HOW LEARNABLE IS PHONOLOGY?

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The real task of a child acquiring the phonology of a language is to learn to produce and to recognize the phonetic forms that other speakers use, including alternant forms of morphemes and their stylistic (and accidental) variants. It is generally agreed that the child, in learning to pronounce and perceive speech, acquires underlying or lexical forms at some at least minimal level of abstraction (phonemic, morphophonemic, systematic phonemic) and a set of mappings (processes, rules) which relate the underlying (lexical) and surface (phonetic) levels.

Accounts of how the child sifts through and sorts out the actual rumble of adult speech to acquire its phonological system are determined by the approach taken to phonology itself. Natural phonology proposes that the automatic phonological processes of a language are derived from innate constraints on human speech perception and that acquiring the ability to pronounce and recognize the phonetic forms of a language is a matter of overcoming these innate inabilities. Other phonological theories, including generative phonology, can be grouped together as conventionalist in regard to acquisition, since they claim that the child discovers or formulates these processes on the basis of the speech to which it is exposed, by observing patterns of alternation, variation, and complementary distribution—but with the aid of various constraints, both formal and substantive, on possible phonologies.

The discussion of these two views of acquisition—the naturalist and the conventionalist—will be limited here to phonology only, excluding morphophonology.¹ This distinction is parallel to that of Baudouin (1895) between divergent and correlative alternations, or Sapir (1925) between mechanical and non-mechanical processes, or Bloomfield (1933) between automatic and non-automatic alternations. From a teleological point of view, it is parallel to Baudouin’s distinction between neophonetic and paleophonetic alternations and Bazell’s between (phonetically) motivated and unmotivated principles (1954).

However, while phonology is "automatic", it is by no means "autonomous". Proponents of autonomous phonology claim that even the identities of morphemes play no role in the acquisition or analysis of phonology. Theories which distinguish between phonemes proper and what might be called automatic morphophonemes have the property of "autonomy": such theories would represent the final segment in, e.g. German [lant] 'land' (plural [lEnder]) as phonemic /t/, while theories that allow reference to morpheme identity give a morphophonemic final
But knowledge of the identity of morphemes is not only necessary to arrive at a morphophonemic representation like /land/; it is necessary even to arrive at the phonemic representation /lant/ if this can be pronounced as [lantʰ] as well as [lant]. That is, the learner must recognize that the various pronunciations are variants of a single morpheme even just to determine the phonemic representation of 'land'. Because of variation, any theory of phonology and, therefore, any theory of phonological acquisition, must refer to morpheme or form identities and to the learner's recognition of these identities.

No one would claim, of course, that the difference between the naturalist and the current conventionalist views centers on the autonomy of phonology. But it has been wrongly claimed that the difference centers on abstractness. It should be pointed out that the abstractness of underlying or lexical representations is not the principal difference, or even a significant difference, between natural and conventionalist phonologies. Natural phonology (unlike the "natural generative" phonology of Vennemann (1971, 1972) and Hooper (1976) adheres to no *a priori* principles regarding how abstract representations may be. It is true that natural phonologists do not accept, for example, the abstract "systematic phonemic" representations required by rules like Chomsky and Halle's vowel shift or velar softening (1968), but this is because the non-automatic alternations these rules represent are not phonological but morphophonological, and it is not clear that such alternations ought to be represented in phonological—or phonetic—terms (see Footnote 1). Abstractness itself is not the issue where phonology proper is concerned.

Having dispensed with these two possible misconceptions, if we now ask what the various phonological theories imply about how phonology is acquired, we will find that they seem to fall into three major groups: phonemics and generative phonology, natural phonology, and Jakobson's *Kindersprache* theory. In Jakobson's theory, acquisition involves successive bifurcations of the universe of sounds into distinct phonemes. In various phonemic and generative phonological theories, however different otherwise, it involves distributional analysis. In natural phonology, it involves inhibition of natural processes which generate mispronunciations.

**Jakobson's View of Acquisition**

In the view developed by Jakobson in his *Kindersprache, Aphasie, und allgemeine Lautgesetze*, the acquisition of phonology is the gradual acquisition of the distinctive features of phonemes. The child makes successively finer cuts along distinctive-feature lines in the set of sounds it hears, until it has mastered all the phonemic distinctions of adult speakers. According to Jakobson, universal implicational laws govern the order in which phonemic oppositions and the members of each opposition are acquired. Thus, after the child masters so many discriminations, his repertoire matches that of adults, and the remaining undiscriminated sounds remain as allophones of those phonemes whose distinctive features they share.
Jakobson's account is attractive in a number of ways. The universal implicational laws are panchronic and are based on limitations on the child's phonetic abilities. The child proceeds simply by the progressive addition of detail. But behind Jakobson's apparently simple account lurk a number of difficulties.

First, there is abundant evidence, some cited by Jakobson himself, that the child can discriminate in perception and in memory between the adult pronunciations of phonemes that he cannot yet distinguish in his own pronunciations. Jakobson says of this, "there are two varieties of language for the child..., one he controls actively, the other, the language of the adult, only passively" (22). But how is this adult language represented in the child's memory? No direct answer is given. Jakobson nowhere suggests that the child subjects the adult forms to phonemic analysis, and since he provides no mechanism whereby the child can account for combinatory alternants, we might conclude that he assumed that in the child's memory, its linguistic experiences with mature speakers are simply represented in phonetic terms. In this respect, his theory would not be remarkably different from the distributionist theories to be discussed below.

A second question also arises: how is the adult language related to the child's speech? Jakobson does not propose a mapping of adult forms onto those of the child, but leaves us to assume that the child's own phonemic representation is separate from his representation of adult speech. This leads to the question of how, when a child acquires a new opposition, he knows how each lexical item is marked with respect to this opposition. If a child represents both tea and key phonemically as /ti/, and subsequently acquires the t/k distinction, it would appear that he would have to re-learn key in order to change its phonemic form to /ki/. But this is clearly falsified in a number of studies (see especially Smith 1973). On the other hand, if the child can simply refer to its representation of the adult form to make this change, what does it mean to say that the child's phonemic form for key is /ti/?

A further difficulty arises in Jakobson's conception of the phoneme as characterized by invariant phonetic features. Overlapping allophones, even in complementary environments (e.g. Danish /t/ and /d/, pronounced [d] and [D] after vowels) forced Jakobson and Halle (1956: 17) to accept a relativistic interpretation of distinctive features. And cases like the allophones of English /t/--which include [t], [th], [Z], [D], [?], to name only a few--where the distinctive features are not shared by all the allophones, show that the assumption of invariance simply cannot be maintained. But if we cannot depend on phonemes having invariant features, it is hard to see how the child could ever arrive at the same set of phonemes that occur in adult speech by making distinctions along feature lines.

It is also hard to see how the child, in Jakobson's model, arrives at the same set of allophonic variants, in the same positions, as the adult has. For example, although he says that the young child, like the English-speaking adult, does not distinguish between an oral vowel and
its nasalized counterpart, Jakobson does not explicitly account for the fact that both child and adult pronounce only the nasalized vowel before nasals. The Jakobsonian model gives no account of how the child arrives at an adult-like distribution of allophones. In fact, Jakobson does not even make clear whether (or when) the regular but nondistinctive features of the adult's speech are perceived by the child.

To remedy this problem, a set of phonetically motivated substitutions or processes could be assumed to mediate between phonemic sameness and allophonic diversity. Context-sensitive processes would not only account for the realization of phonemes as different allophones; they would also account for contextual neutralizations and phonotactic constraints, which Jakobson does not discuss. A similar set of context-free processes could account for the regular correspondences (which Jakobson seems to recognize, but which his model neglects) between adult forms and those of the child. Further, the phonetic motivations of such processes would account for the unilaterality of Jakobson's universal implicational laws.

A set of phonetically-motivated processes is, of course, the foundation of natural phonology, allowing it to provide answers to the questions that remain for Jakobson's model. These will, it is hoped, become clear in the brief account of the naturalist model which will be presented below.

The Conventionalist Model of Acquisition

The remaining conventionalist and naturalist theories of phonology imply entirely different views of the child's task in acquiring the phonology of a language, and the implications of these views ought to be examined. The conventionalist view of phonology is in important respects shared not only by generative phonologists and the American and European structuralists (excluding Jakobson and his followers) but by the London prosodic phonologists as well. To be sure, these approaches to phonology differ from each other in many important ways, including the degree of attention they devote to phonological acquisition, but in all of them, the fundamental step in the linguist's analysis of a language is a comparison of the distributions of phonetic characteristics in a corpus of observed utterances. And in all such theories the child's acquisition of the language is--explicitly or implicitly--compared to the linguist's analysis. The comparison may be explicit, as in generative phonology (Kiparsky and Menn 1977). Or if, as in American structuralism, little or no attention is paid to the child's acquisition of language, we may simply be left to conclude that the child must use something like the linguist's method, since no alternative method is suggested whereby a child could arrive at anything like the linguist's analysis. In other words, in most conventionalist theories, which regard phonology as learned, the child learns a phonology by performing a distributional analysis.

On the distributional model, the child must record in memory, in phonetic representation, those forms that he can identify (the need for recognizing morphemic identity was established above), together with any
information about the context in which each form occurred that might play a role in its analysis. He thus creates a sort of dictionary of forms with examples in phonetic transcription. Unlike the linguist, who can record her examples on tape or (given enough repetitions) on paper, the child must register all in memory.

The child must then analyze these data, comparing variant and alternate forms of phrases, words, and morphemes according to their original contexts, and determining which features are due to contextual factors, or rather, which could be, since there would be gaps in even the most extensive corpus. These analytic procedures are familiar, though their details would differ considerably depending on whether the child uses the methods of Prague, Yale, London, or MIT. An eclectic child, noting that vowels are often nasalized adjacent to nasals, might formulate a rule which makes nasality in vowels match that of following consonants, and check to see whether any phonetic form in memory violates the rule. Let us assume that he confirms that only nasal vowels occur before nasals—this much of the rule can be installed, subject of course to disconfirmation by new arriving data. But suppose he finds that before oral consonants both oral and nasal vowels occur. Numerous alternative hypotheses remain to be tested. Let us assume that he determines that nasal vowels occur only before oral consonants which are spirants, and that nasal consonants never occur here. He could then install the other half of his original rule, and a new rule deleting nasal consonants before spirants. This enables him to erase the nasality specifications from all his vowels, a good day's work indeed.

By now the thoughtful reader will have perhaps experienced some misgivings.

The distributionist method suggests that to acquire a dictionary the child must first commit to long-term memory what is quite literally a concordance of phonetically represented utterances. Long-term memory, because on this model the child must recall every phonetic detail until he has discovered a rule to explain its distribution.

We are aware of no evidence for this kind of long-term memory for phonetic detail either in children or in adults. In fact, as far as adults are concerned, the evidence seems to indicate just the reverse. Memory for exact phonetic detail is extremely short-term—on the order of a few seconds. Werker and Tees (1984), in attempting to distinguish between phonetic and phonemic perception, find evidence for phonetic perception in adults, but they also find that phonetic memory, like "precategorical", "acoustic", or "auditory" memory, is subject to rapid decay (cf. Crowder 1982, Crowder and Morton 1969, Berwin and Baddeley 1974, Wood 1975). And although one occasionally hears anecdotes that attest to a child's acute ear for phonetic detail in an immediate-response situation (as when a repetition of 'banana' brings the child's response "But you just said [bəˈnænə]," noting a whispered final syllable), we know of no cases where such detail is shown to be borne in long-term memory ("No say [tʰæ], Dada. Mama and me say [tæ̃].").
The amount of memory required by this model of acquisition is also worth considering. If the child were required to remember all the phonetic details of one form for each morpheme, this might not seem an excessive task, but until the child can perform an analysis to determine which phonetic features are significant and which are due to allophony or accident, the model requires that he remember all the phonetic details of all the forms he hears (or at least a considerable variety of them) and any facts about the contexts (phonetic and social) of each form which might affect the distribution of its elements.

After having memorized some unspecifiable number of phonetic forms, the child is allowed, in each step of the phonological analysis that follows, to proceed from remembering more to remembering less. The role of simplicity or economy is not discussed in this respect by those using a distributionist model.

Further, this dictionary or concordance must be organized or indexed in such a way as to allow the child to make continual comparisons—not only among forms of the same morpheme but also among all forms that are phonetically similar along given lines. Even though the child's vocabulary (active and passive, since the child must remember phonetic forms for even those morphemes he only recognizes) is small compared to the adult's, the memory and, perhaps more importantly, the accessing and matching capabilities this model requires of the child (for a corpus large enough for successful distributional analysis) are not inconsiderable.

Any step in the distributional analysis may result in wholesale restructurings of the lexicon and rule/process components. The child described above who figures out vowel nasalization in English must make global changes: all the lexical representations of forms with phonetically nasalized vowels must be searched out and changed to have oral vowels, and nasal consonants must be restored where they are absent in actual speech. Processes that account for nasalization must be constructed, as must the processes that interact with these (e.g. the process that deletes nasal consonants before certain other consonants), and the new processes must be ordered correctly with respect to each other and to other processes.

And since the evaluation metric, by which these systematic changes are confirmed or rejected, must compare the alternative systems that a change implies, the child must hold in memory two (or more) entire alternative lexicons (or concordances) as well as their associated alternative rule systems, while the evaluation takes place. Such data-crunching would tax the abilities of a large computer; but even if one grants the child a memory of extraordinary capaciousness (which might be justified on other grounds) and a calculating ability of extraordinary rapidity, one must admit that no independent evidence that the child can or does perform such global changes has ever been advanced. No changes in the child's linguistic behavior have ever, to our knowledge, been interpreted as signalling some global lexical adjustment.
In any case, the kinds of searching and comparing procedures such changes imply are surely not found in adults. Despite their abilities to rhyme and alliterate, which require searching for a single form with a particular phonetic pattern, adults are rarely successful at searching for all forms that are similar in some respect. For example, an adult asked to list all the monosyllabic words he knows that end in [En] will usually do so by setting up a blank-plus-final-[En] and filling in the consonants as he runs through the alphabet, or by thinking of some rhymes "offhand" and then making up rhyming nonsense forms and selecting from these the real words. No systematic searching ability comparable to that imputed to the child seems to exist.

The questions being raised here have to do with the learnability of the phonological system, given the model proposed (or implied) by a given theory. Now, the question of logical or formal learnability, often discussed with respect to syntax, has not been much discussed with respect to conventionalist phonological theories. Wexler and Culicover mention a difficulty regarding phonological learnability: "The learner is presented with only superficial phonetic information, on the basis of which he must infer both the underlying phonological representations and the rules relating them to the phonetic forms. Unless the class of phonological components is enormously restricted, and unless the set of possible underlying representations is equally severely restricted, this will present a learnability problem" (1980:482-3).

Mark Johnson of UCSD has implemented a discovery procedure in Lisp to study phonological acquisition in the generative (and therefore distributionist) framework. The input to the discovery procedure is a set of paradigms representing surface forms—a two-dimensional array with each row representing a single stem and each column representing an affix. Not only can Johnson's procedure determine a single phonological rule from such paradigms, it can also determine a sequence of ordered rules even when the rule contexts are opaque, and it thus demonstrates that systems of ordered interacting rules "are not in principle unlearnable" (1984). Johnson's procedure yields underlying forms congruent with the rules that it proposes to account for the alternations in his data, but it does not perform the kind of analysis that could propose underlying forms where the surface forms do not alternate. No allowance is made for allophony. The procedure assumes that some sort of phonemic or distinctive-feature analysis has already been done. Moreover, the paradigm arrangement represents a completed morphological analysis, and it eliminates the prior question of what forms are relevant in the creation of the rules. Thus, although Johnson's discovery procedure seems to answer one possible objection, it does not address all the problems noted here.

If one wishes to claim that children have long-term phonetic memory and the ability to perform global phonetic searches, changes, and system evaluations, and if ordered rule systems are not formally unlearnable, then the conventionalist model of acquisition might be maintained. But there is another model, and it does not require such abilities of the child.
The Naturalist Model of Acquisition

In natural phonology (Stampe 1973; Donegan 1978; Donegan and Stampe 1979), the child begins with a set of phonological processes. These have been called innate, in the sense that they are immediate, direct, or natural responses to phonetic difficulties which result from the form and abilities of the human vocal tract and perceptual mechanisms. The claim that natural processes are innate does not imply that they represent some genetically-transmitted neural program; to say that they were innate in this sense would explain nothing. Instead, what is meant is that because of the (genetically-transmitted) physical abilities and limitations of human speakers, some combinations and sequences of phonetic features are more difficult than others, and the substitutions that speakers make (in the mental processing of their speech) to ease these difficulties represent natural processes. For example, the substitution of voiceless for voiced obstruents is a response to the difficulty of combining obstruency and voicing, and the substitutions of [w] or [y] for [l] are possible responses to the difficulty of narrowing the tongue to produce a lateral. The child may or may not observe such substitutions. When he makes them, he does so because he finds it too difficult to do otherwise. The presence of natural processes as part of the equipment with which a child approaches the acquisition of language does not imply that there is an inherited "list of processes" or any such specialized phonological-acquisition device in the brain. The processes are there because the phonetic difficulties inherent in the speaker's physical makeup are there, and because the brain is capable of the kind of planning that can overcome such difficulties.

The segmental natural processes consist of fortitions, which maximize specific phonetic properties of individual segments (and are thus perceptually as well as articulatorily motivated), and lenitions, which make sequences of articulations easier.

Fortitive processes account for the substitutions a learner makes when he encounters a segment he cannot say; they correspond to the speaker's inability to say certain individual sounds or sound-classes, and thus they limit the phonemic inventory, in that allowing a fortition to apply relieves the learner of the obligation to learn to say its input. For example, as long as the fortition consonants become non-palatal applies in one's speech, one does not learn to say [ʂ]. Thus fortitions limit the phonemic inventory in production since they limit as far as possible the set of intend-able phonological segments, or phonemes. In adults, fortitions also constrain the inventory in perception: they seem to limit the set of sounds that can be perceived by the hearer as intended-by-the-speaker.

Lenitions, in perception, allow the hearer to perform a kind of causal analysis of the words and sounds he hears; he may attribute certain features he actually hears to the application of lenitive processes and thereby discount these features, thus limiting the features he must represent in long-term memory. For example, if there is a lenition process, consonants become palatal before front vowels (in
addition to the depalatalizing fortition process), the hearer can analyze a palatal consonant [s] that he hears before a front vowel as an alveolar consonant [s] by undoing this lenition process in perception. He need not mark the consonant as palatal in long-term memory. He will say the palatal consonant [s] before front vowels, because the lenition applies in his productions as well as in perception, but he will say the palatal [s] while aiming at the alveolar [s]. Since he can get away with intending to say the simpler or more perceptible alveolar, the learner can also maintain the depalatalizing fortition $\overset{s\leftarrow s}{\rightarrow}$ that eliminates palatal consonants from underlying or phonological forms.

Now, if the learner confronts a palatal like [s] that does not precede a front vowel, he will have to suppress the $\overset{s\leftarrow s}{\rightarrow}$ process, because the [s] he encounters cannot be attributed to the context-sensitive palatalization process. Or if he encounters an [s] before a front vowel, he will have to suppress the palatalization process in order to learn to pronounce such sequences. And in such a case, knowing that palatalization must be suppressed, he can no longer attribute any [s] he encounters to its application.

In this system, the context-free fortition process constrains the phonological form if possible, and the context-sensitive lenition process may make the constraint possible by accounting for a phonetic variant. (See Stampe 1984 for a more complete description of the model, including an account of how the child recovers opaque phonological forms.)

This interaction of fortitive processes, which constrain the phonological forms, and lenitive processes, which may alter the phonological forms in a given phonetic context, allows the child to analyze the language word by word. The child is not required to remember all the phonetic details he hears, or the contexts which might be responsible for these details. As he hears each word, he attributes some of its phonetic features to the application of lenition processes, which are part of his innate language ability. And since the multiple forms he hears are often derived by lenitions and can be accounted for by on-the-spot analysis, he need not remember multiple forms for the same morpheme. Further, the child does not have to compare lists of unrelated forms to discover the distribution of a particular phonetic feature or feature combination. Instead, any predictable feature is associated with a particular context by a process which originates in the child's innate phonetic capacities. The child must, of course, compare morphologically related forms to acquire morphophonemic representations: presumably the German learner would analyze [hUn] 'dog' at first as /hUn/, and only revise the phonological form when he realizes that this form is related to /hUnd/. On noting the relationship, he could attribute the final [t] to the final devoicing process, which he has not suppressed, never having been confronted with a word like *[hUnd].

In the natural phonology model, the child does not compare phonetically similar forms, formulate and order rules, make global changes in the lexicon to fit the rules, or evaluate alternative systems of rules-plus-appropriate-lexicon. Instead, his task consists of targeting for elimination and then in fact overcoming (suppressing or
limiting) all the natural responses to phonetic difficulties which the
pronunciation of his language requires him to overcome. A process is
marked for suppression or limitation as soon as a child encounters a form
which cannot be accounted for if that process applies. At this point the
child may not actually be able to suppress the process in his own speech,
but the process can no longer be a part of his analysis of phonetic
forms. And eventually the child must overcome the process in production
as well.

Note that in this model the information that the child must
consider at any given point in the acquisition process is extremely
limited; only the current form and the rules which may affect it (and,
for morphophonemic alternations, another form of the same morpheme) are
needed. The analytic activity the child performs is also simpler:
instead of formulating rules, the child only allows them to apply or
marks them as inapplicable (or limits their application to phonetically
motivated sub-classes or particular prosodic or social contexts).

No global revisions of lexical forms are necessary--any word
misanalyzed in perception must be revised individually. (For example, if
a child analyzes [șit] sheet as /sit/ by ‘undoing’ a consonant
palatalization and later finds out that this palatalization is
inapplicable in his language because the language also allows [sit]
seat, then he must revise the representation of adult [șit] to
/sit/ when he next hears that word.) Such individual perceptually
motivated revisions in the lexicon will have little effect on production,
which lags behind, because processes marked for eventual suppression or
limitation may continue to apply for some time, merging distinct lexical
forms to accommodate the child’s limited articulatory capacities. (That
is, the child might at first pronounce [șit] from an underlying form
/sit/ for adult [șit], because he would be attributing the palatality
of the [ș] to the palatalization process, which applies in his own
speech. But even when he realizes that palatalization must be suppressed
in his language because adults also say a different word, [sit], he may
not at first be able to suppress this process in his own productions, and
may say [șit] for either /șit/ or /sit/.) The only global changes
the child’s language undergoes are changes in production, not changes in
the lexicon. Such changes usually result from the suppression (in speech
production) of processes that have been merging in speech what are
clearly distinct phonological forms for the child, and these changes
correspond to the acquisition of articulatory control of a distinction.

In this examination of the requirements of different theories of
phonological acquisition, formal learnability has not really been the
issue; instead, we are concerned with what might be called empirical or
relative learnability, which has for some time been a concern in
phonology, underlying the controversies surrounding abstractness of
representations and opacity of rules. To determine the relative
learnability of a system, one must consider the type and amount of data
it assumes to be available to the learner (in phonology, this is probably
less a question of memory capacity than of memory type and access), and
the restrictions it imposes on the posited computational capacities of
the learner. Natural phonology requires remarkably little of the learner
in terms of the data that must be considered at any one time, and the kinds of computation that must be performed. Theories which assume a distributional model of phonological acquisition require a great deal more. An intention of this paper is to point out the kinds of memory and computation that the distributional model requires, and to ask if there is evidence that the learner has such capacities.

In return, one might ask if there is any evidence that the "equipment" required by the naturalist theory--the set of natural processes--exists. There is such evidence, often cited by Stampe and recently substantiated by experiment. When adult pronunciation is achieved, some natural processes have been suppressed or limited, and some still apply, like vowel nasalization in English or final obstruent devoicing in German, to produce the correct allophonic or morphophonemic alternants of the language. But there remains, after a language is learned, a set of processes that are not suppressed because the language does not require them to be, but which do not apply in speech because the language offers no forms for them to apply to. These latent processes explain the mispronunciations (and even the misperceptions) of adults who--even in the limited situation of pronouncing single foreign words--attempt to acquire a second-language phonology. Their substitutions on encountering new sounds are exactly like the substitutions of children who encounter those sounds insofar as the articulatory difficulties child and adult encounter are the same.

For example, a speaker of a language which lacks final obstruents has never been required to overcome the process by which final obstruents are devoiced. Natural phonology predicts that if he tries to learn a language which has voiced final obstruents, he will devoice them even though he has no distributional reason for doing so. The fact that devoicing does occur in such second-language situations (Flege and Davidian 1983) is evidence that the natural process exists and surfaces in the adult when he attempts to produce the sounds of a foreign language. Nothing in any conventionalist phonological theory makes such a prediction.

Notes

1Morphophonology is sensitive to the morphosyntactic structures of utterances rather than their prosodic structures, and to their phonemes rather than their features. Morphophonological rules relate one underlying phonological representation of a form to another underlying phonological representation, not to surface phonetic representation. Of course, this principle does not correspond to current practice in phonology, which continues to express morphophonological rules in terms of accent, phonetic features, etc., in spite of the lack of evidence that such rules are (synchronously) sensitive to such features.

Phonological processes, on the other hand, are sensitive to features in prosodic structures. They are insensitive to the distinction between allophones and phonemes, and they are insensitive to morphosyntactic structures except insofar as these are secondarily reflected in prosodic structures. Processes relate the underlying
phonological representations of prosodically configured utterances to their surface representations.

2 Note that the a/E alternation here is a non-automatic morphophonemic alternation.

3 Braine (1974) has raised some objections to the generative model of language acquisition that are similar to those that will be raised here. The position of natural phonology seems for the most part compatible with Braine's. Perhaps this is because Braine distinguishes, as do natural phonologists, between processes that govern the Sapirean "mechanical" level of motivated alternation and variation and the "supra-Sapirean" rules which are lumped together with these "mechanical" processes as "phonological rules" in generative phonology.

4 It should be noted that much of the literature on this topic distinguishes only between "pre-categorial" or "acoustic" and "phonetic" memory. "Phonetic" may, it seems, refer to any level processed linguistically--hence, in our terms, phonetic or deeper. The distinctions that count as phonetic in this literature, are phonemic distinctions--e.g. in Wood 1975, the b/d/g difference represents a phonetic dimension, but a pitch difference represents a nonphonetic dimension (for English speakers). Werker and Tees, as noted, distinguish phonetic from phonemic differences.

5 It would not alter the theory of natural phonology substantially to say that processes may be discovered by the child as he learns to use his vocal tract (just as the child discovers that by leaning against a table or chair he can stand without holding on, while he still has too little subtlety of balance to stand entirely on his own). Perhaps this discovery happens in babbling and in early speech. But if processes are learned, they are learned as matters of physical coordination are learned--by doing—not by the kind of cognitive processing that is required to learn other components of language, like syntax, or morphology, or morphophonological rules. Processes are different in nature and in origin from most of what generative phonologists call phonological rules.

References


