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ABSTRACT

Smith (1973), Stampe (1972), and Braine (1973) believe that by the time the child speaks his perception is well-developed, and that any discrepancy between child forms and adult forms are due to organizational and production difficulties. Other linguists believe immature perception determines the form of child speech. This paper suggests that children with articulation and/or reading and spelling dfficulties have failed to learn the phonological system of English and that in many cases the deviant phonological system reflects delayed or disordered perceptual abilities. Two kinds of tests, the oral verbal intelligence tests and the "phonic" spelling tests, are suggested as ways of gaining insight into the nature of possible misperceptions. It is further suggested that a child's success in verbal development depends on his ability to perceive the discrepancy between his forms and adult forms, and that the role of perceptual constraints should be considered in the investigation of deviant phonclogical systems. Studies of children with delayed language skills enable linguists to study phenomena that pass by too rapidly to be studied in most children. (Author/AM)

Phonological Development: Does Misperception Play a Role in Children's Misarticulations?

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A major part of a child's task in learning his language is learning how to pronounce it. This includes perceiving the sounds, remembering them, figuring out the articulatory gestures that will produce them, and developing the necessary motor control to do so with precision.

Some of the linguists who have studied early phonological development believe that by the time the child speaks his perception is well-developed, and that any mismatch between the child's forms and those in the standard adult language are due to organisational and production difficulties. (Smith 1973; Stampe 1972; Braine 1973).

Based on an analysis of the data of his son's speech development, Neilson Smith claims

> By the time he begins to speak, indeed for him to be able to begin to speak, the child's competence insofar as the form of lexical representation is concerned must be in terms of the adults' surface phonemic form. (Smith 1973: 206)

Stampe attributes children's misarticulations to innate phonological processes operating on phonological representations and cites evidence to support his claim that "the child's representations closely conform to adult speech" (Stampe 1969: 446)

Braine argues that the child's phonological representations of words probably do not contain the same feature complexes as the adult phonemes in those

words, and suggests that the phonemes, for children, are auditory gestalts. Nevertheless he assumes that perceptual competence is ahead of articulatory competence and that "the child's lexical entries for words often contain auditory representations that are richer (i.e. more differentiated) than the articulatory representation by features."

On the other hand, the role of immature perception in determining the form of young children's speech is acknowledged by Ingram (1973). In his variation on Stampe's theory of natural phonology Ingram suggests that the same phonological processes which determine a child's production first act as constraints on his perception, so that the child actually filters out aspects of the signal that are beyond his abilities. The 'Perceptual Conditions' for each child at a given time will determine the available linguistic data - the canonical shape of words that will be perceptually salient for him, and therefore allowable into his lexicon.

Waterson (1970, 1971) is still more emphatic in her views on immature perceptual abilities.

> Nobody would claim that a child's physical, mental and conceptual development is equal to an adult's so it seems highly improbable that a child could function like an adult in the hearing, recognition and production of sounds.

Waterson's beliefs are based, in part, on a study of her own son's earliest words. She sees perceptual abilities developing slowly in children. The child at first can cope only with short utterances and only a portion of the signal is functional for him. His perception of a word is determined by the phonetic character of the sounds. The longest, loudest and noisiest parts of words will be most salient. Thus a young child is most apt to respond to and reproduce a vocalic element, a strongly articulated consonant (a stop consonant at

syllable onset; a nasal consonant in non-final position, followed by an oral stop or at the onset of a stressed syllable) or a consonant with strong friction. While less audible consonants - final stops, especially voiced ones, often unreleased in final position; non-sibilant fricatives, liquids and glides - go unperceived. Waterson's data suggests to her that the child first responds to words, not as sequences of segments, but as schemata, and the order of elements is not necessarily preserved.

Ferguson (1973), in reviewing theories of phonological development cites the two conflicting views of the child's early perception as a high priority for further investigation.

Studies on sound discrimination in infancy (Eimas, et al) have demonstrated that even at a few weeks babies are capable of making same-different discrimination. Though the ability to categorize, store, recall, and use these discriminations phonemically - to keep words apart - may take a long time to develop. (Shvachkin, Garnica).

It is hard to get information about the perceptual abilities of very young children, and by the time they reach school age, and are more amenable to questioning, and more able to enter into a variety of test situations, most have learned to pronounce their language as adults do. Two possible sources of data on children's perceptual abilities are 1) older children, whose articulation abilities are inexplicably delayed, who are said to have normal hearing, normal control of articulatory musculature, normal cognitive abilities. 2) older children with "learning disabilities", whose specific difficulty in learning to read and spell is said by psychologists, speech pathologists and other clinicians who investigate them, to be due to an "auditory perceptual problem". (Wepman; Myklebust; Berry and Eisenson).

Over the past twenty years, as a clinical psychologist, I have assessed the intellectual and learning abilities of hundreds of these children, and

more recently, as a graduate student in linguistics, have tried to look more closely at the nature of the language deficit in a small number of children with articulation and/or reading and spelling difficulties. Most linguists would agree that a child, with normal hearing, who mispronounces many words, has not yet acquired the phonological system of his language. I would like to suggest that these children I am concerned with have failed to learn the phonological system of English; and further, I would suggest that in many cases their consistent misarticulations of familiar words, their inability to repeat polysyllabic words, their occasional misunderstanding of questions, directions and explanations, and their performance on formal and informal perceptual tasks indicate that the deviant phonological system is a reflection of delayed or disordered perceptual abilities.

Perceptual testing of children is difficult, and results are apt to be invalidated because the child fails to understand the same-different notion; because he may be able to differentiate between words globally but still fail to perceive and reproduce the essential difference (which may have to do with the order of elements, or voicing of one of the consonants, or the height of one of the vowels); because he is restless or distractible in a task that seems meaningless; or, because his ability to differentiate between words in isolation in a test situation is unrelated to his ability to perceive all the features of all the segments in running, casual speech in real world situations where background noises may mask parts of the acoustic signal.

There are two kinds of test situations where careful inspection of children's responses to speech may throw some light on the nature of possible misperceptions.

1) The orally administered verbal intelligence test. Here the child is required to answer a variety of questions and to define words presented to him out of context.

2) The "Phonic" spelling test. Here, to demonstrate his knowledge of English spelling conventions the child writes down the spelling of unfamiliar polysyllabic words.

Consider the following observations: Brian and Blaine are eight year old twin boys, both of whom have strikingly immature speech and language, despite normal hearing and average IQ on non-verbal tests of intelligence. When the twins' almost unintelligible speech is analyzed beyond the surface level of substitutions and omissions, certain underlying phonological processes (Stampe 1969, 1972; Edwards and Bernhardt 1973) appear to be operating. These include

1. weak syllable deletion e.g. bother ⟶ [bɔʔ]
   elephant ⟶ [ɛfʌn]

2. simplification of consonant clusters e.g. stop ⟶ [tɔp]
   lost ⟶ [lɔs]

3. metathesis, e.g. guitar ⟶ [dəkɔ]
   Betty ⟶ [dɛbi]

4. linguals becoming coronals, e.g. give me ⟶ [dImi]

5. velarization or glottalization of final coronal stops following a velar stop, e.g. cut ⟶ [kʌk]

6. above generalized to all final coronal stops, e.g. hit ⟶ [hIk]

7. coronalization of all final nasals, e.g. comb ⟶ [kon]

8. delateralization in initial position, e.g.
   letter ⟶ [yɛtər]
   look ⟶ [yʊk]

9. loss of postvocalic liquids, e.g. where ⟶ [wɛ]
   pedal ⟶ [pido]

   and others.

Smith and Stampe would attribute these processes to a set of realization rules mapping the adult phonemic form onto the child's phonetic form - rules presumably due to the failure to suppress or limit natural processes that conflict with the phonological system of the child's native language. Smith, in discussing an example from his son's speech says, "what appears to be happening is that the child is confronted with a number of perceptually discrete but for him unpronounceable sounds and proceeds to formulate hypotheses as to their nature in terms of the distinctive features already available to him". (Smith p.153)

However, some of the twins' responses when they were being tested with the Verbal items of the Wechsler Intelligence Scale for Children suggested that some of the phonological processes cited above might be perceptually determined.

Consider the responses to the following items from the Vocabulary subtest, where the task is to define a series of words.

1. Examiner: diamond
   Brian: [blo we – ə bɔn]
   [ə bɔn] ← a bomb by the process of coronalization of final nasals.

   I guessed that [blo we], in conjunction with "a bomb" meant "blow up", and that Brian was defining "dynamite", which through the processes of metathesis, unstressed syllable deletion, reduction of consonant clusters was, for him perceptually homophonous with "diamond".

2. Examiner: join
   Blaine: [sɪgəwɛt]

   I presume Blaine is defining "joint", which, with cluster simplification operating, is, for him, perceptually homophonous with "join".

3. Examiner: What's sword?
   Blaine: [yo æn sɔ]

   I interpreted this to mean "your hand's sore", suggesting that Blaine does not discriminate between sword and sore.

4. Examiner: What's brave?
   Brian: [sʌn ɛɹ]

   This was glossed by me as "some air", and I guessed that Brian confused brave and breathe. There were, in his own speech, several instances of coronalization of fricatives in final position.

   knife ⟶ [naɪs]
   leaf ⟶ [liːs]
   stove ⟶ [tos]

It seems fairly certain that both boys (whose phonological systems are strikingly similar) misperceive much of what is said to them. In the examples cited the words were deliberately presented in sentence final position, articulated clearly and loudly and usually repeated. Presumably casual running speech is even more liable to misperception. It is not claimed that all the misarticulations or phonological processes that appear to be operating in the twins' speech are due to faulty perception, but it seems likely that the failure to perceive the less salient parts of some words, or the failure to appreciate the order of segments in some words, has determined their pronunciation of these words.

This may very well be the case for younger children whose language is developing normally, but whose early renditions of words reveal the same phonological processes as Brian's and Blaine's.

I have collected similar responses from other school age children whose speech was free of misarticulations, but for whom a history of late language development or severe difficulties in learning to read and

spell raised the question of delayed development of perceptual abilities. While these children seemed to decode speech fairly efficiently in everyday conversation, where they could make ample use of verbal and non-verbal contextual cues, their responses to words and questions out of context suggested that these were not always accurately perceived. Their confusions here may very well point to the kinds of confusions and misunderstandings that happen in the school room.

The following examples of responses given by intelligent school age children to items on the Vocabulary Subtest of the WISC suggest misperceptions at the time of testing, or that underlying representation of familiar words is different from the standard form.

Paul, an eight year old boy, with serious problems in learning to read and spell, had a history of late onset of speech, but at the time of testing he had mastered the standard form of most words, with only occasional difficulty pronouncing unfamiliar polysyllabic words.

5. Examiner: What's lecture?
   Paul: You plug it in.

6. Examiner: What's roar?
   Paul: You roar the boat.

Peter is nine years old. His difficulties are with reading and spelling. He too was very late in learning to talk but at the time of testing only [θ] and [ʧ] were misarticulated, consistently replaced by [f] and [v] in all positions.

7. Examiner: What's nuisance?
   Peter: being mad.
   Examiner: What do you mean?
   Peter: Being mad a someone. You get spanked. You bug people.

   Three items later:

Examiner: What's nonsense?
Peter: You said that already.
Examiner: What does it mean?
Peter: being mad.

Mark, age six, has only been speaking for two years. He still speaks in very short sentences, with several substitutions and frequent omission of unstressed syllables.

8. Examiner: What's polite?
Mark: [ə wʌɪt bʌb]('a light bulb')

Karen is nine. Her speech is clear, but her language is immature with many structures missing or misunderstood. Although she has a low average IQ on non-verbal tests she is in a special class for children with language problems.

9. Examiner: What's gamble?
Karen: gamble soup.

10. Examiner: What's sword?
Karen: [sɔr] a desk. ('saw a desk'. Karen's mother has an epenthetic [r] in her speech)

Grant has a long history of speech and language difficulty, though at age 11 his spontaneous speech is error-free.

11. Examiner: fable.
Grant: When you're almost dead - or just alive a little. (fatal? feeble?)

Spelling errors provide another window on perception. The Phonic Spelling test of the Durrell Analysis of Reading Difficulty (Durrell) consists of fifteen polysyllabic words, normally unfamiliar to children, who are told to "spell them just the way they sound". Children with learning disabilities make numerous errors. They omit letters, or whole syllables, substitute letters, make errors in the order of letters.

Their productions frequently suggest that they have failed to perceive all the segments in the word.

In one study (Golick 1971) of eighteen children with learning disabilities between the ages of nine and thirteen - who judging by their ability to spell CVC words, had learned all the English single consonant spellings, I found that the most frequent errors were made on segments that spectrographic analysis revealed to be of less than 8 cs in duration. These very brief consonants were usually members of a consonant cluster and frequently in unstressed syllables.

Though Stampe and others claim that universal phonological processes like cluster reduction, weak syllable deletion, metathesis, are mental processes largely determined by articulatory complexities of segments or sequences of segments, there seems to be evidence that clusters are sometimes reduced, syllables are sometimes deleted, segments are sometimes reordered because the cues to their character are too brief or of too low intensity to be perceived.

In a recent study (Tallal) in which school age children with "developmental aphasia" were compared with a matched group of normal children in their ability to a) judge the order of two tones presented sequentially at different time intervals; and b) judge whether the two sounds were the same or different, Tallal concluded that the developmental aphasics have a gross deficit in rate of auditory processing. She hypothesizes that it is this perceptual speed restraint which effects the processing of certain speech sounds that underlies the observed gross impairment in the development of verbal language in these children.

Immature or disordered perception, rather than limitations of our speech capacity may determine some of the phonological processes we see in children. Furthermore, immature perception may influence phono-

logical development in another way: If, as Stampe and others claim, the acquisition of mature pronunciation consists of suppressing the innate phonological processes as the child meets counterinstances in the language he is learning, then his success depends on his ability to perceive the mismatch between his forms and the adult forms.

Stampe, in discussing nativization of loan words allows that for adults a phonological process may act as a perceptual constraint, but suggests that in children "whose phonetic expectations must remain open", such a phenomenon would be "devastating". In children whose language has, in fact, been devastatingly affected the role of perceptual constraints should be considered. It may be the case that investigation of the phonological systems of children whose auditory processing skills are not progressing normally allows us to look more closely at phenomena that pass by too quickly to be studied in most children.

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