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Auditory processes involved in dysphasia

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AUDITORY PROCESSES INVOLVED IN DYSPHASIA

by

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CHAPTER I

INTRODUCTION

Statement of the Problem

At the present time, there appear to be several variant educational hypotheses that attempt to explain the processes involved in developmental receptive aphasia. In a similar vein, medical practitioners have proposed numerous causative factors relating to this disability, ranging from neuroendocrine imbalance to gross or microscopic cerebral lesions. This paper, however, does not propose to investigate the validity or hypothetical possibility of such medical correlates. Rather, the thrust of this work has endeavored to illuminate the psycholinguistic processes that appear to be involved. Furthermore, the results of the research-based investigation culminate in a number of remediation suggestions that will benefit the children burdened with this handicap.

The terminology that appears throughout this work suggests two dimensions that may offer a problem for the reader. The first of these difficulties encompasses the medical and historical perspective of aphasia, and the second one is of a personal nature, and is probably also internalized by many readers. In the first case, the term aphasia originally denoted an adult condition, with the onset occurring subsequent to the development of language ability. Thus, the remediation programs, whether they were language or motor-oriented, were a relearning of skills previously established.

The subjects of this paper--children--are apparently born with or develop this disability, such that the most appropriate explanation of their condition is not receptive aphasia, but developmental aphasia, or dysphasia. Therefore, this last term, dyaphasia, will appear throughout the paper, and should be understood to suggest developmental receptive aphasia.

The second problem is keenly appreciated by the author, and undoubtedly by many educators, parents, and other interested persons reading this work. This quandary pertains to the labeling of children with specific terms that inherently offer no beneficial or behaviorally illustrative information. The reason for inclusion of such a term here is simply for purposes of clarity of the concepts under discussion. The author, like other involved specialists in the field of education, deplores the senseless, and often-times damaging effects that are incumbent from labeling. However, even while cogently aware of this detrimental practice, the author believes that the use of such succinct terminology is necessary in a paper of this nature.

Statement of the Purpose

The final objective of this work was the arrangement of remediation suggestions that may be utilized for children with dysphasia, and related disorders. Therefore, based on the present knowledge of the affected processes, a program of remediation is offered in reference to the particular learning skills that require extraordinary teaching methods. These suggestions are comprehensive in perspective, as far as the necessary teaching skills are concerned. It is anticipated that such a listing of methods will prove beneficial for educators engaged in teaching children, educationally disabled by this, and other closely allied learning handicaps.

The method of inquiry that resulted in this expression of remediation suggestions was a close scrutiny of the literature relating to dysphasia, specifically the auditory aspect of this disability. The author proposed to review the available sources, and thereby secure an understanding of the most crucial deficits in learning skills. This review was concerned with only the educational manifestations, and implications, and not the underlying physiological correlates that may or may not be responsible. In the field of education, it is of little value to the teacher of learning disabled children to be acquainted with the etiological foundations of the handicaps, for it will not arrest the progress of the dysfunction.

The final sphere of investigation, and one that closely approximates a reasonable understanding of receptive disabilities, was an appraisal of the current theories of the auditory decoding process. The author believes that an inquiry into the decoding process, though it may only explore a theoretical construct, may contribute to a more appreciative understanding of the intricate processes involved.

Explanation of Definitions

Auditory dysphasia may be described as an impairment in the acquisition of symbols for a language system. The severity of this disability must be such that it interferes with the child's ability to communicate. Furthermore, it is the child's perceptual disability for auditory events which precludes the acquisition of the auditory symbols. Eisenson explains, "his [the child's] expressive disturbances are a manifestation of his intake or decoding impairment. A child cannot produce language if he cannot decode the speech to which he is exposed, or if the speech remains for him sounds without sense."[1]

This paper does not begin with an accepted explanation of the decoding process, for it is the contention of this work that such a definition requires a fair amount of research. Therefore, the body of this paper offers a theoretical definition, and thereby an explanation for the auditory decoding process.

Scope and Limitations

This paper dealt only with the receptive aspect of dysphasia. Furthermore, only the auditory channel was investigated. This represents a considerable limiting of the potential field of inquiry, and yet, affords sufficient latitude for a meaningful work. This same narrowing of the material available also pertains to time reference. The last ten years has witnessed an increased interest in this and related fields, such that it has generally proven unnecessary to investigate works much before this time.

The major emphasis of this work was the educational implications of auditory receptive dysphasia, and as such,

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[1]Jon Eisenson Ph.D., Aphasia in Children (New York: Harper and Row, 1972), pp. 68-69.

attempted to inquire into the learning processes that may be affected by it. It is the author's contention that the knowledge gleaned from a perusal of the sources on dysphasia is of little use to educators, unless it is translated into meaningful remediation suggestions. Therefore, this aspect of the work has attempted to explain as completely as possible, the processes involved, and offered numerous suggestions that may prove helpful in a remediation program.

Summary

The scope of this work was threefold in nature, with the first two areas offering background information for the arrangement of the third. These two initial sections deal with the educational implications of dysphasia, and the theoretical mechanism behind the decoding process. The author contends that an understanding of these two areas will prove immeasureably beneficial for the construction of remediation suggestions, which constitutes the last portion of this paper.

The benefit for teaching that emerges from this work is not restricted to children handicapped by dysphasia. Processes involved in this disability, such as rate of information processing and auditory sequencing, are not limited to this incapacity alone, but are intricately involved in other educational handicaps. For this reason alone, the scope of this work encompasses a greater breadth of application, than may be perceived initially.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction of Involved Processes

Children who are described as dysphasic generally manifest one or more educational disabilities. The author proposes to document four of these major categories that appear in the literature of researchers and experts in the field. These categories are not all inclusive, but do represent the preponderance of auditory channel difficulties that are evidenced. Though the literature available today, because of the relatively recent nature of research in this field, is oftentimes conflicting, and in many instances incomplete, it does signal a substantial outline of the significant psycholinguistic disabilities.

The prominent categories frequently display considerable overlap in function and hierarchical interdependency. For this reason, though the processes may be dealt with separately to familiarize the reader with their peculiar manifestations, they do indeed function together to produce the auditory abilities/disabilities of the individual.

The first of these speculative underlying causes includes auditory discrimination for both speech and non-speech sounds. Eisenson notes that "the child may be able to discriminate between isolated phonemes . . . but cannot make the discriminations an the perceptions when the phonemes are incorporated into phonetic contexts . . . ."[2] The next speculative causes encompass the sequencing of stimuli both on an auditory and temporal level. Eisenson continues that "sequencing difficulties are pronounced for auditory events, and especially for speech . . ."[3] The third category encompasses short term auditory memory and the storage mechanism, with Stark, Poppen, and May commenting, "the essence of the difficulty that aphasic children have in decoding and encoding language may be related to an impaired auditory memory for sequences."[4] The final process under investigation includes the auditory rate of information processing. The studies of Shields suggest that "these children may require longer

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[2]Ibid., p. 63.

[3]Jon Eisenson, Ph.D., "Developmental Aphasia: A Speculative View with Therapeutic Implications," Journal of Speech and Hearing Disorders 33 (February 1968):6.

[4]J. A. Stark, R. Poppen, and M. Z. May, "Effects of Alterations of Prosodic Features on the Sequencing Performance of Aphasic Children," Journal of Speech and Hearing Research 10 (December 1967):854.

to process information, and . . . their nervous systems may operate more slowly than those of normal children."[5]

The order in which these four auditory skills are presented is not random, but represents a level of complexity and superiority within the disability. The research illustrates that the speculative underlying cause of one auditory dysfunction, for example discrimination, may be attributable to a failure in another auditory skill, such as the auditory storage mechanism, or perhaps in the realm of temporal sequencing. For this reason, the empirical generalizations and conclusions that may be offered by one researcher do not necessarily harbor the most advanced knowledgeable hypotheses at this time. It was imperative to review all the potential underlying causes, and then produce a comprehensive appraisal of the importance of each speculative dysfunction.

Auditory Discrimination and Dysphasia

Auditory discrimination represents the first skill that demands attention. At the most primitive level, auditory discrimination refers to the ability to recognize a difference between sounds. This may be further elaborated upon to suggest a differentiation between pure tones, environmental sounds, and speech sounds. Furthermore,

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[5]D. T. Shields, "Brain Responses to Stimuli in Disorders of Information Processing," Journal of Learning Disabilities 6 (October 1973):504.

speech or phonemic sounds also carry a classification of difficulty, from long and short vowel sounds, to initial consonants, blends, and alike.

In the case of dysphasics, Eisenson notes that these "children are impaired in their perceptual abilities for the auditory events that constitute speech. The basic impairments are manifest intially in faulty discrimination and categorization . . ."[6] Here Eisenson recognizes that the initial failure for perception of speech sounds may lie at the level of discrimination and categorization. This is interesting because this level marks one of the low hierarchy skills of speech perception, and was recognized some time ago as a possible underlying dysfunction.

The same author offers an explanation for the above statement with the following:

> Categorical development for phonemes may also be impaired if the child does not modify his primary categories to permit the development of useful discriminations. If for example, the primary category for sibilant sound [letters or combinations of letters that form a hissing sound] is so broad as to include s, sh, th and f sounds, he will be unable to make the necessary discriminations from what he hears to respond differentially to speech that includes these sounds. At the other extreme is the possibility that the child's categories are too narrow, too restricted, and too rigidly set. Thus the

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[6] Jon Eisenson and David Ingram, "Childhood Aphasia: An Updated Concept Based on Recent Research," <u>Acta Symbolica</u> 3 (Fall 1972):116.

> child may have too many categories for functional sound discrimination. If a child's categories are discrete, he necessarily has to overload his storage system with more individual sounds than he can readily recall and match as he is exposed to speech.[7]

Thus, on the one hand, the author stresses that too many sounds of a similar nature may be erroneously grouped together based upon faulty discrimination. Similarly, a plethora of minutely graduated sounds, so alike in production, that to discriminate between them compounds the categorization and compartmentation of the storage mechanism is possible. Feedback and memory retrieval of this information then becomes a problem of inestimable magnitude for the dysphasic child.

Another explanation has been offered by Tallal and Piercy that is similar to Eisenson's position, in that it suggests that discrimination between consonants, and not necessarily vowel sounds, produces the majority of the auditory perceptual disability. "Dysphasic children . . . have selective difficulty in processing transitions as such."[8] The authors continue:

> . . . dysphasics' discrimination of consonant stimuli was significantly inferior to controls and their own discrimination of vowel stimuli and non-verbal auditory stimuli of the same duration. It is hypothesized that

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[7]Eisenson, Aphasia in Children, pp. 30-31.

[8]Paula Tallal and Malcolm Piercy, "Developmental Aphasia: Rate of Auditory Processing and Selective Impairment of Consonant Perception," Neuropsychologia 12 (January 1974):92.

> it is the brief duration of formant transitions[9] which results in dysphasics' inability to discriminate consonant stimuli, and this deficit may be sufficient to explain the speech disorder of these children.[11]

Tallal & Piercy note a significant difference between the dysphasics' ability to discriminate vowels and non-verbal stimuli from synthesized consonants of the same duration. Eisenson's study previously noted displayed this same suspicion of the consonants, but attributed the underlying problem to the inaccurate categorization of phonemes, rather than the duration of the formant transitions.

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[9]A formant may be described as one of the two stable frequencies that is associated with each vowel in an individual's speech. Sanford notes that "the formants are determined by the shape of the vocal tract above the glottis, and they are essentially independent of the glottal source."[9] To elaborate upon the significance of the transitions in this experiment, the authors explain that:

> differences in phoneme perception are associated with different duration of the critical formant information in these two classes of speech sounds as well as with differently shaped formants. The major auditory cue for synthesized vowels has been shown to be the steady state frequencies of the first three formants which remain constant over the entire length of the stimulus and have a relatively long duration (approx. 250 msec.). However, for the stop-consonants the essential auditory cue is the rapidly changing spectrum provided by the second and third formant transitions. These are not only transitional in character, but also of relatively short duration (approx. 50 msec.).[10]

[9]Sanford E. Gerber, Ph.D., Introductory Hearing Science • Physical and Psychological Concepts (Philadelphia: W. B. Saunders Company, 1974), p. 262.

[10]Paula Tallal and Malcolm Piercy, "Developmental Aphasia: Rate of Auditory Processing and Selective Impairment of Consonant Perception," Neuropsychologia 12 (January 1974):83.

[11]Ibid., p. 92.

In either case there are sufficient grounds to suspect the auditory discrimination ability of dysphasics as an underlying cause of the disorder. Both arguments offer substantial merit. Quite possibly the complicated nature of these disorders might be increased were a union affected, such that the problem of differentiating between formant transitions would be multiplied by a categorization abnormality. On the other hand, the dysfunction may represent a less complicated paradigm than previously noted, as Tallal and Piercy suggest the alternative, that "children with developmental aphasia . . . demonstrated inferior discrimination of sound quality."[12] Regardless of which underlying dysfunction in the realm of discrimination is held to be of significance, the literature displays the interconnection of a sequencing disability.

Auditory Sequencing and Dysphasia

An auditory sequencing problem interferes with the normal ability to remember the order of a presentation of items. This skill is referred to by other terms, such as temporal ordering, or temporal sequencing, but is the same concept. Writing on aphasia, and generalizing about auditory perceptual problems, Eisenson remarked that

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[12]Paula Tallal and Malcolm Piercy, "Defects of Non-Verbal Auditory Perception in Children with Developmental Aphasia," Nature (British) 241 (February 1973):468.

"auditory dysfunction . . . includes difficulty in . . . phonemic sequencing. By sequencing we mean the capacity to hold a series of events in mind and to respond to an ongoing event in light of immediately past events."[13] As previously noted, in the discussion on discrimination dysfunction, phonemic sounds appear to pose a significant problem to the decoding process of dysphasic children. Writing on developmental aphasia the above author states that:

> . . . the child may be able to discriminate between isolated phonemes, even when they are much alike as /s/ and /z/ or /t/ and /d/ . . . but cannot make the discriminations and the perceptions when the phonemes are incorporated into phonetic contexts.[14]

The reason may lie in the rapid sequencing of the phonemes in normal speech, and may also include a deviant system of categorization, or more simply, an inability to process the rapid presentation of formant transitions.

> We can consider it to be definitely established that aphasics as a group suffer from a profound defect of auditory sequencing. What is not established is the relationship of the clearly defined deficit of auditory function to the understanding of spoken language.[15]

Since auditory skills whose mechanisms are not properly understood are being dealt with, it is reasonably accurate

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[13] Eisenson, Aphasia in Children, p. 63.

[14] Eisenson, "Developmental Aphasia: A Speculative View. . ." p. 6.

[15] Robert Efron, response on Ira J. Hirsh, "Information Processing in Input Channels" in C. H. Millikan and F. L. Darley, eds., Brain Mechanisms Underlying Speech and Language (New York: Grune and Stratton, 1967), p. 30.

to state that the process is not empirically explainable at this time. There are, however, theoretical suggestions for these skills and the processes of decoding, association, and encoding.

At this point, the paper digresses to briefly investigate the decoding process, as this process is intricately involved with the auditory skills under discussion.

Auditory Decoding Process and Dysphasia

The decoding process may be thought of as the reception of stimuli, in this case, auditory stimuli: Perhaps one of the most significant aspects of the decoding process remains the dearth of information pertaining to it. Because it is a theoretical construct, and cannot be empirically tested, the most advanced knowledge still remains in the realm of educational assumptions. This, however, should not detract from the positive value that such models offer.

Decoding is defined by Osgood as "the total process whereby physical energies in the environment are interpreted by the organism."[16] For our purposes this may be

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[16]C. E. Osgood, "A Behavioristic Analysis of Perception and Language as Cognitive Phenomena," Contemporary Approaches to Cognition (Cambridge: Harvard University Press, 1957) quoted in Guy R. Lefrancois, Psychological Theories and Human Learning: Kongor's Report (Monterey, California: Brooks/Cole Publishing Company, 1972), p. 169.

reinterpreted to suggest the perception of auditory stimuli by the child. This perception of auditory events becomes mediated by three levels of neural organization--projection, integrational, and representational. This Osgood model may seem strangely familiar, and indeed it should to anyone who has a working knowledge of the Illinois Test of Psycholinguistic Abilities (ITPA). In fact, the clinical model of the ITPA includes all three processes, but only the integrational (automatic) and representational levels. The reason for the exclusion of the projection level will be explained shortly.

This projection level "is simply the transmission of neural impulses from receptors to the cortex. . .",[17] or more simply, a reflexive mechanism. This level is very basic and does not account for any of the auditory language concept growth experienced through the other levels. Similarly, because of the elementary nature of this level or organization, it should prove extremely difficult to devise a clinical test that would bear fruition.

"The retention of linguistic symbol sequences, the execution of automatic habit-chains and factors of limitation"[18]

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[17]Guy R. Lefrancois, Psychological Theories and Human Learning: Kongor's Report (Monterey, California: Brooks/Cole Publishing Company, 1972), p. 170.

[18]Patricia I. Myers and Donald D. Hammill, Methods for Learning Disorders (New York: John Wiley and Sons, Inc., 1969), p. 36.

are controlled at the integrational or automatic level. The activities governed at this level display responses that are highly predictive in nature. For example, the ITPA includes the four subtests of auditory closure, sound blending, grammatic closure, and auditory sequential memory. In each case, the appropriate response is one that demands no concept formation, but does depend upon rote learning and automatic feedback. The recognition of the words automobile and movie theatre for auto_o_ile and mo_ie thea_re demonstrates the ability of auditory closure, while the sentence "This ball is large, but that one is ______." suggests the automatic nature of grammatic closure.

The final and most complex level of organization includes the utilization of symbols that carry meaning. Concept formation is illustrative of the activities operational at the representational level. Auditory reception and auditory association are examples of ITPA subtests at this level. In the first case, the response to an auditory reception question must be simple, and should not require verbal expression, such as "Do dogs bite?" or "Do oceans whistle?" On the other hand, auditory association does require a simple oral response to statements such as "An engineer rides in a train; a pilot rides in a _____."

The process of auditory decoding, as noted earlier, has considerable significance at the integrational and representational levels of teaching. Certainly, it is infrequent that a professional involved in the education of dysphasics, or learning disabled children be aware of the theoretical basis of his (her) teaching model. And yet, the hierarchy of the teaching program is well internalized. In spite of this, the integrational level of the auditory decoding process offers an exemplar listing of the hierarchy of skills that need be mastered: listening to sounds coupled with the object that produces them; matching sounds and experiences; discriminating between sounds, with accompanying choice of originating objects or pictures; localizing sounds in the spatial dimension, including right and left and the stereo components; and following a sound blindfolded. These skills are developmentally mastered, with each one performing as a substantial basis for the next.

When Osgood writes of auditory stimuli that are interpreted by the individual, he is noting both the reception and the perception of those auditory events. These events may be meaningful or nonmeaningful, but in every case they are integral to the language function. As noted earlier, there exists a hierarchy of levels of communication within the decoding process, which may be utilized on the theoretical level to suggest a pattern of appropriate remedial techniques. Indeed, the successive steps and stages which are an inherent aspect of any successful remediation program, derive their significance from the hierarchy of the decoding process.

Just as Osgood and others have found a gradation of levels of communication processing in decoding, so might there exist a similar continuity between the subskills of auditory perception. The author has suggested above that a dysfunction in sequencing may have a bearing on the discrimination disorder, and indeedin some research this was found to be the case (Eisenson, 1968; Kottler, 1972; Tallal and Piercy, February 1973). Eisenson comments on this:

> . . . the child with developmental aphasia [is] one who has a basic impairment in the necessary capacity for the analysis of speech signals and for the sequencing of temporal events, which are received through the ear, and require not only discrimination and identification, but in addition, auditory processing.[19]

A number of other researchers offer a more central role to the sequencing disorders that underlie dysphasis (Lowe, 1965; Stark, 1967; Efron, 1967; Monsees, 1968). A decade ago Lowe surmised, "it would appear that the temporal ordering malfunction of the aphasoid child . . .

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[19]Eisenson, Aphasia in Children, p. 12.

may be a factor contributing to his communication problem."[20] Testing dysphasic children's ability to do auditory and visual-motor sequencing tasks, including the Knox Cube Tapping Test and the sequencing subtests of the Illinois Test of Psycholinguistic Abilities, Stark surmised that his findings "lend support to the observation that the core of the disability in the aphasic child may be in temporal sequencing."[21] Kottler also concluded that sound sequencing plays a central role in auditory problems.

Reinforcing this assertion, Monsees notes that

> . . . the reception of spoken language signals involves a sequential series of acoustic events occurring along a time dimension. Evidence gathered from diagnostic work and the teaching of aphasic children indicates that the integrity of this function may be critical to the proper comprehension of spoken language.[22]

In explaining this dysfunction, Eisenson states:

> . . . the aphasic child is markedly impaired in his ability to deal with linguistic sequences. He is inept

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[20] Audrey D. Lowe and Richard A. Campbell, "Temporal Discrimination in Aphasoid and Normal Children," Journal of Speech and Hearing Research 8 (September 1965):314.

[21] J. A. Stark, "Comparison of the Performance of Aphasic Children on Three Sequencing Tests," Journal of Communication Disorders 1 (May 1967):34.

[22] Edna K. Monsees, "Temporal Sequence and Expressive Language Disorders," Journal of Exceptional Children 35 (October 1968):142.

> at a game that requires anticipating what might be about to occur in a flow of utterance on the basis of what has already occurred.[23]

This hypothesis is further clarified by the writing of Hess on the same subject.

> This [anticipatory behavior] achievement is based upon associations which were developed between sensory stimulation and central patterns of nerve excitation at an early stage in the learning process. Whenever similar patterns of verbal stimuli are presented, the old memories and the corresponding contents of consciousness become reactivated and comprehended. Thus, there is no trace of a causal evolution of understanding of verbal stimuli by way of an uninterrupted chain of conscious correlates of the sensory mechanisms. Instead, central patterns of excitation are elicited as though by resonance when specific sensory messages arrive.[24]

Auditory Memory and Storage and Dysphasia

Using matched groups of dysphasics and normal children Stark, Poppen and May concluded that "the difficulty which certain aphasic children have in sequencing is largely due to their forgetting the first item in the sequence."[25] From these findings the authors expressed their conclusion that "the essence of the difficulty that aphasic children have in decoding and encoding language may be related to

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[23]Jon Eisenson, "Developmental Aphasia (Dyslogia): A Postulation of a Unitary Concept of the Disorder," Cortex 4 (June 1968):194.

[24]W. R. Hess, "Causality, Consciousness and Cerebral Organization," Science 158 (December 1967):1281.

[25]J. Stark, R. Poppen and M. Z. May, "Effects of Alterations of Prosodic Features on the Sequencing Performance of Aphasic Children," Journal of Speech and Hearing Research 10 (December 1967):854.

an impaired auditory memory for sequences."[26] It is of significance to note that the authors specifically enumerate the boundary of the disability as pertinent to the perception of language, and not verbal and non-verbal stimuli combined.

Writing on this hypothetical dichotomy, Eisenson notes that the "child's storage system for speech signals may be defective . . . " such that "the characteristics of those auditory events that constitute speech, call for different control and storage than do other auditory events."[27] The basis for this postulation is expressed in the work of Liberman et al.[28] In addition, the literature suggests that dysphasics tend to perform better on auditory tasks that emphasize non-verbal sounds over the productions of verbal sounds (Stark, Poppen, and May, 1967; Aten and Davis, 1968; Tallal and Piercy, 1974).

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[26]Ibid., p. 855.

[27]Eisenson, "Developmental Aphasia: A Speculative View . . .," p. 6.

[28]A. M. Liberman et al, "Perception of the Speech Code," Psychological Review 74 (November 1967):444. "The conclusion that there is a speech code, and it is characterized by processes different from those underlying the perception of other sounds, is strengthened by recent indications that speech and nonspeech sounds are processed primarily in different hemispheres of the brain . . . . Brain stimuli presented to the right ear (hence mainly to the left cerebral hemisphere) are better identified than those presented to the left ear, and that the reverse is true for melodies and sonar signals."

Rosenthal concluded that dysphasic children display no peculiar difficulty identifying sounds when presented singly, whether they be non-speech or speech. He drew the conclusion that the auditory dysfunction must therefore be more complex than "a simple function of identification or discrimination difficulty."[29] Rosenthal interprets the findings in much the same manner, and adds that "the nature of the auditory processing defect in aphasic children is primarily in the domain of short term auditory storage or memory."[30]

Rate of Auditory Information Processing and Dysphasia

The first three mentioned examples of underlying auditory dysfunctions--discrimination, sequencing, and memory--have some degree of interdependency. Just as the short term memory for items in a sequence may have a bearing on the ability to reproduce that same sequence, so does the sequencing of phonemic speech sounds weigh on the ability to discriminate between vowel sounds and synthesized consonants. Rate of information processing is the final

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[29]W. S. Rosenthal, "Auditory and Linguistic Interaction in Developmental Aphasia: Evidence ofrom Two Studies of Auditory Processing," Papers and Reports on Child Language Development (June 1972) quoted in Norma S. Rees, "Auditory Processing Factors in Language Disorders: The View from Procrustes' Bed," Journal of Speech and Hearing Disorders 38 (August 1973):307.

[30]Ibid..

example of a major underlying factor, and even more so than the first three examples, this factor effects the seriousness of the dysfunction. The impaired rate of processing distorts the capacity for short term memory, thereby confusing and delaying the mechanisms of auditory sequencing and discrimination. Tallal and Piercy noted that "previously reported impairment of auditory sequences in aphasics may well be attributable to an inability accurately to perceive stimulus elements at rapid rate of presentation."[31]

Both Eisenson and Tallal and Piercy recognize the significance of the speed constraint in auditory processing, and they acknowledge this defect as ranging along a continuum of severity.

> Dysphasic children are not usually completely unable to utilize language and they also differ individually in language ability. These individual differences could be directly related to differences in speed of auditory processing. The greater the speed constraint, the fewer speech sounds will be accurately processed and hence the greater the language disorder.[32]

As mentioned earlier, dysphasic children may exhibit a marked difficulty not only with the processing of non-verbal sounds, but may display a selective difficulty in dealing with transitions, especially those speech sounds which contain differing, though prolonged formant transitions.

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[31] Paula Tallal and Malcolm Piercy, "Developmental Aphasia: Impaired Rate of Non-Verbal Processing as a Function of Sensory Modality," Neuropsychologia 11 (October 1973): 396.

[32] Tallal & Piercy, "Developmental Aphasia: Rate of Auditory Processing . . .," p. 92.

Shields noted this depressed rate of information processing with the assertion that "these children may require longer to process information and . . . their nervous systems may operate more slowly than those of normal children."[33] Judging from the works of Eisenson, Tallal and Piercy, and Rosenthal this speed constraint is developmental in nature, and tends to decrease in severity with time. Rosenthal suggests that there is a strong likelihood that the "disorder which is presumed to underlie childhood or developmental aphasia serves to retard normal development, but not to prevent its emergence completely."[34]

This last suggestion is a heartening one, and in many instances the progress of dysphasic children substantiate this assertion. However, if this hypothesis tends toward the empirical truth, then much of the time spent in remediation work may merely serve as readiness training for these children, with little initial linguistic progress to show for it. Even if this approximates the situation, it follows that dysphasic children do benefit, albeit little, from these programs, and that is important.

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[33]D. T. Shields, "Brain Responses to Stimuli in Disorders of Information Processing," Journal of Learning Disabilities 6 (October 1973):504.

[34]Rees, "Auditory Processing Factors . . .," pp. 306-307.

Summary

Reviewing the research cited above, it is apparent that an auditory perceptual dysfunction is intricately involved in dysphasia, and probably many other allied disabilities. What is not apparent, is the degree of involvement of the four aforementioned auditory functions: discrimination; sequencing; short term memory; and rate of information processing. Research shows that all four functions appear to contribute to the auditory disability, with some bearing a more significant role.

The author suggests that one of these factors appears to hold peculiar significance as an underlying dysfunction in dysphasia. This assertion is based on a two-fold appraisal of the research and the hierarchical nature of the four speculative underlying causes. On the other hand, the levels of superiority of auditory functioning follow the chain of superiority that progresses from the base level of discrimination, through sequencing and memory, to rate of processing. Discrimination of auditory events may be as elementary as differentiating between two divergent pure tones, or as difficult as perceiving a difference between a rapid progression of phonemic sounds. In the first example above, there exists a simple one-to-one correspondence between the auditory stimuli, and dysphasic children have been shown to be capable of differentiating this difference in many instances.

A decided and documented problem appears when these auditory events are strung together--sequenced--thereby compounding the initial discrimination problem, especially for certain phonemic sounds. At this state a discrimination problem is compounded by the infusion of a multitide of auditory events in sequence that demand appropriate decoding. In a similar manner, a proper sequential decoding of the stimuli requires the necessary functioning of short term memory. The elements of a particular sequence must be processed in temporal order, and appropriately stored in memory storage. It has been suggested that the sequence is not decoded intact because the memory mechanism fails to process all the elements, "forgetting some" as it were. In this way, the speech sounds for example, do not arrive sequentially intact for the dysphasic child to formulate associations, and thereby elicit meaningful responses.

The underlying reason why the auditory events are not properly discriminated, sequenced, and accurately stored lies in the suggestion that they are not all accepted because of a speed constraint. Quite simply, what is not processed cannot be dealt with on any other level. Like the befuddled single-tongued American tourist, gaping at the incomprehensible stream of execrations issueing from the rush hour Roman motorists, the dysphasic child is lost in a similar profusion of speech sounds. For this child there appears to be no semblance of order in the disjointed utterances of the people around him.

The dysphasic child then appears to lack the ability to rapidly process the auditory information to which he is exposed. It is a debilitating dysfunction that retards his early cognitive growth, because most early learning is acquired through the auditory mode. Furthermore, it spawns the seeds of discontent and frustration that are incumbent from this failure to communicate with others around him. And yet, this disability need not remain a permanent dysfunction, as Tallal and Piercy note:

> . . . a high proportion of dysphasic children eventually attain near normal language proficiency . . . . The possibility exists that developmental dysphasia results, not from a permanent deficit, but from delayed development of rapid auditory processing.[35]

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[35]Tallal and Piercy, "Developmental Aphasia: Rate of Auditory Processing . . .," p. 92.

CHAPTER III

REMEDIATION SUGGESTIONS AND SUMMARY

The dysphasic child who is entering a formal learning situation is a sensitive and probably easily frustrated individual. This child requires a great deal of attention not only from an educational perspective, but from a psychological one as well. Many years of confusion and inaccessibility to the significance and meaning of speech signals around him may have "turned off" this youngster to auditory events. It then becomes of crucial importance to reassert the need to communicate, and this may be accomplished through a program of auditory successes. Such a program requires much internal structure and must approximate the hierarchy of auditory perceptual skills which follow the normal developmental sequence.

Listed below is the hierarchy of skills which should be taught along a continuum that progresses from gross sounds to speech.

Awareness of sounds
Auditory attention
Auditory attention span
Localization of sound
Discrimination of sound
Auditory memory
Auditory memory span

Sound sequencing ability
Auditory projection ability
Auditory separation
Auditory blending
Auditory closure
Re-auditorization[36]

Heasley offers a comprehensive explanation for each of these auditory skills, such that the author does not deem it necessary to elaborate. However, the sequence of auditory stimuli progression needs to be reviewed.

Gross sounds that are frequently encountered in the child's environment should be handled first. Tape recorded sounds of cars, bells, planes, rhythms, hammering, sirens, etc., should be introduced initially. Then animal sounds may be utilized along with the appropriate pictures. Animals sounds are introduced as a transition to certain speech sounds, such as vowels. Then speech sounds, including consonants, blends, etc., should be taught. The teaching of spoken words, and phrases and sentences establishes a basis for the introduction of connected speech as well as a wide variety of unstructured speech material. This process which has been neatly summarized in one paragraph, however, represents many years of patient teaching.

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[36]Bernice E. Heasley, Auditory Perceptual Disorders and Remediation (Springfield, Illinois: Charles C. Thomas, 1974), p. 18.

Reagan has provided a listing of sensible procedures that should be implemented while teaching the dysphasic child.

1. Avoid excessive stimulation. Too many visual and/or auditory aids distract. Also excessive enthusiasm may be a distracting element.

2. Allow ample time. Speak slowly and clearly [and use a low volume voice]. Wait for a longer period of time than you think is necessary for child to comprehend verbal directions.

3. Present materials in small increments.

4. Present activities in sequential order.

5. Prepare and present materials to meet immediate needs of child.

6. Re-evaluate frequently.

7. Avoid frustrating child. If signs of frustration appear, change to another method, different materials, or activity.

8. Use as many modes as possible in presenting each task.

9. Program periods of activity and relaxation.

10. Present materials as many times as necessary for learning to take place.

11. Use any means to build up self-image.

12. Include rhythm and music activities frequently.

13. Present, as often as possible, concrete rather than abstract concepts.[37]

Items two and three in the above listing address themselves to the findings in the previous section of this

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[37]Cora Lee Reagan, M. A., Handbook of Auditory Perceptual Training (Springfield, Illinois: Charles C. Thomas, 1973), p. 33.

paper--rate of information processing as a central factor in dysphasia. It is important to note at this time that it is not enough simply to speak slowly and clearly to dysphasic children, because they require more time to process information than can be allowed by slowing down the rate of word presentation. These children require time between words, phrases, and sentences to meaningfully decode speech. It is therefore essential that they receive this speed constraint on the presentation of speech material.

The presentation of auditory perceptual exercises should follow the taxonomy noted earlier. That taxonomy progresses from gross sounds to connected speech, and should follow the hierarchy of auditory skills. Quite naturally, it proves necessary to develop awareness of sounds before any other stage is attempted. The succession of teaching gross sounds proceeds through awareness of auditory events, to attention, localization, etc. Each of these steps should be dealt with until the child displays a mastery of the skill that will serve as a basis for the next step. The last step fulfills the sequence of skills that present listening to and identification of gross sounds.

Summary

The teaching program then should continue through the presentation of animal sounds, to vowel sounds, etc., while always including those auditory skills that bear relevance. Lessons should proceed at the rate where the dysphasic child secures not only an increased familiarity with sound signals, but also develops a feeling of self-improvement and positive self-concept. Lessons should be taught in stages, not concurrently, such that new exercises are not presented until previous ones are well learned. This pacing is an integral aspect of any teaching, and holds a peculiar significance with dysphasic children because of their extraordinary need for a secure understanding of the developmental progression of learning skills.

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