Is the Theory of Generative Grammar Relevant to Neurobiology?*

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I. Preliminary Remarks

Grammar is generally thoughtof as a systematization of people's knowledge of their language. It is not, however, a systematization of all of linguistic knowledge; rather it is only one component of such a systematization. Linguistic capacities in the human adult include not only the ability to render judgments about the grammaticality of potential sentences, but also to produce and to recognize the production of sentences in real-life situations. The abilities to speak and to listen (with comprehension) are skills; the ability to render linguistic judgments is a reflection of a cognitive system.

It is not possible to tap the grammar of a naive informant directly, for the judgments that he will spontaneously render will reflect not his internalized grammar but rather his internalized systems for speech perception and production. To illustrate, consider the fact that practically no naive speaker of English would find example (1) acceptable.

(1) The poor man swallowed with difficulty was young.

Yet it is grammatical, as one can see as soon as one notices that it is derived by a rule of English grammar from the same structure that underlies (2).

(2) The poor man who was swallowed with difficulty was young.

The reason for the unacceptability of (1) is that it contains an

apparent clause <u>the poor man swallowed with difficulty</u>, which cannot be related, in perception, to the remaining part of the sentence <u>was young</u>. This misanalysis of (1) is enhanced by the pragmatics of swallowing: a man is more likely to swallow than to be swallowed.

Most cases of the mismatch between acceptability and grammaticality involve sentences which are grammatical but unacceptable (Chomsky 1965: chapter 1; Bever & Langendoen 1971; Langendoen, Kalish-Landon & Dore 1972). However, the opposite kind of mismatch also arises; one that has been treated in detail (Langendoen & Bever 1972) involves the <u>not un-</u> construction, as in (2).

(2) *A not unhappy man arrived.

Despite the acceptability of examples like (2) to most adult speakers of English, they are ungrammatical, due to a restriction in English grammar that disallows phrasally negated adjectives to appear before the nouns they modify.

Language acquisition, especially since Chomsky's famous review of Skinner's <u>Verbal Behavior</u> (1959), has been thought of as providing an account of how grammar is acquired. Only recently has it been suggested that it is important to look also at how systems of speech perception and production arise in the child. Now, I wish to turn the tables further by asserting that these skills arise and develop long before grammar arises and develops, so that from the point of view of development neurobiology, grammar is the last thing that one should be looking at.

II. <u>Processes of Perception and Production of Language</u>.

Speech perception and production are rule governed, and may be systematized as an ordered set of rules, just like grammar. For sake of clarity, let us call the rules of perception and production "processes", simply that they may be distinguished terminologically from "rules" of grammar. Since perception and production are dynamic, and since their rules are actually employed in speaking and listening, the term is appropriate. It is doubly so, since it is also the term used by Sapir (1921) to describe systematic aspects of language, and Sapir as we know was particularly interested in those aspects of linguistic knowledge which were psychologically "real".

The lag of production behind perception provides evidence for the nature of some production processes. Consider, for example, the child who pronounces rag as wag, yet is able to tell these words apart when they are spoken to him. The child's production is governed by a process according to which [r] becomes [w] prevocalically. To learn to speak the English of his parents, he must eventually discard this general process. Indeed the very young child's production is governed by a large number of such processes, which can be thought of as biologically determined filters through which the adult language model must pass before it gets out of his mouth. As the child is able to bring his production into line with what he hears, those processes which do not characterize the adult language are discarded, those that characterize it in part are retained in part, and those that characterize it fully are retained in full.

Production processes apply sequentially, and frequently later, more specific processes contradict the effects of earlier, more general ones. There is, for example, a general process which converts the velar nasal [ŋ] into an alveolar nasal [n]. This process survives in part in most speakers of English; it accounts for their tendency to pronounce Vietnamese names with syllable-initial [ŋ] as starting with [n]. However, there is a restricted process which converts [n] into [ŋ] before a velar obstruent [k,g]. Finally, there is an even more restricted process which deletes [g] that follows [ŋ] in the same syllable. Thus, velar nasals are created which are immune to the general process that converts them to alveolar nasals (English speakers, even many young ones, do not pronounce sing as sin).

The processes that govern speech perception seem to be a subset of those that govern production, namely the ones which apply earliest. Thus the general process that converts [ŋ] to [n] is part of perception, but not the restricted process that converts [n] to [ŋ] before [k,g], nor the one that drops [g] following [ŋ]. This accounts for our hearing (and spelling) [liŋk] as link and [siŋ] as sing. Similarly, there is a general process which specifies that vowels are inherently non-nasalized; this accounts for the impression which most English speakers have that the vowels of English are characteristically non-nasal, even though in words like pant they always are. Children who acquire French learn to suppress this process, for reasons which have to do with the nature of the French language (for discussion, see Stampe 1972).

If a process is applicable both early and late in production, then only its early application is relevant to perception. An example is the process that specifies that an obstrent in the same syllable with a preceding [s] is voiceless. This process accounts for our hearing the stop in _spy_ as [p] rather than as [b], even though that segment is phonetically halfway between the pronunciations of [p] and [b] when no [s] precedes. The same process applies again in sloppy speech to devoice voiced stops which come to be adjacent to [s] as a result of resyllabication (see below, Section IV). For example, the phrase _let's go eat_ may be pronounced [skwi:t], where the [k] results from the underlying [g] of _go_. But if the phrase is understood at all, it is understood in its full form.

III. Rules and Processes Compared and Contrasted.

The rules of grammar are the simplest set of generative principles which describe the structures of all and only all the sentences of a language. A grammar of English constructed in conformity with the dictates of simplicity would represent the stop consonant in _spy_ as neither [p] nor [b] (since there is no contrast), but as a bilabial stop that is not specified for voicing. Such a grammar would also contain a rule to the effect that stops following [s] in the same syllable are voiceless (like [p]) and without breathy release (like [b]). That part of the rule which specifies the value of the voicing parameter would be identical with the last of the processes described in section II above. But it is not to be confused with that process; its ontological status is quite different. It is not part

of the mechanism by which we understand or produce English. It
accounts, rather, for the linguistic generalization that the voic-
ing of stops that follow [s] in the same syllable is predictable.

A phenomenon of English whose descriptions in terms of gram-
matical rules and perceptual processes are different is the assimila-
tion of nasal consonants to the point of articulation of a following
obstruent. Consider the words limp, lint and link--pronounced
[limp], [lint] and [liŋk]. The simplest grammar of English would
represent the nasal consonants in these words with the single
specification [+Nasal], and it would contain a rule that copies all
point of articulation features of the following obstruent onto that
segment. But, as we have seen, there is no process that is analogous
to this rule. The only applicable process in perception is the
context-free one converting [ŋ] to [n]. Since there are no pro-
cesses that relate [m] to either [n] or [ŋ], the nasal consonant
in limp is heard as [m], in lint as [n] and in link as [n]. Recent
attempts to make the grammatical description of English phonology
look more like the description of perception or of production, such
as by Chomsky & Halle (1968) and by Stampe (1972) are mistaken.
Such efforts are based on a failure to recognize the distinction
between rules of grammar, which are cognitive in nature, and the
processes of perception and production, which have to do with
the ongoing tasks of speaking and listening. The recent attempt
to justify the taxonomic phoneme in generative grammar (Schane
1971; Stampe 1969) is based on the same mistake. The taxonomic
phoneme, or something very much like it, may be a perceptual unit,

but it is certainly not a grammatical one.

IV. <u>The Phonological Unit of Production is the Syllable.</u>

The gradual maturation of the child's competence at producing
his native language will probably yield, at least initially, the
most information about the biological bases of language. To be
sure, the study of perception, particularly in the very young child,
will yield important results, but the great speed at which it appears
to develop as compared with production makes it less amenable to
study, to say nothing about the problems involved in trying to deter-
mine what in fact the child has understood in any given situation,
natural or experimental. There is another aspect of speech pro-
duction that makes it relevant for students of what languages have
in common, namely that any given sentence may be spoken at a variety
of speeds, and the faster the sentence is spoken the more general
processes of production (which may have been suppressed in the gram-
mar of the language) will be brought in. This point has been made
most elegantly and convincingly by Stampe (1972). Stampe has shown
that the simplest <u>unified</u> account of the variety of pronuncations
that a given word, phrase or sentence may have at different speeds
involves the systematic resyllabication of the stretch of speech
each time that segments are dropped. Each time a new alignment of
segments into syllables is achieved, the same set of processes that
apply in slower speech reapply, and new processes may be brought
in. From his work, moreover, we see that each pronunciation of a
given stretch of speech may naturally be broken down into syllables;

that the processes apply so as to preserve the integrity of the syllable. This tendency of speech to organize itself into syllables no matter how fast it is spoken is the single most important observation of Stampe's work, and from it it follows quite naturally that the syllable is the minimum unit of speech production.

It is suggestive to note that all speech derangements which do not leave the patient speechless also preserve the integrity of the syllable (though this is not the thrust of Lecours presentation here, it certainly is exemplified in it). The syllabic underpinnings of speech production, in other words, are so secure that they are the last to be eliminated.

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