vistas for a comprehensive study of the brain and its functions as well as for the science of language and other semiotic systems.<sup>11</sup>

Deeper insight into the biological foundations of language may be expected from the ongoing experience with split-brain operations (see Sperry and Gazzaniga 1967 and Gazzaniga 1970). The further progress of comparative inquiry into aphasia, on the one hand, and into agraphia and alexia, on the other, must throw new light on the interrelation between spoken and written language, their ties and divergences, while general semiotics will benefit from parallel research in language disorders and other forms of "asemasia" (see RJ 1964b:289) such as amusia or disturbances of gestural systems.

So far almost nothing is known about the internal network of verbal communication and, in particular, about the neural stage in the output and input of distinctive features; let us hope that in the near future neurobiology will provide an answer to this question of primary interest for the comprehension and further study of the ultimate linguistic units. The superiority of the right ear in perceiving distinctive features and of the left ear for any nonverbal stimulus was demonstrated by international research of the last decade and enabled the Boston Aphasia Research Center to observe the identification and relative discrimination of these features in the process of learning and immediate memory. The discovery of neurological, psychological, and linguistic invariants in the perception of speech (cf. Bruner 1957) becomes a responsible and vital task for the several disciplines in question.

The transmission of the ultimate linguistic units obtains a more and

more precise elucidation with the rapid progress of physical acoustics, but the discrimination of invariants and variables requires the assistance of those linguists who realize the extrinsic abstrusity of phonological patterns and intrinsic autonomy of phonological systems. A more systematic exchange of information between these two sets of scientists must further a fuller and clearer grasp of the universal laws of phonemic patterning (see RJ 1966a). This research becomes particularly productive when results of linguistic analysis are matched with the psycho-physical data, as, for instance, with the recent findings of H. Yilmaz, who has disclosed a basic structural homology not only between vowels and consonants but also between speech sounds perceived by the human ear and colors seen by the human eye (1967).

### Linguistics and Physics

Acoustics is the only branch of physics that shares a common subject matter with the science of language. Yet the gradual reorientations in both physics and linguistics throughout our century have brought forward some crucial epistemological lessons and questions which turn out to be common to both sciences and deserve a concerted discussion. F. de Saussure still believed that in most of those domains which are studied by science, the question of units is not even raised, they are given from the outset (see 1966:8). At that time linguistics seemed to its protagonists to be the only discipline having difficulties in positing its elementary units. Today similar problems have spread over various fields of knowledge. Thus, particle physics, for instance, is faced with the controversial question whether the "elementary" particles that form the nucleus are not built from even smaller discrete units labeled "quarks," and the underlying principles of these physical and linguistic debates are of mutual interest and use also for other fields of knowledge.

Although the interaction between the object under observation and the observing subject and the dependence of the information obtained by the observer on his relative position, briefly, the inseparability of objective content and observing subject (Bohr 1962:30, 307), are realized nowadays both by physicians and linguists, nevertheless in linguistics all necessary inferences from this compelling premise have not yet been drawn, and, for instance, when mixing the speaker-hearer's standpoints, investigators get into difficulties. The possibility and desirability of applying Bohr's principle of complementarity in linguistics was brought out already by his outstanding compatriot Viggo Bröndal (1943), but it still awaits systematic examination. Many more examples of common theoretical and methodological problems could be named, as, for example, the concepts of symmetry and antisymmetry, which acquire a still more important

position in linguistics and in natural sciences, as well as questions of "temporal" or "morphic" determinism and of reversible fluctuations or irreversible changes (see RJ 1958a:527, 1962c). Several essential points common to sciences of communication and thermodynamics, in particular the "equivalence of negentropy and information" (Brillouin 1964), open new prospects (cf. Schrödinger's perspicacious view, in 1945). The joint seminar on physics and linguistics Niels Bohr and I conducted over ten years ago at MIT resulted in the conclusion that the contraposition of linguistics as a discipline of inferior precision to the so-called exact sciences and, particularly, to physics is one-sided. Actually, "Observation is essentially an irreversible process" (Bohr 1962:232); *information* obtained from the outer world by the physicist consists merely of one-way "indexes," and in their interpretation he imposes upon experience his own code of "symbols," an additional "work of imagination" (in Brillouin's parlance [1964:21]), whereas the code of verbal symbols actually exists and functions with any speech community as an indispensable and efficient tool in the reversible process of *intercommunication*. Consequently, the realistic investigator, a factual or virtual participant in such an exchange of communication symbols, merely translates them into a code of metalinguistic symbols and, hence, can achieve a higher verisimilitude in the interpretation of the phenomena observed.

Since, in the end, science is a linguistic representation of experience (Hutten 1956:15), the interaction between the objects represented and the linguistic tools of representation demands control of these tools as an indispensable prerequisite for any science. This task implies an appeal for assistance to the science of language, and linguistics, in turn, is summoned to widen the scope of its analytic and synthetic operations.<sup>12</sup>

## Linguistics and Communication Theory

### EDITORS' NOTE

Communication theory—which for Jakobson includes the domains known as information theory, mathematical theory of communication, and cybernetics—is a formal, quantitative, and especially, a statistical (probabilistic) approach to the production and transmission of information. Jakobson found in it much corroborating evidence for his conception of language as a communicative tool. He discusses here a variety of notions that he considers to be most important for linguistics: relational invariance, redundancy, binarism, translation, regularity, and deviation.

As pointed out in the Introduction, Jakobson was so influenced by communication theory that he was even led to borrow certain technical terms from it and to replace his own earlier usage. For example, "redundant features" superseded his earlier "contextual variations"; "code-message" substituted for "langue-parole"; "encoder-decoder" supplanted "speaker-addressee"; and "encoding-decoding" replaced "production-comprehension."

This essay was presented at the Symposium on the Structure of Language and Its Mathematical Aspects, 1960.

Norbert Wiener refuses to admit "any fundamental opposition between the problems of our engineers in measuring communication and the problems of our philologists" (1950b:697). There appear indeed striking coincidences and convergences between the latest stages of lin-