Daniel A. Dinnsen, Mary Elbert and Gary Weismer

Some Typological Properties of Functional Misarticulation Systems *

This paper focuses on the characterization of children's functional (non-organic) speech disorders involving phonological misarticulation. One basic assumption of the work done to date within Generative and Natural Phonology frameworks is that children's underlying representations are the same as the surrounding (ambient) speech community's (Compton 1970, 1975; Lorentz 1976). By virtue of this assumption about underlying representations, misarticulators are viewed as a homogeneous population. Such an assumption across the board no doubt misrepresents the apparent diversity across these systems. The numerous and diverse phonological rules that have been posited to convert the underlying representations into their phonetic (mis)productions make it difficult to discern any but gross commonalities across functional misarticulation systems (see Ingram 1976: 98—122 and references therein).

In this paper we will make the following points: First, the nature of underlying representations need not be *assumed a priori* but rather is an issue that can and should be subjected to empirical considerations. Second, our approach provides for a typological characterization of functional misarticulation systems. Several types of systems can be identified, each with characteristic constraints which distinguish them from one another — both functionally disordered and normal. Third, the correctness of our typological characterization may be evaluated in the effects of remediation.

The empirical considerations include morphophonemic alternations, nonalternating forms (contrasts), and the absence of a contrast in certain contexts. These considerations are routinely employed by generative phonologists (see e.g. Kenstowicz and Kisseberth 1979: ch 3).

Given the above empirical considerations about underlying representations, at least three distinct types of functional misarticulation systems are identifiable. The first type (Type A) is characterized in part by underlying representations which generally correspond with those in the ambient system. That is, the phonemic and phonetic inventories of the two systems are (nearly) identical and most shared morphemes can be shown to have the same segment-by-segment composition at some level of representation. What makes the system different from the ambient system is the surface patterns derived from phonological neutralization rules. This may be different in certain crucial respects from any rules in the ambient system. These points are illustrated by the following data from the functionally deviant speech of Jamie (Age 7; 2):

* This work was supported in part by a grant from the Public Health Service, number SO 7 RR 7031. We are grateful to Michelle Blank, Edith Maxwell and Fred Eckman for their comments and suggestions.

[kæ:]	'cab'	[kæbi]	'cabby'	/b/ alternates with null
[ka]	'cop'	[kapou]	'copper'	/p/ alternates with null
[kɪ:]	'kid'	[kɪdou]	'kidder'	/d/ alternates with null
[pæ]	'pat'	[pæti]	'patty'	/t/ alternates with null
[dɔ:]	'dog'	[dɔgi]	'doggie'	/g/ alternates with null
[dʌ]	'duck'	[dʌki]	'ducky'	/k/ alternates with null
[mʌ:]	'mud'	[mʌɾi]	'muddy'	/ɾ/ alternates with null

These data exhibit morphophonemic alternations motivating underlying representations that correspond to those in the ambient system. They also motivate a phonological neutralization rule deleting word-final obstruent stops — a rule which obviously cannot be associated with English sound patterns.

Not all rules in systems of this type differ so markedly from those in the ambient system. Consider, for example, the alternations evident in the functionally deviant speech of Louise (Age 4; 10):

Omissions		*Morphophonemic alternations*	
[bʌ ə]	'but the'	[bʌt wio]	'but we'
[bɛi bai]	'beddy-bye'	[bɛd]	'bed'
[ga ə]	'got a'	[gɛt sʌm]	'get some'
[dæi]	'daddy'		

But note consonants not omitted:

[sɛpt ə]	'except a'	[dʌgʌs]	'Douglas'
[sistos]	'sisters'	[wabɪn]	'Robyn'

These data motivate an Intervocalic Dental Stop Deletion rule — structurally and functionally quite similar to the English Flapping rule.

A number of constraints seem to govern phonological rules in those functional misarticulation systems with underlying representations corresponding to the ambient system's. All of these constraints enhance the recoverability of underlying representations despite the neutralizing effect of the rules. One constraint is that the rule must be *optional*. This is characteristic of both children's rules above as can be seen below:

Louise		Jamie	
[dæi]/[dædi]	'daddy'	[pɪ:]/[pɪg]	'pig'
[sʌmbʌi]/[ɛnibadi]	'somebody/anybody'	[gɔ:]/[gɔg]	'dog'
[paɪ]/[padi]	'potty'	[mʌ:]/[mʌd]	'mud'
[pɛdɪŋ]	'petting'	[nait]	'knight'
[ənvaidəd]	'invited'	[wʌd]	'what'

Another constraint limits a rule's potential for neutralization by severely limiting its focus. This is exemplified by Louise's Intervocalic Dental Stop Deletion rule referred to above. It is, of course, logically possible that *all* obstruents be deleted between vowels, but such general classes seem not to constitute the focus of a rule in this type system. It is thus not uncommon to find other motivated restrictions on rules limiting them to, e.g. labials or to voiceless strident continuants. The effect of such restrictions renders phonetic forms derived from the associated rules only a few ways ambiguous. A similar constraint ensuring recoverability has been identified by Kaye (1978) for natural (non-deviant) phonologies.

It might seem that the above constraint is non-necessary in view of the *general* rule deleting obstruent stops in Jamie's speech (see above). It should be noted, however, that Jamie (and certain other children) maintain a vowel length distinction before the omitted final consonant that corresponds perfectly to the voice distinction of the omitted consonants (Weismer, Dinnsen, and Elbert, to appear). Thus given a word with an omitted final stop, the only information that is apparently not recoverable is point of articulation. The vowel length adjustments are sensitive to the voice distinction in consonants underlyingly allowing more general rules without loss of distinctions superficially. Similar compensatory, anti-neutralization processes are also common in natural languages.

Given this characterization of type A functional misarticulation systems, we predict that a child with ambient-like underlying representations will not have obligatory rules effecting those representations. Moreover, such a child should not have highly general rules unless compensated by some anti-neutralization process. In short, Type A systems substantively and functionally resemble natural languages in general and the ambient language in particular.

A second type of functional misarticulation system (Type B) sharply contrasts with type A. The underlying representations in type B systems are radically different from those in the ambient system; both the phonemic and phonetic inventories are drastically reduced relative to the ambient system, and the composition of morphemes is simpler. Moreover, there are no morphophonemic alternations and thus few, if any, phonological neutralization rules. The constraints governing pronunciation in these systems are phonotactic in nature. These points are illustrated in the functionally deviant speech of Matthew (Age 3; 11):

[dɔ]	'dog'	[dæɪn]	'standing'	[bʌə]	'brother'
[wɛ]	'red'	[wɪo]	'little'	[wʌɪn]	'looking'
[tʌ]	'truck'	[ʌmbʌi]	'somebody'	[wæɪ]	'rabbit'
[dai]	'doggie'	[bɛ]	'bed'	[tiə]	'zebra'
[dæi]	'daddy'	[pɛi]	'plate'	[bɛə]	'better'
[bɛi]	'spreading'	[bɛ]	'bread'	[mɛi]	'maybe'

While Matthew fails to realize obstruent stops at the end of the word (like Jamie above), a rule of word-final stop deletion would be unmotivated in this instance since there are no morphophonemic alternations (viz. [dɔ] 'dog' ~ [dai] 'doggie'), and more generally, there are no obstruent consonants after vowels — whether at the end or in the middle of a word. A phonotactic constraint excluding obstruents after vowels appears to hold at all levels of representation including underlying representations and thus precludes any morphophonemic alternations. The claim is, then, that Matthew apparently does not *know*, at least productively, that obstruents can follow vowels as in the ambient system. This claim receives support from the fact that Matthew also fails to distinguish vowel length as did Jamie (Weismer, et al., to appear).

Correlating some of the grammatical properties of this system-type, we predict that for those children whose underlying representations are substantially reduced in number and type of distinctions relative to the ambient system, there will be no phonological neutralization rules or at least none like those in the ambient system. We also predict that there will be much less variability in the pronunciation of a given word as was evident, for example, in the type A systems (see above) due to influence of phonotactic constraints in type B systems.

While type B systems are substantively quite different from the ambient system, they do not appear to be unlike other natural language systems with shallow phonologies (e.g. Thai, Burmese). Type B systems may even represent a very early stage in the acquisition of the ambient system.

Yet another type of functional misarticulation system (Type C) is characterized in part by underlying representations that include roughly the same number of distinctions but not qualitatively the same type of distinctions relative to the ambient system. The phonetic inventory of type C systems is considerably reduced relative to the ambient system. That is, the child does not produce all the same sounds that occur in the ambient system. The phonemic inventory, however, appears to be much more elaborate than the phonetic inventory and corresponds closely to the number of distinctions evident in the ambient system. While these phonemic distinctions are not apparently articulatorily-based in type C systems, they are at least evident in terms of the operation of phonological rules. That is, a single phone may need to be distinguished diacritically at some more abstract level of representation in order to account for the different patterning characteristics of that sound. These points are illustrated from the functionally deviant speech of Melissa (Age 7; 6) as reported in Maxwell 1979. Melissa's phonetic inventory fails to realize [s, z, θ, ð] in any context. The sound typically replacing those sounds is a dental stop, [t] or [d] depending on voicing. Dental stops exhibit different patterning characteristics and thus motivate corresponding distinctions within the class of dental stops. Specifically, some dental stops alternate with null in clusters *obligatorily* and other phonetically identical stops alternate with null in the same clusters *optionally*. While the rule motivated by these alternations does not resemble any rules in the ambient system, the distinction involved in the rule corresponds with the English t/s, d/z distinction. Yet other phonetically identical dental stops alternate with labiodental fricatives in word-final position. Again, the rule is not English-related, but the distinction involved in the rule corresponds to the English t/θ, d/ð distinctions.

An interesting characteristic of type C systems which distinguishes them from type A systems and presumably from other natural language systems is the neutralizing character of the rules and the nature of the underlying distinctions being neutralized. That is, phonetic forms in type C systems are many-ways ambiguous while in Type A systems they are only a few-ways ambiguous. Recoverability is apparently not a constraint governing type C systems. Moreover, given the limited phonetic inventory of type C systems, the level of abstractness required for underlying representations places these systems in an unusual and controversial class of language systems.

It may be, however, that type C systems are less peculiar and more like type A systems than has been suggested here. Specifically, acoustic studies such as Maxwell and Weismer 1979 may reveal systematic productive phonetic distinctions which are not perceptually salient in the ambient system. Such a finding could mean that the phonological rules are either less neutralizing than had been thought, or possibly even allophonic. In any case, type C systems would still be distinct from type A inasmuch as the phonetic inventories would be qualitatively different relative to the ambient system.

Type C systems are also distinct from type B systems in terms of phonemic inventories and rules. Type C systems have more phonemes albeit more abstract. In addition, type C systems have phonological neutralization rules while type B systems have no such rules.

The typological characterization provided herein claims that there are substantive differences across functional misarticulation systems, and that functional misarticulators need not be viewed as a homogeneous population. One area in which to test this claim and the value of our approach is in remediation. Our approach suggests that misarticulating children possess differential tacit knowledge about their own phonologies and presumably about the ambient phonology. This means that different children will have to learn and unlearn different aspects of phonology depending on which type of misarticulation system they belong to. One might expect then that children from the three different types of systems described here would respond differently to the same type of training. Responses to training can be measured in degree of generalization (Elbert and McReynolds 1978). It is reasonable as well to expect that children belonging to one type of system would benefit more from one type of training as opposed to another. For example, type B children may benefit more from teaching contrasts while type A children may benefit more from teaching morphophonological relationships among the child's alternating forms, i. e. teach the child that his morphophonemically related words do not alternate. These and other tests of our claims await further experimental investigation.

Bibliography

Compton, A. 1970. Generative Studies of Children's Phonological Disorders. JSHD. 35. 315—39.

—, 1975. Generative Studies of Children's Phonological Disorders: A strategy of Therapy. In S. Singh (ed.) Measurements in Hearing, Speech and Language. Baltimore: University Park Press 55—90.

Dinnsen, D. A., M. Elbert and G. Weismer. 1979. On the characterization of functional misarticulation. Paper presented at ASHA, Atlanta.

Elbert, M. and L. V. McReynolds. 1978. An experimental analysis of misarticulating children's generalizations. JSHR 21: 136—150.

Ingram, D. 1976. Phonological Disability in Children. New York: Elsevier.
Kaye, J. 1978. Recoverability and deep constraints. Phonology in the 1980's. (ed.) D. L. Goyvaerts. Ghent: Story-Scientia.
Kenstowicz, M. and C. Kisseberth. 1979. Generative Phonology: Description and Theory. New York: Academic Press.
Lorentz, J. P. 1976. An Analysis of Some Deviant Phonological Rules. In B. M. Morehead and A. M. Morehead (eds.) Normal and Deficient Language. Baltimore: University Park Press. 29—59.
Maxwell, E. M. 1979. Competing Analyses of a Deviant Phonology. Glossa 13: 2, 181—214.
—, and G. Weismer. 1979. On the Acoustic Differentiation of [d] in a Deviant Phonology. Presented at the LSA, Los Angeles.
Weismer, G., D. A. Dinnsen and M. Elbert (to appear). A study of the voicing distinction associated with omitted word-final stops. JSHD. (Also distributed by the Indiana University Linguistics Club.)