DOCUMENT RESUME

ED 098 791 FL 006 361

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TITLE Some Suggestions on the Role of Systematic Phonemics in Child Phonology. Papers and Reports on Child Language Development, No. 1.
INSTITUTION Stanford Univ., Calif. Committee on Linguistics.
PUB DATE Mar 70
NOTE 14p.

EDRS PRICE MF-$0.75 HC-$1.50 PLUS POSTAGE
DESCRIPTORS *Child Language; Comprehension Development; *Generative Phonology; *Language Development; Language Patterns; Language Skills; Linguistic Theory; *Phonemics; *Phonological Units; Phonology; Psycholinguistics; Syntax

ABSTRACT

The major purpose of this paper is to initiate discussion on the validity of systematic phonemics in the area of language acquisition. This is not an attempt to write a phonology, but rather an outline of some theoretical and formal devices that may be used for gaining insight into the phonological system of the child. An evaluation procedure suggested is that of "developmental adequacy" which accounts for the process by which a child moves closer to a system that is constantly presented to him. Such a procedure includes statements of stability that mark certain aspects of the child's system as similar to, and others as distinct from, the model to which he is presented. A summary of rules suggested for the child's system include: reduplication, diminution, production alternation, and adaptation. The productive rule is introduced to cover the child's comprehension of sounds he does not yet produce, and the adaptive rule expands the notion of "developmental adequacy." (Author/LG)

SOME SUGGESTIONS ON THE ROLE OF SYSTEMATIC PHONEMICS IN CHILD PHONOLOGY

David Ingram

INTRODUCTION

1.0 I am not aware of any study that attempts to adapt the theoretical assumptions of "systematic phonemics" (e.g., Harms, 1968) to help account for the development of a phonological system in the child.[1] One reason for this may be the time lag between linguistics and child language research, a lag which has led Brown and Hanlon (1968) to remark that psycholinguistics trails present linguistic research anywhere from five years on, and generative phonology has made some of its greatest advances in the last three years.[2] Second, much of the work has discussed the importance of the orthographic system and its correspondence to abstract morphophonemics (i.e., Chomsky & Halle 1968, Schane 1968) which leaves a false impression to some that one cannot discuss abstract underlying representations until the child has reached an understanding of the writing system. Third, the only extensive characterization of the adult phonological system, that of Chomsky & Halle (1968), presents a difficult model to account for in terms of acquisition.

The major purpose of this paper is to initiate discussion on the validity of systematic phonemics in the area of language acquisition. I shall first discuss some basic assumptions of generative phonology and how they apply to child language. Second, I shall make some suggestions as to how the theory may be expanded to provide insights into a different way to look at phonological development. An evaluation procedure will be suggested in the process, that of developmental adequacy.

2.0 Some Basic Assumptions of Generative Phonology. The development of generative phonology has proceeded on the belief that autonomous phonemics is an inadequate and unnecessary level of linguistic theory.[3] Instead, it suggests that phonology entails two levels of significance, "that of phonetics and morphophonemics" (Postal, 1968, p.98).[4] The main criticism of autonomous phonemics has been that it functions under the condition of invariance between the phonemic and phonetic levels, so that there must be a one-to-one correspondence between the units of each (Chao, 1933). Systematic phonemics has loosened this condition and has replaced it by the naturalness condition (Postal, 1968) and the alternation condition (Kiparsky, 1968).

The naturalness condition is difficult to define, according to Postal, but roughly the "relation between phonological and phonetic structures is a natural one" (Postal, p.56). For example, suppose a hypothetical language has the phonetic items in (1)X.

		X		Y	Z
(1)	A.	[tam]	"fascism"	/tam/	* /tam/
	B.	[dam]	"doggie"	/dam/	* /θam/
	C.	[dat]	"racist"	/dat/	* /dat/

Autonomous phonemics, by the process of segmentation and classification, would posit the items listed under (1)Y as the phonemes. Systematic phonemics, however, may be willing to posit the forms in (1)Z for reasons of greater generality not evident here, which would violate the

principle of invariance. The relation between [d] and */0/ is not arbitrary, but determined by the naturalness of the relation between the subsequent sounds. A violation of the naturalness condition would be positing any of the forms in (2) for (1) Z,B.

(2) */ŋam/

*/hxam/

*/Uam/

I shall accept through the rest of this paper the naturalness condition as a working hypothesis. As such, I loosen the restriction of bi-uniqueness to see if it will yield generalizations about the child's linguistic system that otherwise would not be available.

The other condition, the alternation condition, argues against absolute neutralization (Kiparsky, p.13 ff). An example of absolute neutralization as given by Kiparsky is Chomsky & Halle's suggestion of a final /-e/ in words like tolerance, eminence, relevance, and competence that is never phonetically realized. It is suggested, however, to account for English stress placement. Instead of such a device, Kiparsky favors the use of diacritic features.

It will be the contention here that the alternation condition cannot be held in its strong version and, if so, it would miss significant generalizations about the child's competence. It can only be held in its weak form, a possibility that Kiparsky has considered.

> "The weaker alternative, to which we may well be ultimately driven, is that the alternation condition is a clause of the evaluation measure which says (among other things) that absolute neutralization is linguistically complex" (p.22).

The reason for this, as will be discussed in section 4.3, is the difference that exists between the child's comprehension and production. Both of these are aspects of performance, whereas competence incorporates the two. The child will hear distinctions that he does not make in his production. The phonology of the child, if it is taken as an expression of linguistic competence, will have to take this into account. Jespersen (1921) discusses this phenomenon: "the child hears the correct sound some time before he is able to imitate it correctly; he will thus still say t for k, though he may in some way object to other people saying 'tum' for 'come' ... Such a child, as soon as it can produce the new sound, puts it correctly into all the places where it is required. This, I take it, is the ordinary procedure" (p.110). I suggest that such a word as 'tum' above would have the underlying form */kə:/ and that such units as */k/, which have not yet achieved phonetic realization though they are a part of his comprehension, will be marked by the feature [-productive]. The rest of this paper will be concerned with speculation about a small set of universal features, such as this one, that may be used in child language to account for the child's total phonological competence.

3.0 Evaluation Procedures. Chomsky (1964a, p.63) has discussed three kinds of evaluation procedures, those of observational, descriptive, and explanatory adequacy. The first procedure results in a grammar that describes the facts without attempts at generalization. It would, for example, note in the case of 'permit' and 'permit' only that these two words have different stress placement. The second procedure, descriptive adequacy, attempts to make generalizations about linguistic phenomena. It would, in our example, state that a noun derived from a verb will have a stress shift. Explanatory adequacy requires a general linguistic theory independent of any particular language. In this example, "the level of explanatory adequacy requires a phonological theory that prescribes the general form of such syntactically determined phonetic processes" (Chomsky, op.cit., p.66).

It is of heuristic value to examine these evaluation procedures and their effects upon the construction of a child's grammar. First, there is observational adequacy. In phonology, the child operates with a small set of tokens that can be described in terms of the observed behavior; i.e., via the child's production. This has been the measure implicit in most studies on the child's phonology.

The next measure applicable is that of descriptive adequacy. The proposals in this paper can be taken as an attempt towards such a measure; i.e., an attempt to incorporate generalizations beyond the child's observable linguistic behavior. Sections 4.2 and 4.3 are direct attempts to formalize such an incorporation. Footnote 5 sums up the need for such an approach if any significant advances are to be made.

There is an additional measure that we can incorporate into child language (here phonology), that of developmental adequacy. The nature of such a measure is highly speculative. Basically, it is a procedure that accounts for how the child moves closer and closer to a system that is constantly presented to him. Such a measure includes statements of stability, ones that mark certain aspects of his system as similar to, and others distinct from, the model to which he is presented.

An example of this can be taken from the child's acquisition of past tense. The first stage prior to learning the past affix /-ed/ is when the child produces past forms like 'came' and 'went'. These forms at this early stage are very close to the adult system, though they will undergo changes as the child advances. Take two grammars at this stage of syntax. Developmental adequacy claims that, all being equal, a grammar is more highly valued if it can formally mark the instability of these forms. Section 4.4 discusses a procedure for marking such phenomena in phonology.

The following sections (4.2 and 4.3) attempt to show how certain aspects of child phonology can be made descriptively adequate. They point out generalizations that can be captured by going beyond attempts to account for the child's production alone. The suggestion of adaptation features in section 4.3 introduces a formulation for developmental adequacy. It is stated that a grammar containing features marking stable versus unstable

phonemes is more highly valued than one that does not. All three sections also relate to the notion of explanatory adequacy. A theory that includes them makes the claim that they would account for universal phonomena in phonological acquisition.

4.0 Some Suggestions for Child Phonology

4.1 The examples for the following discussion are taken from Holmes (1927), who phonetically transcribed the speech of his daughter Mollie at 1;6. The data is listed in the Appendix and consists of 46 one-word utterances. The phonetic inventory is shown in (3).

(3)

Consonants			
p	t	tʃ	k
b	d	dʒ	g
	s		
m	n		
w			

Vowels		
i		u
ɪ		
e	ə	o
ɛ	ʌ	
æ	a	ɔ
ai	ɛə	au
	aə	ou

4.2 Reduplication. A look at the canonical form of these words and their alternates reveals the following shapes.

(4)

	Shape	Frequency	
a.	CV	17	
b.	CVC:	12	
c.	*CVCV	10	*(reduplication)
d.	CVg	6	(glide)
e.	CVCV	2	
f.	*CVC:	1	
g.	VC:	1	(variations of the same
h.	V	1	word, #22 "hat")

The ones that are most frequent are (4)a-e. If we collapse (4)d under (4)c, we then have (5).

(5)

a.	CV	23
b.	CVC:	12
c.	*CVCV	10
d.	CVCV	2

These can be reduced further by the following changes. First, reduplication is a powerful device in child language, and is distinctive (e.g., #20 [bæ] "bath"; and #15 [bæbæ] "apple"). Many languages also use reduplication for distinctions of meaning (e.g., Suk). It is suggested that reduplication, in this sense, operates as a kind of class marker, those words that reduplicate and those that don't. As such, reduplication may be handled as a syntactic feature of those words. Thus, #15 [bæbæ] "apple" will be shown as (6) in the lexicon.[6]

(6)
$$\left[\begin{array}{l}\text{[-human}\ \ \text{]}\\ \text{[-animate}\ \ \text{]}\\ \text{<-pronoun}\ \ \text{>}\\ \text{<+noun}\ \ \text{>}\\ \text{<+reduplication>}\end{array}\right]$$
"bæ"

This is distinguished from #20 [bæ] "bath" which is shown in (7).

(7)
$$\left[\begin{array}{l}\text{[-human}\ \ \text{]}\\ \text{[-animate}\ \ \text{]}\\ \text{<-pronoun}\ \ \text{>}\\ \text{<+noun}\ \ \text{>}\\ \text{<-reduplication>}\end{array}\right]$$
"bæ"

Then, as Chomsky has suggested, the phonological rules can handle this by assuming "that at the beginning of the phonology each ... syntactic and morphological feature of a morpheme m is assigned to every phonological segment of m".[7]

This simplifies (5) to (8).

(8)
a.	CV	33
b.	CVC:	12
c.	CVCV	2

Now look at the items that constitute the form of (8)b, such as #38, "book" with [buk:] varying with [buki] (observe also #33 "walk" [wɔki] as compared with #40 "duck" [dʌk:]). Of these, it can be suggested that the underlying forms are either CVC: or CVCi. From #38 "bookie", we might predict that "duckie" could also occur, although it is not attested. I suggest giving all of these forms the underlying shape of CVCi, with a Phonological rule (9), which also will be needed to account for #38.

(9)
$$\underset{1\ \ 2\ 3\ \ 4}{C_1,V,C_2,i} \Longrightarrow 1,2,\ \left[\begin{array}{c}3\\ +\text{long}\end{array}\right],\theta$$
condition 1 2 ≠ 3 4

There are alternative ways to handle the lexical entries for this rule. Item #38 "book" will be optional to this rule. One may mark items such as #40 as obligatory for the rule and others like #33 as exceptions. The other alternative is to allow all such underlying forms to undergo the rule optionally, which would allow for forms not yet recorded. Later data could help decide the issue.

The powerful process of phonological diminutives can now be accounted for. This reduces the forms in (8) to (10).

(10)	CV	33
	CVCV	14

The words of the sample now fall into two distinct classes in terms of canonical form. This generalization is achieved by discussing reduplication as defining two morphological classes, which appears to be the case syntactically, and two P rules, the Reduplication Rule that would follow from above, and a Phonological Diminutive Rule[8] which would have been required anyway. The former solution, the inclusion of syntactic information, continues as an important motivation for the morphophonemic level. The only two cases not yet explained, (4)g and (4)h will be discussed forthright[9].

4.3 Production Features. As mentioned earlier, the child's discrimination of sounds will precede his active production. To account for competence, we have to take this into consideration (see footnote 5). In our data, this occurred particularly with #22, [æ] or [æt:] "hat". These two forms are also the two canonical forms that do not fall into (10). It can be included though, by positing the underlying forms */hæ/ or */hæti/ (or */hæt/, see footnote 8). The phoneme */h/ will have, among its distinctive features, the feature [-productive]. This case will be handled by a Productive Alternation Rule roughly like (11).

(11) [-productive] ⟶ ∅

This kind of format can be quite useful in treating those forms discussed by Jespersen (1922) where sounds are comprehended but not produced. An argument for the positing of the underlying */h/ is also made from the fact that this word is the only anomaly in terms of the canonical forms.

Another type of Productive Alternation Rule occurs when the child understands a sound but replaces it productively with one already in his system. Brown has mentioned a child who pronounced the word "fish" as [fɪs]. When the adult would say [fɪs], however, the child would say, 'no, not [fɪs], [fɪs]'.[10] In this case, the underlying form would be */fɪʃ/, with a Production Alternation Rule that changes the */ʃ/ to [s]. Statements such as this in terms of distinctive features may yield significant generalizations about the child's system.

In Holmes' article, he gives data collected four months later. Among these items are those in (12).

(12) [wæt] "hat"
[wæŋki] "hanky"
[wæn] "hand"

This shows a second stage of development in terms of Adaptation rules. The first is when the systematic phoneme is reduced to zero. The second is when that sound becomes phonetically realized, but not by the correct sound. In our example, this indicates that (11) has changed to (13).

(13) $[-\text{productive}] \longrightarrow \overset{h}{w}$

Again, a body of such rules in terms of features may reveal some general properties of phonological acquisition.

4.4 Adaptation Features. These features handle an aspect of the child's phonology that comes under the 'developmental adequacy' measure described above. The child, in his development, is constantly presented with phonetic models of the adult system. One way that he may convert them to his own system is to reduce them to simple canonical forms (sec. 4.2). Next, he can leave out sounds that he comprehends but is not yet able to produce (sec. 4.3). A third change, and one that occurs often, is that he may adapt the sounds he hears to another in his system, even though he has the original sound. There are several examples of this in our data. Look at the vowel [æ] in (14)a and compare to the [æ] in (14)b, as matched with the adult model.

(14)a.	i.	[kækæ]	"cracker"	#12
	ii.	[dæ]	"that"	#39
	iii.	[dædæ]	"daddy"	#2
(14)b.	i.	[mæmæ]	"mamma"	#1
	ii.	[tætæ]	"tata"	#34

While the child's production has [æ] in all cases, the adult model has two vowels, [æ] in (14)a and [a] in (14)b. Yet, the child does have the phonetic [a].

(15)	i.	[da]	"doll"	#23
	ii.	[wa]	"want"	#25
	iii.	[ba]	"bread and butter"	#11

The prediction would be that the vowel in (14)a will remain constant during the acquisition of the adult model, whereas those in (14)b will change at some point. These two sets of vowels then, have a different status in the child's competence.

What I suggest is that we consider the underlying vowels for those items in (14)b as */a/. Their underlying forms, with reduplication as a syntactic feature are as in (16).

(16) */ma/ "mama"
*/ta/ "tata"

In these items, the */a/ will have a feature to distinguish it from the vowels in (15). This feature will be [+adaptive]. Its feature matrix is given in (17).

(17)
$$\begin{bmatrix} +\text{vocalic} \\ -\text{consonantal} \\ -\text{high} \\ +\text{back} \\ +\text{low} \\ -\text{round} \\ +\text{adaptive} \end{bmatrix}$$

The vowel in */wa/ "want" will be different from (17) for it will be [-adaptive].

There will then be a rule which converts the adapted sounds. For the above, it would be

(18)
$$[+\text{adaptive}] \xrightarrow{a} [-\text{back}]$$

More general rules could be formulated once the other adaptive vowels are determined.

Take the items [ko] "come" #35, and [ko] "coat" #21. While these are homonymous on the surface, they would be represented as different underlying forms.

(19) */kə/ "come"
*/ko/ "coat"

The */ə/ would be [+adaptive]. The rule for this change is informally shown in (20).

(20)
$$[+\text{adaptive}] \xrightarrow{\text{ə}} [+\text{round}]$$

This feature would also apply to consonants. Scanning the list reveals that most of them have been picked up correctly. However, item #15 [bæbæ] "apple", and #18 [bɛt:] "bed" differ in this respect. The underlying consonants for these two would be */p/ and */d/ respectively. The underlying forms would be as in (21).

(21) */pæ/ "apple"

*/bɛdi/ or */bɛd/ (see footnote 8) "bed"

Both the */p/ and */d/ of these words would have the additional feature of [+adaptive]. The P rule that changes these would be something like (22).

(22) $\begin{bmatrix} +\text{consonant} \\ -\text{vocalic} \\ +\text{adaptive} \\ \alpha\text{voice} \end{bmatrix} \longrightarrow [\ \alpha\ \text{voice}]$

Thus the adaptation rule for consonants shows that this is a voice change. The list of P rules that affect adaptive vowels will be a general statement on what the child is doing to the model sounds he hears. As the child approaches a more adult-like system, these changes would be seen as a loss of adaptive rules. They will be replaced by the more complex adult rules.

5.0 Concluding Comments. This has not been an attempt to write a phonology, but rather an outline of some theoretical and formal devices one may use to gain insight into the phonological system of the child. I have suggested the use of reduplication as a syntactic feature. In terms of phonological features, I have introduced the notions of [+productive] and [+adaptive]. The first is included to cover the child's comprehension of sounds he does not yet produce. The latter feature helps expand the notion of "developmental adequacy", which is a statement and prediction on the stability of certain sounds in the child's system. A summary of the rules suggested is given in (23).

(23) Reduplication Rule
Diminutive Rule
Productive Alternation Rules
Adaptation Rules

One final comment might be made on the notion of the cyclic principle. As more is done on children's phonology, perhaps this may give us insight into its validity. So too, the more current notion of 'persistent rules' (Chafe, 1968) may prove valuable for child phonology.

FOOTNOTES

1 By this I mean more than the application of distinctive features, which has been attempted by Menyuk (1968), Moskowitz (1969), and others.

2 See, for example, Stanley (1967), Chafe (1968), Chomsky & Halle (1968), Harms (1968), Kiparsky (1968), Schane (1968).

3 For a full discussion of this, see Postal (1968).

4 or "process morphophonemics", Kiparsky (1968).

5 This distinction and the need to consider not just performance but also comprehension has been emphasized by Chomsky.

> "It seems to me that, if anything far-reaching and real is to be discovered about the actual grammar of the child, then rather devious kinds of observations of his performance, his abilities, and his comprehension in many different kinds of circumstances will have to be obtained, so that a variety of evidence may be brought to bear on the attempt to determine what is in fact his underlying competence at each stage of development. Direct description of the child's actual verbal output is no more likely to provide an account of the real underlying competence in the case of child language than in the case of adult language." (Chomsky, 1964b, p.36.)

6 These are not complete feature specifications. For a discussion of lexical entries in childrens' one-word utterances, see Ingram (1969).

7 Cited in Postal (1968), p.128.

8 An alternative solution with as much validity would be to have CV and CVC with the Diminutive Rule as additive rather than subtractive.

9 Case (4)f is also now explained as a CVCV that is [+reduplication] and could be one argument for a subtractive Diminutive Rule.

10 my paraphrase.

11 the letter represents a set of features.

APPENDIX - Holmes data

1.	[mæ mæ]	"mama"
2.	[dædæ]	"daddy"
3.	[dɔ]	"dog"
4.	[tɪti]	"kitty"
5.	[bɪbi]	"bib"
6.	[bo]	"bird"
7.	[kau]	"cow"
8.	[bɛbɛ]	"baby"
9.	[pu]	"spoon"
10.	[pu]	"pudding"
11.	[ba]	"bread and butter"
12.	[kækæ]	"cracker"
13.	[njæ njæ] or [næ næ]	"dinner"
14.	[ke.k:]	"cake"
15.	[bæ bæ]	"apple"
16.	[d.ʒ u]	"orange joice, or orange"
17.	[wə] or [wə wə]	"water"
18.	[bɛ] or [bɛ.t:]	"bed"
19.	[nau]	"down"
20.	[bæ]	"bath"
21.	[ko]	"coat"
22.	[æ] or [æt:]	"hat"
23.	[da]	"doll"
24.	[si] or [ti]	"see"
25.	[wa]	"want"
26.	[nou]	"no"
27.	[gu.d:] or [gu]	"good"
28.	[bæ.d:]	"bad"
29.	[t.ʃ u]	"shoe"
30.	[ta.k:]	"stocking"
31.	[kai]	"cry"
32.	[we]	"way"
33.	[waki]	"walk"
34.	[tætæ]	"tata (goodbye)"
35.	[ko]	"come"
36.	[pi.k:]	"peek"
37.	[ba.k:]	"box, then bottle"
38.	[bu.k:] or [buki]	"book"
39.	[dæ]	"that"
40.	[dʌ.k:]	"duck"
41.	[tʌ.k:]	"Tuck, a boy next door"
42.	[dʌ.k:]	"Dick, the same"
43.	[ku.k:]	"bacon (from cook)"
44.	[dɛə]	"there"
45.	[kœi]	"squirrel"
46.	[tɪ.k:tɪ.k:]	"tick-tick (for clock)"

The other utterances do not introduce any new information.

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