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Ohio Tests of Articulation and Perception of Sounds; Bobath Neurodevelopmental Treatment

ABSTRACT

Speech, language, and communication disorders were among the topics of papers presented at the convention of the Council for Exceptional Children in Chicago, 1970. Discussions include evaluation theory and caseload selection by Lear Ashmore, differential diagnosis in a rural school by William L. Shinder, the practical application of differential diagnosis for urban school clinicians by Patricia Brown, the use of motor and language development scales by Joann Fokes, and the Ohio Tests of Articulation and Perception of Sounds by Ruth Irwin and Aleki Nickles. Additional papers are concerned with the therapy implications of recent developments in psycholinguistics (Sue Pace), implications for new speech techniques with the neurologically impaired (Lois Sanders), the Bobath neurodevelopmental treatment in speech therapy (Suzanne Morris), and the effects of sensory modality stimulation on the disarthria of cerebral palsy (Russell Love). (JM)

Speech, Language, and Communication Disorders

Papers Presented at the

48th Annual International Convention

The Council for Exceptional Children

Chicago, Illinois

April 19-25, 1970

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Evaluation Theory and Caseload Selection: Diagnosis and Disposition

Lear Ashmore
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There are at least two things to be accomplished in this presentation. One is a brief review of the procedures of evaluation and the other is to look at, in as much depth as possible, a theory of evaluating communication behavior as it appears at the time of evaluation. Evaluation of speech and hearing behaviors in the schools has been traditionally short-changed because of the belief that there is not enough time to do anything in depth.

A procedure which has been followed in the past, at least in situations I have known about, has been to see the children for a screening evaluation, then seeing those children who failed to meet the minimum criteria of the screening for a bit more of an evaluation to get some idea of the nature of the communication problem, and then starting the therapy process. In some school systems, the children go from screening to therapy without the intermediate step. Then, with the children in therapy, there is periodic appraisal to see if they are making progress on what they are being "therapized" for. If the children do not make progress after a semester or a year of therapy, then there may be an attempt to find out what the problem is and why it isn't moderating with therapy.

For fulfilling the criterion of expediency, the previously described procedure has been considered effective for those children who have clear-cut and relatively uncomplicated speech and hearing problems. But how about those children who have spent a semester or a year in a type of therapy which has not been effective for them. They, all too frequently, get disgusted, unhappy and fed-up with the process and other problems begin to develop on top of the communication problem. This has happened in clinics as well as in public schools.

The justification for this type of practice may be explained by a theory of behavior modification which has been present in our field. This is the idea that the clinician works with the manifest behavior and, with principles of learning theory, controls and directs the communication behavior by strictly applied schedules of reinforcement (reward and punishment, etc.). It is probable that all communication behavior can be modified in such a way, if it is done correctly and with a thorough knowledge of the steps involved. Speech is a learned behavior as far as we know, but the clinician must know the bases of the learned behavior and what aspects of it can and cannot be modified by such an approach.

This is where the importance of evaluation comes in. I do not believe that the clinician can take the speech behavior at face value and start modifying it and have one hundred per cent success. This is the type of therapy the parent applies when she says "talk slower" or "say soup not thoup", and this approach is apparently effective with the vast majority of children. At least 90 to 95% of them are not recipients of our services. But with the other 5 to 10% there must be something different about them that caused them to end up stuttering or saying "thoup" in the second grade in spite of mother's teaching technique.

The parents didn't have differential diagnostic information to help them in their therapies. In a like manner, I believe that in the past, there were a number of speech clinicians who didn't have and who didn't attempt to get this differential diagnostic information. As indicated, this was in the past. Now, I sense that the majority of speech clinicians in the schools are seeking more effective ways of determining their case loads and the types of remedial procedures which these children need. Thereupon rest the reasons for this presentation.

Following is a brief review of the steps in diagnosis which you had drilled into you in your training days. In my opinion, the most important evaluation tool is the case history. If we were having a diagnostic contest and I had come up with a sound and meaningful evaluation and I could choose only one instrument, I would choose the case history. If a clinician is skillful at inter-

viewing parents or guardians, the clinician can get the very exact and complete information which he needs to arrive at some kind of an appraisal of the problem. However, let me stress that the case history is like any other instrument a clinician might use and it is no better than the person who uses it. A clinician can do a poor case history and it will tell him nothing or he can do a good case history and it is better than a thousand Peabody's, Wepman's, audiometrics, ITPA's, etc. Obviously, I am not talking about the type of printed case history filled with little blanks that the mother takes home and fills out and mails back to the clinician.

Another step in evaluation is observing and describing the child's communication behavior during the evaluation sessions. Accurate observing of behavior is always structured although the degree of structure may vary. I am going to talk in more detail about this step later on.

The next step is usually a tentative statement of the problem, the nature and degree of involvement, perpetuating factors, etc. This statement should be as complete as possible and as detailed as necessary.

The fourth step involves the design of a future program for the child. The clinician should answer questions such as: What kind of a program can be designed for him? Can it be handled in the currently existing school program? Is the school program the best one for him? If the clinician's case load is full, what alternative plans are there? What can be done at home?

The next step evolves from the previous one and it is a statement of prognosis which involves the utilization of information from all the preceeding steps. We all know our guessing rate could be improved but if the clinician looks at all this accumulated information, he should be able to come up with a fairly accurate statement of prognosis. For example, "If he is placed in this specialized, strongly speech-oriented program for slow-learning children in X school, the chances are good that he will acquire a useful basic vocabulary, be able to express most of his needs, learn to interact verbally with his peers on a relatively direct level, etc."

These then are the essential steps of a complete evaluation. How long has it been since you have taken or been allowed the time to do an evaluation of this detail in your school experience?

It is very easy to spell out the things one should do. The complicated part is what goes on as subsections of each one of these major divisions of the process of evaluation. In view of the fact that I think the case history is the most important step, I am going to discuss the second step in evaluation with you. It is difficult for school clinicians to get parents in for detailed case histories so the next best thing is to conduct the best evaluation possible of communication behavior.

Allow me one more digression. As you may have observed by now, I talk about evaluation and not diagnosis. We rarely diagnose in the true sense of the word. Most of the time the speech problem is clearly evident and we only evaluate it for complexity and severity. Also, if we talk about evaluation it is more explicit that what we are doing is an ongoing process and something which is constantly a part of our work and not a one-shot affair as is implied in diagnosis.

Now to step two. I feel that it is important that the diagnostician be able to evaluate communication behavior and its significance with some sort of a systematic approach. The system I advocate is one which involves initiating the evaluation at the highest, most complicated aspect of speech and hearing behavior that the clinician thinks the child is capable of and then moving from there to gradually less complicated tasks as needed. This approach places a great deal of responsibility on the clinician to know speech and hearing behavior hierarchies; to know what is a less or more complex speech task. In my opinion, the nice thing about this approach is that the clinician does not have to rely on commercially available instruments but can rely on himself and his knowledge of behavioral hierarchies. The system doesn't preclude the use of fancy instrumentation; it just makes its use more systematic and informative.

Let's say that I am at X school and a child has just transferred who is suspected of having a relatively subtle oral language problem. The principal asks me to see the child on an emergency

basis since I won't be back to the school for another week. I have to refuse because another clinician is using the ITPA, Peabody, Bellugi-Klima, and Kent Emergency in another building, so I don't have my subtle oral language evaluation kit with me. What kind of an opinion is the principal going to have of me as a professional speech clinician?

On the other hand with my systematic observation approach, I don't need those instruments in order to do an evaluation of current oral language behavior. In fact, I may do a better job of it if I don't pull out a bunch of tests because the child may be fed up with testing at that stage of the game.

Where do I start in evaluating speech behavior? To me, the most sophisticated level of speech behavior is talking coherently and with some detail about some event or abstract concept. For example, if I asked one of you to tell me something of your reasons for going into the profession of speech and hearing service, you could respond to this with some degree of coherence, detailing reasons with appropriate vocabulary, appropriate sentence structure, articulating your words with an acceptable intelligibility and with a non deviant voice quality and appropriate stress, inflection and rhythm. Or you were less than satisfactory in some of these dimensions. If, as you talk, I notice a breathy quality or intermittant phonation, then I am going to go immediately to a voice analysis.

With a child, I usually start off with "Why did you come to see me today?" and take his response or lack of response as a starting place. If his answer is appropriate in structure and content but characterized by a great number of non-essential interruptions and repetitions, then I am immediately going to do the things I do when I investigate stuttering. If I don't get any response at all to my initial question, then I will have to structure my succeeding remarks until I can finally get some speech behavior. But I have to know how to change the structure. I may have to move from the very abstract question above (because he didn't answer it) to a more concrete level where

I am asking him to name common objects for me, but I am constantly restructuring in order to get maximum information at each level. Also as in most evaluation procedures you assume success at all levels lower than the one at which he attains acceptable performance. This saves a lot of time.

Taking the four dimensions of oral behavior that I deal with, language structure, articulation, voice, and rhythm, I naturally prefer to start off with language because response here can reveal deficiencies in the other dimensions. I have seen youngsters who had such bad speech that I couldn't tell whether they had words in the right order or were answering the question correctly. So I know I will not continue on this level of language but move on to more structure and ask him to name objects for me. I hold up a cup and he says /ʌ/ and I show him a cat and he says /ɹ/, etc. Then I quickly zero in on the articulation dimension and work with it until I can describe his articulation behavior. Later I can go back to language when I have a better idea of his articulatory repertoire and can decode his articulation code. There is no point in pursuing language when it is not giving me any meaningful information.

Each of the four dimensions I use (and you may use others) has its own units of distinctive behaviors and these must be explored completely. What are all the behaviors related to articulation that you would want to explore for any particular child and these would be selected on the directions in which his articulation behavior is going. Do you want to analyze for articulatory or acoustic features, pre or post vocalic, pre or post consonantal, stimulability, discrimination, sound synthesis, etc. ? If you had a child with an interdental lisp you would probably not do a features analysis but you might want to do a pre and post vocalic and consonantal test, with and without stimulation. Again don't have a specific routine that must be accomplished with each child. Be selectively evaluative.

The same type of approach can be accomplished with auditory or hearing behavior. In this

area, there are two dimensions: one is sensitivity and the other is interpretation of what is heard.

To me the most sophisticated auditory behavior you can expect of an unsuspecting person is to make him sit in a very small room, put earphones on and remember to respond consistantly and rapidly to something as abstract as pure tones which are getting fainter and fainter. When you have a client you have to teach or condition to respond, you remove the task from the level of extreme complexity and simplify it considerably.

The other level of auditory behavior, comprehension, can be evaluated (and usually is) in connection with the language evaluation. In testing the language dimension, questions were asked and directions were given which had to be understood before correct responses were made. If correct responses were not forthcoming then the level of input was modified in the direction of less complexity. In the audiometric evaluation, a series of directions are given which must be comprehended to complete the test successfully without conditioning.

An obvious thing here that probably does not need mentioning is that you explore aspects of speech and hearing behavior through the same systematic approach. They cannot be separated. You should not find yourself saying "I am going to ask this question twice, once to see if he heard it and understood it and the second time to hear how good his speech is when he responds".

I have seen very good speech evaluations done in five minutes with this approach by relatively inexperienced student clinicians (I have also seen some very bad ones done). The advantage of this approach is that the clinician does not waste his time doing things which do not result in additional specific information. How much time has been wasted doing just a screening articulation test like the Bryngelson-Glaspey when the child obviously had one significant error. How much time has been wasted doing an ITPA because the child doesn't seem to have plurals, past tense, grammatic closure (in their terminology) when in reality his articulation is the thing causing the difficulty.

The major rule to be remembered in this approach is do not persist in a task that is not

giving you increasingly specific information about a child's communication behavior.

Differential Diagnosis in a Rural Public School Setting

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Basically, the role of the speech clinician in a rural school setting will not vary much from that of the urban-based speech clinician. However, the speech therapist in the rural public school system is more likely to work with a greater number of children with more severe communication disorders because of a lack of other professionals and agencies for referral, diagnostic and remedial services.

A primary assumption of a "differential diagnosis" is that differential treatment is required to ameliorate communicati on disorders with various underlying causal factors. It is, of course, possible to describe overt behavior without reference to causal factors. This, I think, leads to a therapy program which, while successful in changing behavior during the time the child is with the therapist, may have little carry-over value to real-life situations. Thus, a differential diagnosis of speech disorders implies:

1. describing current communication behavior and underlying processes;
2. discovering concomitant causal factors; and
3. determining prognosis and remedial procedures to be used.

In developing a differential diagnostic approach for a rural setting one might want to consider the following approach: First, the therapist should see the child and analyze the child's current communication behavior and underlying process which may give clues to possible causal factors. The approach outlined by Dr. Ashmore would certainly be valid in a rural setting. My only modification would be to tape record a conversation between the child and therapist and, when indicated, analyze the child's linguistic competency using a modification of Paula Menyulis experimental pro-

cedure. By dividing the child's language sample into what Hunt calls terminal syntactic units, the therapist can quickly determine the level of language competency, the emerging structures which are developing, and the deviant language patterns which the child employs. At the same time, the therapist can note the articulatory errors present and determine whether they are linguistically based or not. Speech rhythm and voice quality can also be noted.

Often, the speech therapist in a rural setting suffers from "professional isolation"; however, this need not occur. The speech therapist is responsible for developing liaison with all available professionals and agencies such as local physicians and dentists, public health services, welfare services, and the school health nurse, and consultants from the state department of education.

As Dr. Ashmore mentioned, the case history is of prime importance in a differential diagnosis. The speech therapist in a rural setting after seeing the child in the school, will want to visit the child's home and talk with the parents. It is difficult for parents in this type setting to visit the school, which may be a considerable distance from home. Also, the parents will probably be more at ease in their own home; and finally, the therapist can pick up significant cues about the child's home environment which may explain his current communication behavior. I found it very useful to work with the visiting teacher in obtaining a case history because of her familiarity with most of the families in the community. At times, one might see a child in a rural setting with a significant communication disorder whose parents are unaware of the effects of the disorder in relation to the child's learning in the classroom. Here, the visiting teacher can work to introduce the speech therapist to the family, as well as supply information about the family's social history. In this way, the parents are made aware of their child's communication disorder in a setting comfortable and familiar to them, which increases the possibility of their cooperation. At this time the therapist should have some positive suggestions to give the parent in working with the child in the home. This is particularly important when the parents are made aware of a problem

which they had not previously considered themselves.

Care should be taken when referring a child to an agency outside the local community. The speech therapist in a rural school setting should provide the agency with a comprehensive diagnostic evaluation of the child's speech and language behavior. This is particularly important when the family must travel a great distance and the agency may not be able to see the child more than the initial visit.

To summarize, I feel that the rural setting suggests some modifications of procedure in a differential diagnosis of communication disorders. However, the information gained is certainly the same. The therapist must be prepared to diagnose and provide therapy for certain children with more severe communication disorders, the kind of child who might otherwise be provided for in an urban speech and hearing clinic.

Practical Application of Differential Diagnosis for Urban Public School Clinicians

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Salt Lake City, Utah

With increasing focus on communicative disorders of children, it is ironic that many professionals are overlocking some of the most obvious language discrepancies. These language discrepancies occur among professionals in the field of speech pathology; speech clinicians appear to be suffering from an advanced type of communicative disorder.

The language and terminology used to describe and diagnose speech disorders is highly variable, to the point of unintelligibility. There appears to exist inter-clinician communicative disorders and inter-professional communicative disorders. When attempts are made to describe the diagnosis of a certain child, mass confusion can result.

Professional communicative disorders can be more obvious in a large urban school district where it is necessary to manipulate large numbers of speech defective children. Not only must a clinician communicate with ten, twenty or forty speech clinicians, he must also communicate with a large number of related professionals. Probable persons or agencies who might need to communicate with the urban clinician could include the following: clinicians in surrounding districts or agencies, hearing conservationists, physicians, community mental health services, social workers, numerous administrators, reading specialists, community agencies, school nurses, state department officials, classroom teachers, psychologists, psychometrists, and special education teachers for hearing impaired, emotionally disturbed, learning disabilities, mentally retarded, orthopedically handicapped, etc. This list could grow as rapidly as new specialities grow. Communication with these persons will be necessary for the purpose of referrals, reports, requests for specific information, follow-up, case histories, diagnostic information, progress reports, and general exchange of professional information. Because of the myriad professional jargons, a high incidence of communication barriers and misunderstanding exist. Information gathered from these sources may play a part in your differential diagnosis of a child. Foul up the lines of communication and you foul up or lose part of your diagnostic information on the child, to say nothing of injuring future professional relations.

Just as one attempts to correct communicative disorders of children through language training, professionals must also attempt to correct defects in their own communications. Let us consider the problem of language and how it relates to differential diagnosis. Language is actually the manipulation of symbols in order to organize our environment; symbols are much easier to manipulate than the concepts they represent. Language thus leads to terms, naming, categories, that is, labels. When we communicate professional information we generally label a child.

The problem arises when clinicians attempt to dissiminate diagnostic information without first having established a common language. One of the first steps in any speech or remedial program should be the development of a language by common agreement upon terms or symbols. The urban clinician must be able to communicate diagnostic findings in a familiar language with a large staff of other clinicians. Know how to describe diagnostically and how to interpret language used by your colleagues.

In conjunction with a common language comes the basic structure of any speech program. This basic program or guide lines should be established before one tests, makes a diagnosis, and places children in therapy. Although this might seem elementary, too many public school speech programs are developed in reverse. Clinicians beat the bushes finding children before they consider basic philisophy, guide lines, and purpose of their program. When this occurs, the process of diagnosis becomes blurred. Clinicians are uncertain of their objectives and are uncertain of their diagnostic case selection.

Certain standardized terminology enables clinicians to rapidly compare large numbers of children within a framework of differential diagnosis. An example of this is a program developed in School District 110 in Overland Park, Kansas. Children were selected for therapy according to the severity of their problem, with numerical ratings used as an index of severity in the basic areas of voice, articulation, fluency and language. Children were rated on a scale of 1 to 4, with 1 as mild and 4 as chronic-severe. Complete diagnostic information was available on each child, and yet a very brief rating enabled manipulation of these symbols. This was the development of a common language by agreement of the clinicians. This language facilitated the manipulation of large numbers of children in an efficient manner. It was possible to better initiate therapy programs if it were known, for example, that School A had thirteen 4's and twenty 3's. Detailed information concerning this program will be available during the workshop portion of this presentation.

Urban schools have untapped resources of large numbers of children who would be available for standardization procedures. If you are not content with your diagnostic case selection, innovate programs that will meet your needs. Use your school population for standardization to determine if your program is indeed fitting your purpose.

Now that we have determinded the relationship between diagnosis and various aspects of a school speech therapy program, let us consider differential diagnosis per se. It is with hesitation that the term "diagnosis" is used. Diagnosis implies stamping a label on a child, which is another whole area of discussion. Although stress is placed on common language among professionals, it is difficult to reconcile the use or misuse of certain labels.

Diagnosis, if that is what the process is to be called, must consider the picture of the total child relating to his environment. Two broad areas to be considered in evaluation are informal and formal assessment

of the child. Informal assessment would include observation and recording of the child's average daily functioning. This might include activities such as jumping rope, playing baseball, building with blocks, "show and tell" time, eating in the school cafeteria, painting a picture - general, average activities of the child. This is an excellent opportunity for assessing gross and fine motor ability, language, social and emotional stability, visual perception, auditory skills, etc. This type of approach is directed towards the emphasis on describing behavior rather than applying labels. A good behavioral description can be the best differential diagnosis possible. This would be the process of determining the child's strengths and weaknesses in relating to his environment. From this assessment would come implications for remediation: utilize the strengths to remediate the weaknesses.

Formal assessment of the child's abilities would include more contemporary ideas of testing. This would be an assessment of the child's best attempts in a standardized situation, or formal tests. A variety of tests and diagnostic tools should be available in the following suggested areas: social, visual perception, motor development, general intellectual, non-verbal intellectual, language, academic, projectives, and auditory perception. Within each area should be a wide selection of tests available in order that the clinician might choose the test best suited to the child. For example, non-verbal intelligence tests made available might include: Raven's Progressive Matrices, Columbia Mental Maturity Scale, Nebraska-Hiskey (forms for hearing and hard-of-hearing available), Leiter, Merrill-Palmer, Peabody Picture Vocabulary Test, Ammons Full-Range or Quick Test, plus portions of other tests which might be applicable.

The use of formal assessment, while still attempting to move from labels to behavior, is included for several reasons. The usefulness of standardized tests has been accepted in the areas of placement, comparison, evaluation of progress, and implications for remediation. It is the misuse of test scores that has been distressing. Formal tests may help to pinpoint exact difficulties and to confirm or reject previous hypotheses on a child. In addition to these positive features of standardized tests, they form a basis of efficient communication among professionals. It has seemed more efficient to provide a label than a detailed description of cafeteria behavior. Somehow one should be able to combine the formal and informal assessment into significant terms of language, minus degrading labels. Perhaps the idea of a language for labeling behavior will be the next trend in special education.

Too many clinicians are hesitant of their own abilities and zealously refer children to clinics and physicians for a "complete diagnostic work-up". The child may return with a long string of labels following him, but his behavior is essentially the same. Look at what the child is doing and what he is not able to do. Clinicians in behavioral science are operating on a medical model, seeking a cure or a pill for unacceptable behavior. Diagnose or evaluate the child at his level of functioning and work with him from there. Diagnosis is not just stamping a label on a child. It is constant evaluation and appraisal of behavior. However, for those who feel more secure with standardized tests, and for those who wish to increase their knowledge of tests available, a basic inventory of diagnostic measurements is presented.

A BASIC INVENTORY OF DIAGNOSTIC MEASUREMENTS

As Viewed by a Speech Clinician

In an effort to facilitate diagnosis, and thus remediation, of complex language and learning problems of children, numerous testing devices are available to clinicians. The myriad of tests available presents further problems as to selection of the best possible tests for each particular child. The following inventory is an attempt to categorize measuring devices according to the ability the test measures. Tests included were selected according to the author's preference and in no way can they represent the many tests available on the professional market.

A great deal of overlap does occur in some of the tests. An intelligence test may measure a great deal of expressive language, for example. It would be impractical to cross-reference all of the minute abilities that overlap on each test. Therefore, tests have been categorized in this inventory according to the basic purpose they may have for the practicing speech clinician.

Certain tests, particularly the projective and intellectual tests, require intensive, specialized training for proper administration and interpretation. These tests are included for two reasons: 1. for the clinician to be aware of their existence in referring to proper personnel to administer these tests, and 2. for the clinician who wishes to increase his testing repertoire by receiving the proper training necessary for administration and interpretation of these tests.

It is hoped that an inventory of tests may expedite the diagnostic process. Increased knowledge of tests available should also add to the common language among professionals, to further increase professional communication in describing children. To reiterate, this is only one clinician's assessment of a basic inventory of diagnostic measurements.

SPEECH

LANGUAGE - GENERAL

Houston Test for Language Development. Part I indudes a checklist for very young children, 6 mo. to 3 yrs. Part II extends to 6 yrs. and is administered directly to the child. Level, channel and process of language are tapped in this test.

Crabtree, Margaret. The Houston test for language development. Houston: The Houston Test Co., P.O. Box 35152, Houston, Texas.

Verbal Language Development Scale. Developmental language items from the Vineland are utilized in an indirect test version. Indirect version is especially good for very young or unintelligible children.

Mecham, M. J., Jex, J. L., and Jones, J. D. Verbal language development scale. Salt Lake City: Communication Research Associates, Box 11012, 1965.

Utah Test of Language Development. A direct version administered to the child which checks the onset and progressive maturation of language skills. Ease and speed of administration facilitates the usefulness of this test. No time limits are set; test can be completed in several settings if necessary.

Mecham, M. J., Jex, J. L., and Jones, J. D. Utah test of language development. Salt Lake City: Communication Research Associates, 1967.

ITPA consists of nine subtests, which check decoding, encoding and association. Level, channel and process of the child's language are investigated. Ages 2.6 to 9 yrs. As the authors of this test infer, this is an experimental version. Good for diagnosis and remediation.

McCarthy, J. and Kirk, S. Illinois test of psycholinguistic abilities. Urbana, Ill.: The University of Illinois Press, 1961.

Screening Tests for Identifying Children with Specific Language Disability. Children are presented with types of experiences encountered in school. This is a diagnostic test with familiar material; identifies probable perceptual-motor difficulty, visual, auditory or kinesthetic problems. Administered group or individually. Grades 1 to 4.

Slingerland, Beth. Screening tests for identifying children with specific language disability. Cambridge, Mass.: Educators Publishing Services, 1969.

SPEECH

LANGUAGE - GENERAL

Parsons Language Sample. Based on a behavioralistic model and composed of seven sub-tests: tact, echoic, intraverbal, comprehension, echoic gesture, intraverbal gesture and mand. Originally intended as a step in developing programs for mentally retarded children. Parsons Project undertaken at Parsons State Hospital and Training Center, Parsons, Kansas.

Schiefelbusch, R. L. et al. Studies of mentally retarded children. Journal of Speech and Hearing Disorders, 1963, Monogr. Suppl. 10:88.

SPEECH

LANGUAGE - SPECIFIC

Syntax, Morphology, Grammar -

Experimental Test of Comprehension of Linguistic Structure. A test of actual comprehension of structure or rules of the language. Language expression is not required from the child. Syntactic structure, morphological constructions, grammatical categories, form classes and function words are explored. Ages 3-7½ yrs.

Carrow, M. A., Sr. The development of auditory comprehension of language structure in children. Journal of Speech and Hearing Disorders, 1968, 33:99-111.

NSST, the Northwestern Syntax Screening Test is a screening device appropriate for ages 3-8, can be administered in 15 minutes. Tests the ability to comprehend and produce certain syntactic forms; a comparison between receptive and expressive performances is readily available.

Northwestern syntax screening test. Evanston, Ill.: Northwestern University Press.

Exploratory Test of Grammar. Designed after Berko's research, this test is a further attempt to determine what children know about the rules of grammar. Children are presented picture stimuli and are to complete the sentence or phrase initiated by the examiner.

Berry, M. F. and Talbott, R. Expleratory test of grammar. 4332 Pine Crest Rd., Rockford, Ill., 1966.

Procedures of Possibility - These procedures are not yet in standardized test form, but represent the possibility of useful measurements of language.

Berko, J. The child's learning of English morphology. Word, 1958, 14:150-177.

Miller, W. and Ervin, S. The development of grammar in child language. In Bellugi and Brown, R. The Acquisition of Language. Monograph of the Society for Research in Child Development, 1964, 29:9-35.

SPEECH

LANGUAGE - SPECIFIC

Syntax, Morphology, Grammar -

Procedures of Possibility -

Klima, Ursella Bellugi, Evaluating the child's language competence. Nat. Lab. Early Childhd. Ed. Urbana, Ill.: Univ. of Illinois, 1968.

Brown, R. and Bellugi, U., Three processes in the child's acquisition of syntax. Harvard Educ. Rev., 1964, 34:133-152.

Ervin, Susan M. Imitation and structural change in children's language. In Lenneberg (Ed.) New directions in the study of language. Cambridge, Mass.: M.I.T. Press, 1964.

SPEECH

LANGUAGE - SPECIFIC

Vocabulary:-

Peabody Picture Vocabulary Test. Receptive language is tapped as the child chooses the correct picture from one of the four presented. Many implications for use in testing with handicapped or non-verbal children and adults.

Dunn, L. Peabody picture vocabulary test. Minneapolis: American Guidance Service, 1965.

Ammons Full-Range Picture Vocabulary Test. Three forms are available; each form consists of four pictures. Increasingly difficult words are presented to subject, who chooses the best picture to fit the word. A shorter form, or the Quick Test, is also available. Testing advantages are similar to those for the Peabody test.

Ammons, R., and Ammons, H. Full-range picture vocabulary test. Missoula, Montant: Psychological Test Specialistw, 1958.

Children's Picture Information Test. Especially good for home-bound handicapped children. Picture stimuli are objects found in immediate home environments. Ages 2 to 6.

Kogan, Kate L. and Crager, R. L. Standardization of the children's picture information test. J. Clin. Psychol., 1959, 15:405-411.

INTELLECTUAL

General

WISC, Wechsler Intelligence Scale for Children. Divided into two main areas of verbal and performance, this test is also sub-divided into specific sub-tests in each area. Child progresses in each sub-test until he attains his upper limit. Well known for high validity and reliability. Ages 5-15 yrs. Special training for administration is necessary.

WPPSI, Wechsler Pre-school Performance Scale for Infants. Designed in the same test construct as the WISC. Items are appealing to young children and the age range extends to the lower limits not covered by the WISC. Developed in the last few years, its use will probably increase.

Wechsler, D. Wechsler intelligence scale for children. New York: Psychological Corporation, 1949.

Stanford-Binet, form L M. Another well-standardized test considered high in validity and reliability. The organization of this test is on age levels; the subject performs a variety of tests at one age level before proceeding to the next. Age range is especially advantageous; range is from 2 yrs. to adult. Special training for administration.

Terman, L. M. and Merrill, Maud A. A Stanford-Binet intelligence scale. Boston: Houghton Mifflin, 1960.

Basic Concept Inventory. This individual test is simple to administer and provides some indication of predictive school performance. Tests concepts a child must master in order to perform on academic tasks. Especially good for culturally disadvantaged, slow learner, emotionally disturbed, or mentally retarded child. May be administered by classroom teacher. Pre-school to primary grade level.

Englemann, S. E. The basic concept inventory. Chicago: Follet Educational Corporation, 1967.

Boehm Test of Basic Concepts. This test consists of two booklets of 25 pictures each which can be administered in two 15 minute sessions. Child must follow directions to indicate his knowledge of concepts such as size, sequence, number, location, etc. Good standardization. Pre-school to early primary grade level. Administration by teacher.

Boehm, Ann E. Boehm test of basic concepts. New York: Psychological Corporation, 1969.

INTELLECTUAL

Non-Verbal

Merrill-Palmer. Though a small language portion is included in this test, a reasonable evaluation of the child's abilities can be made through use of the appealing performance items. This test is good for very young or non-verbal children.

Wellman, Beth L. The intelligence of preschool children as measured by the Merrill-Palmer scale of performance tests. University of Iowa Stud. Child Welf., 1938, 15, No. 3.

Merrill-Palmer test, C. H. Stoelting Co.

The Leiter International Performance Scale. A series of block matching tasks form the basis for this non-verbal test. No verbal instructions are needed. Imitation can be the basis for the instructions. Implications for handicapped children are encouraging.

Leiter, R. G. The Leiter international performance scale. Univ. Hawaii Bull., 1936, 15, No. 7.

Columbia Mental Maturity Scale. Especially good for children with severe motor problems. Children must select one wrong figure in a set of drawings. Ages 3-12.

Burgemeister, Bessie, Blum, Lucille and Lorge, I. Columbia mental maturity scale. New York: Harcourt, Brace and World, 1959.

Nebraska-Hiskey Test. Though intended for and standardized on a deaf population, the implications for testing non-verbal children are of interest. A newer form is available which has been standardized on a hearing population.

Hiskey, M. S. Nebraska test of learning aptitude. Lincoln, Nebr.: Author, 1955.

Raven Progressive Matrices. Originating in England, this test is used extensively by British psychologists. The test consists of a number of designs with a part removed. Subject must choose part from a number of parts presented to him. 5-11 years and retarded adults.

Burke, H.R. Raven's progressive matrices: a review and critical evaluation. J. Genet. Psychol., 1958, 93:199-228.

Refer also to Peabody, Ammons, and non-verbal sub-tests of other tests.

LANGUAGE

READING

Gates-McKillop Reading Diagnostic Tests. A series of tests for recognition of visual forms of nonsense words and syllabification. Facilitates diagnosis, as the name implies.

Gates, A. I. and McKillop, A. The Gates-McKillop reading diagnostic tests. New York: Bureau of Publications, Teacher's College, Columbia University, 1962.

Picture Story Language Test. Child is asked to write a story about a picture. This is scored for productivity, meaning, and correctness. Three scales measure productivity, or length, syntax, and abstract-concrete concepts.

Myklebust, H. R. Development and disorders of written language, Vol. 1 Picture story language test. New York: Grune and Stratton, 1965.

Gilmore Oral Reading Test. Ten paragraphs which form a story are read orally. The child is checked for oral reading comprehension and oral reading accuracy. This is an indication of the child's ability to transform visual input into auditory output.

Gilmore, J. V. Manual for the Gilmore oral reading test. New York: Harcourt, Brace and World, 1951.

AUDITORY PERCEPTION

Peripheral Hearing - audiological assessment

Familiar sounds test. An audiological assessment particularly designed for younger children. Recordings of familiar sounds (cat meowing, dog barking) are recorded at varying frequencies. Child selects picture that goes with sound.

Downs, M. Familiar sounds test and other techniques for screening hearing. J. Sch. Health, 1956, 26:77-87.

Auditory Memory - WISC or Binet digets, according to directions

Taylor's Auditory Test. An evaluation of auditory memory, included as part of a total assessment.

Taylor, E.M. Psychological appraisal of children with cerebral defects. Cambridge: Harvard, 1961.

Auditory Discrimination-

Auditory Discrimination Test. Individually administered, ages 5-8. Two forms.

Wepman, J. M. Auditory discrimination test. Chicago: 950 East 59th St. copyright by J.M. Wepman, 1958.

Templin Test of Sound Discrimination. Picture stimuli are used with sound discrimination. Ages 3-5 on one form; 6-8 on another form.

Templin, M. Certain language skills in children. Minneapolis: University of Minnesota Press, 1957.

Auditory Identification -

Measurement of Verbal Listening Accuracy in Children. A word-picture matching response is made by the child, who is required to choose the correct label for one of three pictures. The picture sets can be presented individually or to groups.

Mecham, M.J., Jex, J. L., and Jones, J. D. Test of listening accuracy in children. Provo, Utah: Brigham Young University Press, 1969.

SPEECH

ARTICULATION

McDonald's Deep Test. Sounds are checked intensely in fundamental phonetic context. As the name implies, the ability to produce different phonemes in varying situations is tested in depth.

McDonald, Eugene T. McDonald Deep Test. Pittsburgh: Stanwix House, 1964.

Templin-Darley tests of articulation. Can be used as screening, or the longer form can be used in diagnostics. Vowels, consonants, diphthongs, plus intelligibility of conversational speech can be checked. Ages 3-8 yrs.

Templin, M. and Darley, F. The Templin-Darley tests of articulation. Iowa City: Bureau of Educ. Res. State University of Iowa, 1960.

The Articulation Inventory: A Quantitative Index. A numerical score is obtained through consideration of the occurrence of the sound in the English language, age of child, position of the error in the word, type of error, and the ability of the child to stimulate his error sound. The severity of a child's articulation can immediately be compared numerically with other children's scores.

Krafchick, Ivan Paul. The Articulation Inventory: A Quantitative Index. Presented at the American Speech and Hearing Association Convention, 1966.

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Predictive Screening Test of Articulation. This represents an attempt to distinguish between those children with articulation errors who will correct them spontaneously through maturation and those children who will need therapy in order to correct their errors.

Van Riper, C. Predictive Screening Test of Articulation. Cooperative Research Project No. 1538. Kalamazoo, Michigan: Western Michigan University, 1965.

DEVELOPMENTAL MOTOR

Denver Developmental Screening Test. Can be used for screening or for testing in depth. Simple to administer, no elaborate equipment, may be administered directly or indirectly. Good norms appear to be available.

Frankenburg, W. K. and Dodds, J. B. Denver developmental screening test. Denver: Univ. of Colo. Medical Center, 1967.

Gesell Developmental Schedules. Developed from a series of earlier developmental scales, this widely-used measurement has also been adapted in part for a number of subsequent tests and measuring devices.

Gesell, A., et al. Gesell developmental schedules. New York: Psychological Corporation, 1949.

Oseretsky Tests of Motor Proficiency. Developed in Russia, these tests were published by Doll and later by Sloan, who renamed them Lincoln-Oseretsky Motor Development Scale. Arranged by age level, these tests indicate muscular coordination, voluntary action, speed, etc. Ages 6-14 yrs.

Sloan, W. The Lincoln-Oseretsky motor developmental scale. Los Angeles: Western Psychological Services, 1955.

Kephart Perceptual-Motor Survey. A test of sensory-motor patterns developed to determine more specific disabilities in a child; developed in part as a result of remediation programs for children with perceptual problems.

Kephart, N. C. The slow learner in the classroom. Columbus, Ohio: C. E. Merrill Books, 1960.

Heath Railwalking Test. A section from the Vineland, this test consists of three rails of varying lengths. Certain walking abilities are expected of children at increasing age levels. Tests balance and locomotion. Widely used; good norms.

Heath, S. Railwalking performance as related to mental age and etiological types. Amer. J. Psychol. 1942, 55:240-247.

TACTILE - KINESTHETIC PERCEPTION

Kinesthesia and Tactile Perception Test. A series of six tests measure form perception, figure identification, etc. Ages 4-8 yrs.

Ayres, A. J. Southern California kinesthesia and tactile perception tests. Los Angeles: Western Psychological Services, 1965.

Werner's Tactile Figure Background Blocks. An adaptation of teaching methods used to test stereognosis.

Strauss, A. A. and Kephart, N. C. Psychopathology and education of the brain-injured child. New York: Grune and Stratton, 1955, Vol. II.

A test for Oral Stereognosis determines the child's ability to recognize the shapes of objects through oral channels.

McDonald, E.T. and Aungst, L. F. Studies in oral sensorimotor function. In Bosma, J. F., Symposium on oral sensation and perception. Springfield, Ill.: Charles C. Thomas, 1967.

Test of Tactual Form Perception. Child is shown objects, names them, and objects are placed in a box. The child attempts to determine what object he feels without visual cues.

Benton, A. L. and Schults, J. Observations on tactual form perception (stereognosis) in preschool children. J. Clin. Psychol. 4:358-364.

VISUAL PERCEPTION VISUO-MOTOR

Kohs' Block-Design Test. Block patterning of designs, using from four to sixteen blocks; adaptions of this test have been used in many other visuo-motor tests.

Kohs, S. C. Intelligence measurement. New York: Macmillan, 1923.

Frostig Visual-Perception Test. Measures five areas, including eye-hand coordination, spatial orientation, etc.

Frostig, M. et al. Developmental test of visual perception. Chicago: Follett, 1964.

Ayres Space Test. Perceptual deficits in spatial ability, perceptual speed, directionality and position in space are measured. Ages 3-10 yrs.

Ayres, A. J. Ayres space test. Los Angeles: Western Psychological Services, 1965.

Bender-Gestalt Test. Perceptual disturbances can be indicated, though in instances this test is used to determine emotional disturbances and school readiness.

Bender, Lauretta. A visual motor gestalt test and its clinical use. Amer. Orthopsychiat. Ass. Monogr., 1938, No. 3.

Plenk, A. M. Development of a scoring system for the Bender Gestalt test for children of preschool age. Doctoral dissertation, the University of Utah, 1967.

Ayres Figure-Ground Visual Perception Test. Consisting of tasks for differentiating figure from ground, this test is applicable for ages 5-11.

Ayres, A.J. Southern California figure-ground visual perception test. Los Angeles: Western Psychological Services, 1965.

Benton Visual Retention Test. Measures the ability to retain the visual image and to reproduce it.

Benton, A. L. The revised visual retention test: clinical and experimental applications. New York: Psychological Corporation, 1955.

VISUAL PERCEPTION VISUAL-MOTOR

Memory-for-Designs Test. This can be of some limited use in determining the possibility of brain damage, as well as visual perception. Subject reproduces a series of fifteen designs. Ages 8½-adult.

Graham, Frances K. and Kendall, Barbara S. Memory-for-designs test: revised general manual. Percept. Mot. Skills., 1960, 11:446-449.

PROJECTIVES

House-Tree-Person. Child is asked to draw a house, tree, and person. This production is followed by detailed inquiry. Interpretations by trained.

Buck, J. N. Administration and interpretation of the H-T-P test. Beverly Hills, Calif.: Western Psychological Services, 1950.

Children's Apperception Test. Child tells a story about a series of eight pictures. Interpretations are made by trained personnel.

Bellak, L. and Bellak, S. Children's apperception test, revised edition. Larchmont, N.Y.: CPS Inc., 1954.

Rorschach ink blots. A series of ten ink blots are presented to the subject, who describes what he sees in them. Interpretation and administration by qualified training only.

Beck, S. J. Rorschach's test. III Advances in interpretation. New York: Grune and Stratton, 1952.

Draw-a-Person. The simple to administer but difficult to interpret task of drawing the human figure can give considerable insight into the child's feelings.

Machover, Karen. Personality projection in the drawing of the human figure. Springfield, Ill.: Charles C. Thomas, 1949.

Bender-Gestalt. This test consists of reproducing a series of designs from individually presented cards. Some indication of perceptual disturbances, emotional stability, and school readiness can be obtained from this test. Once again the interpretation is important. A recent new scoring system has made this test applicable to pre-school children.

Bender, Lauretta. A visual motor gestalt test and its clinical use. Amer. Orthopsychiat. Ass. Monogr., 1938, No. 3.

SOCIAL

Vineland Social Maturity Scale. A schedule of 117 items of habitual social activity applicable from 0-8 years of age

Doll, E. A. Vineland social maturity scale. Minneapolis: Educational Test Bureau, 1947.

Haggerty-Olson-Wickman Rating Scale. Good for predictive behavior 19-mo. to 7 yrs.

Haggerty-Olson-Wickman Rating Scale. New York: The Psychological Corporation, 1952.

Cain-Levine Social Competency Scale. Areas of self-help, communication, initiative and social skills are tapped in this test. This is a specialized measuring device for trainable mentally retarded children; its usefulness should be in the area of planning environmental programs of placement for the child.

Cain, L. F., Levine, S., and Elzey, F. F. Manual for the Cain-Levine Social competency scale. Palo Alto, Calif.: Consulting Psychologists Press, 1963.

Use of Motor and Language Development Skills

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Today, we want to consider the use of developmental scales as one of many devices in the assessment of behavior. Our regard, here, is a method in which scales from two areas of proficiency--motor development and language acquisition--can be applied in the evaluation of the mentally retarded. The obvious reason for employing a measurement device is to bring about more effective handling of the mentally retarded or dependent child. From scales, we expect to obtain a record of achievement that is indicative of the child's level of operation motorically and linguistically. This information aids in the decision of educational placement as well as in day-to-day handling.

We might also point out the value of scales in assessment during a period of life when other devices may be unusable. Standardized tests of psychological measurement require co-operation and some sophistication on the part of the subject--something that the infant, young child, or retardate is unable to give with any degree of satisfaction. Attempts at testing are often frustrating in that the child is unable to follow instructions or respond according to the formal structure of the test. The evaluator, in such instances, must rely on his powers of observation in forming judgements on the capabilities of the child. In this instance, developmental scales may be the best device available. In fact, some specialized testing situations may be reduced to the use of scales in order to obtain a description of behavior. This does not, by any means, indicate that scales are not useful adjuncts in the conditions where complete evaluations can be conducted. Scales may offer valuable supplemental information in addition to standardized test scores and frequently are included as part of a battery of test.

Construction of Scales. Let us now look at the composition of a scale. Developmental scales are, in a sense, a summary of observed behavior at different age levels. Observed behavior may be made under different conditions. Some types of behavior may be noticed incidentally, such as an observer may make note of a child's manner of grasping while he is at play. A more structured condition is observation carried out under preplanned situations. For instance, if grasping is of focal interest, then a child would be carefully followed as he manipulated a pre-set arrangement of articles. His performance would be recorded on the basis of a prepared checklist. For any item to be significant, it must be repeated a sufficient number of times by the same child as well as other subjects within a relevant age span or developmental stage. If the behavior is prominent, it is recorded as characteristic of that age level. For the item to be differential in nature, it should be common to a particular period as compared to an earlier period when it was either absent or emerging. Once a particular skill is acquired, it may be refined at later stages, such as in grasping behavior. Upon refinement, skill in grasping would be retained throughout later stages. Other acquired skills may be dropped at later stages of development. Crawling is an obvious example. Infants learn to crawl, are able to crawl at advanced stages of development, but give it up in preference to walking. Thus, a particular item of behavior common to a period may be refined at a later stage or discarded for another mode of behavior.

The behavioral data gathered have been surprisingly similar in

placing certain acquisitions within a span of age limits for normal children. Findings have been consistent in denoting particular traits and activities as specific to an age span. Deviations, even among normals, especially when one child is compared against the norms for a group, are not rare. When acquisitions are scaled, or placed in a time sequence, variability is not uncommon, particularly in the area of language. The outstanding feature, however, is the sequential appearance of skills--whether linguistic or motoric. Thus, an acquisition appearing on a scale infers that certain specified stages of development have occurred previously and predicts future expectations.

Scales, then, supply information about expected levels of behavior at different ages. Again, judgements are made on the basis of typical behavior of children.

A critical factor to be considered is that of the observational powers of the investigator. Any behavior is interpreted in the eyes of the observer. The construction of a reliable and valid scale is dependent upon the investigator's capacity as a skilled observer as well as his knowledge of child development. Obviously, he must know what to look for and how to look for it. Much of the subtlety of behavior escapes the naive researcher. He must be trained and accomplished in order to describe an observation, to recognize repeated behavior in varying situations, and to discriminate the relevant from the irrelevant. The most reliable judgements are made when the same behavior is noted by more than one investigator.

The validity of developmental scales, then, are dependent upon the knowledge and skill of the observers plus the mode and coverage of the area of investigation. Some of the scales that have been evolved have served as guidelines in watching growth and development. Most notable is the expansive work of Gesell and his associates who charted the behavioral characteristics of infancy, early childhood, school age children, and adolesence. Usually stated in the prefaces of their publications is that information relative to age levels is designed to serve as a guideline of expectations rather than to set any standard of behavior for a particular age.

Scales have also been designed to be utilized as standardized measuring instruments of behavior as well. A prominent device of this type is the Vineland Social Maturity Scale which samples many areas of behavior. This scale, when administered according to instructions, will yield a social quotient and a social age. Another example is the Valett Developmental Survey of Basic Learning Abilities. Items on this instrument were drawn from various sources and compiled to form a comprehensive type of device for evaluating children's competence. A composite such as this includes items from other scales or tests to create a new instrument. The selection of items from other sources allows the testor to look at reliability of many entries. In summary, scales have been constructed to serve as guidelines or instruments for the evaluation of behavior. Items are selected on the basis of their representing typical behavior at

specific age levels. Again, scales are of value as part of a test battery, or in the instance where no standardized testing is possible.

Use of Motor Scales. Infancy is the period of life when an investigator is obviously restricted in the use of measurements. The prominent characteristics of the period are rapid physical growth and the acquisition of sensory-motor skills. Thus, we have the early research of Mary Shirley and Nancy Bayley on motor performance during infancy and early childhood. When the scales are applied, the state of development of the child gives indication of the integrity of his biological system. Any mother watches for the advent of a new skill whether it is sitting up or handling a spoon. In much the same manner, the teacher or specialist can make observations on the basis of scaled behavior to estimate the level of operation of a particular child.

The Bayley and Shirley Scales, or a composite, such as the Developmental Scale of Motor Abilities provide the teacher or specialist with a checklist of expected behavior. Anyone could use a scale, however, the danger lies in the teacher's or the specialist's capabilities in observing particular forms of behavior. Much of this depends upon knowledge of child development and simple experience in observing children. The best way to gain experience is to indulge in child-watching. Watch your own children, children at school, on the playground, or wherever you come across children. Watch what they do and precisely how they do what they do.

The intelligent use of a motor scale also requires that the user have knowledge of the basic pattern of growth and development. Growth occurs in a cephalocaudal direction, or from head to toe. One just does not see a child with control of the trunk and extremities of the body before he has established control of the head and neck muscles. This is obvious in the case of cerebral palsied children. One does not expect to teach a child to sit up nor work with a pattern for sitting up until he has gained head and neck control.

It takes some experience and instruction on the part of a teacher to differentiate between what we call the grasp reflex of early infancy, the palmer grasp used during the second six months of life, and the refined grasp that children eventually acquire. To continue, the infant at twelve months may be adept in picking up objects, while close observation reveals his release to be difficult--or a voluntary kind of dropping action. The two skills are developed under different mechanisms and are not acquired simultaneously.

Intelligent use of scales can aid in determing a child's "motor age". More important, however, is the fact that scales provide information of previously acquired skills plus the directions that development will follow in the future.

Children who may be slow in other aspects may attain a degree of motor proficiency. Although slower rates of development or fixations in some stages may be noted among retardates, these children generally

achieve motor skills, unless physical handicaps, such as cerebral palsy accompany the condition of retardation. The user not only wants to note the level of operation but the rate of growth through the stages in the case of deviate development.

A child's level of operation motorically does not necessarily imply a comparable level of development in other areas. Adaptive, social, or language development may follow their own course. However, there are relations among these areas. As the organism grows, motor functions and adaptive skills, for instance, interact for more elaborate accomplishments. Cutting with scissors is an example of such behavior. The user of scales must be able to discriminate purposeful cutting from the more primitive motoric activity of simple straight line cutting.

In summary, it should be remembered that motor control is the important characteristic of infancy and early childhood and that its progress occurs in sequential fashion. The relation of motor capabilities to other forms of behavior are not direct.

Use of Language Scales. Scales of language development, such as the composite, Developmental Scale of Language Acquisition, have been described previously. There are tests for language on the market, but these usually miss the subtleties found in spontaneous speech because of the difficulties encountered in constructing devices for testing productive speech. Scaled language behavior as observed in subjects provides the user with guidelines in what to expect at certain age levels. Again children show considerable variability in the time at which they acquire language, but the milestones of acquisition or sequence of occurrence of speech behavior remains the same from child to child. The user must be familiar with the theory and research of language development before application of any scale. The outstanding works of Brown and his associates, of McNiell, and of Lenneberg, to mention only a few, should be familiar.

The neurological mechanisms in the emergence of language are not obvious from the use of scales. Observations of child linguistic behavior reveal that most children go through various stages of babbling during the first year of life. Whether or not this type of vocal activity is necessary for the appearance of language is debatable. What is obvious, however, is that most children do travel through a "prelinguistic" stage of vocal play that is typically characteristic of infantile behavior.

One basic requirement for language, the breath group, is established during early infancy. Investigations have found the infant's cry has a similar pressure waveform to that of the adult utterance. The infant cry, very early in life, is produced within the rudimentary limits of adult phrasing of speech. This basic feature is lacking in the so called "cat cries" of severely demented individuals.

Interest in prelinguistic activity during the first year stems from the diagnosis of the hard of hearing and of the deaf. These children cease babbling during infancy, if they babble at all. Scales

designate the six month's period as the time when the hard of hearing become quiet infants or discontinue vocal play. Such observations should lead to further evaluation of the hearing function.

Parents are generally aware that their year old infants "understand" certain aspects of speech before they produce them. They also "hear" their year-old use words meaningfully. Scales generally record the advent of first words between the twelfth and eighteenth months. The use of the scale alone cannot determine if the infant's use of words is holophrastic. The observer must note if the child's intonation pattern plus the situation in which the word is used brings about an appropriate change in meaning. This is the first essence of a grammatical system.

Scales do not predict the actual words used by children but the patterns of acquisition. After the single word stage, for the precocious child as early as eighteen months, he may begin to construct two or three word phrases. At this time, he is operating on the basis of a set of linguistic rules. The rules are not English by any means but structured from his primitive grammar which will ultimately evolve into the adult language. The user of the scale who observes the young child producing word sequences must determine if the phrase is one created by the child or is simply an imitated utterance. This point is crucial in evaluating the mentally retardate's speech whose responses may be imitative or learned responses rather than creative language.

Children work on all levels of speech at once. The phonological system subdivides and expands while the transformational rules of grammar are acquired. A two and one-half year old child may be difficult to understand because of his limited speech sound repetroire as well as the sentence structure he uses at this stage. A four year old who may be using the grammar appropriate to his age but the phonological system of a three year old will be more difficult to understand by virtue of the increased complexity of his language. A mentally retarded child who may be using the phonological system of a four year old but the grammatical system of a three year old may be more easily understood but is capable of doing less with his language as far as expression. Also, scales generally report the number of words per utterance as a language measure. This item gives little linguistic information as far as what the child is doing with his language.

"Errors" typically reveal a child's level of acquisition. The utterance of "man's" for "men" or of "catched" for "caught" is characteristic of four year old children. Such errors tell the observer that the child knows the rules for plurality and tense and is simply applying his rules to all cases. Some slowly developing children may be unaware of the aspects of plurality or tense or may persist in regularizing rules for a prolonged period of time.

Summary. In summary, the use of scales gives information about particular areas of development as well as contributes to the overall

characteristics of behavior. The relation among language, motor proficiency, and intelligence is not clear. One is not dependent upon the other directly but certainly there are some basic connections. For instance, some minimal intelligence must be present before language can be acquired. Some slow learners may superficially have more language than the more intellectually endowed child. In such instances, the quality or creativity of language should be considered. Or a possibility is that the endowed child, may indeed have a language deficit. If little variability is observed in the depressed scores of several measures, then the slow child is probably operating at his appropriate level linguistically.

Motor ability should not be confused with problems in language unless the child has a motor problem in the production of the sounds of speech. Another interaction at the gross level is that it would be a rarity to observe speech in one who had not developed head control. This lack of control is indicative of gross damage.

If progress is lacking in one particular area, steps may be taken to teach the child the next acquisition to be expected. In severe cases, physical therapy upon medical recommendation may be appropriate for the motorically or physically handicapped. For the less involved, suggested activities as in Understanding and Teaching the Dependent Retarded Child by Rosenzweig and Long may be carried out. For the linguistically delayed child, a program of speech and language therapy should be organized. Later reports this afternoon will discuss these topics.

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Lenneberg, E. The Biological Foundations of Language, John Riley and Sons, New York, 1965.

McNeill, D. "Developmental Psycholinguistics", in Miller and Smith, The Genesis of Language, MIT Press, 1966.

Rosenzweig and Long, Understanding and Teaching the Dependent Child, Teachers Publishing Company, 1968.

Ohio Tests of Articulation and Perception of Sounds (OTAPS)

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Because of the expressed need for standardized "compact" tests which would identify articulatory and perceptual inadequacies, the Ohio Tests of Articulation and Perception of Sounds (OTAPS) were constructed and evaluated. These tests were developed as the result of a series of studies at The Ohio State University (Irwin and Musselman, 1962; Smith, 1965; Stevenson, 1966; Schalk, 1967; and Meyers, 1967). Traditionally, tests of articulation were designed to test sounds in three word positions (initial, medial, final) with three separate pictures for each sound. In the Irwin and Musselman study, however, it was found that clinicians would evaluate two or three sounds in a word as effectively as only one sound. As a result of this study, the speech tests in the OTAPS were designed to allow for testing two or more sounds in each word.

The Speech Subtests

The four speech subtests were developed to meet the following objectives: (1) to test phonemic accuracy in varying linguistic units, (2) to determine the consistency of misarticulations, (3) to analyze phonemic types (omissions, substitutions, distortions), (4) to compare the individual's results with the norm, (5) to determine stimulability of production of sounds, (6) to predict outcome of therapy or maturation, (7) to aid in planning therapy.

The first three picture articulation subtests were constructed by Stevenson (1966) who also collected normative data on the tests for the second and third grades. The fourth subtest which was a stimulability test was based on the nonsense words from Subtest III. Normative data on this test as well as the other three subtests were obtained by Schalk and Myers (1967) for kindergarten and first grade children.

Each of the speech subtests was constructed to test the articulatory production of 67 sounds represented in 30 pictures for Subtests I and II and 27 pictures for Subtest III. All of the consonants in the initial and final positions of syllables, all of the vowels, all of the diphthongs, the initial blends (gl), (tr), (st), (fl), and the final blend (mp) were included. The words used in the first two subtests were chosen from word lists which were considered to have words used by children. With few exceptions, each word was selected to test two or more sounds. The nonsense words were also devised to test all 67 sounds, two or more per word. These nonsense words were designed to be easily pronounced and unlike any familiar word. The words were either nouns or verbs.

Subtest I - Sounds in Isolated Words requires the child to name pictures representing the words. Subtest II - Sounds in Phrases utilizes the same words as in Subtest I and is designed so that the child will say the phrase containing the word used for testing. Subtest III consists of nonsense words represented by nonsense pictures presented in the context of meaningful sentences; and Subtest IV requires responses following two stimulations of the same nonsense words used in Subtest III. Examples of the stimuli appearing in the four speech subtests are as follows: (1) boy, (2) tell a boy, (3) The big dog can boodge. The little dog can (boodge). (The child says the second "boodge".) (4) boodge, boodge (two stimulations precede one response by the child).

The Listening Subtests

The four listening tests were devised by Schalk (1967) and Myers (1967) based on Speech Subtest I to evaluate (1) interpersonal identification and comparator tasks, (3) relationship between speaking and listening tasks, (4) developmental progress, (5) ratio between inter- and intra-personal listening tasks, (6) to predict progress in listening development without therapy , and (7) to plan therapy in listening.

The descriptions of the auditory perceptual subtests follow:

Subtest V - Interpersonal Identification Perception of Sounds. The directions for this test were: "I will name the picture (holding pictures in front of the child). Sometimes I will say it right. Sometimes I'll say it wrong. Tell me if I said it right." For example, the examiner shows the picture of "boy" says "boy," and signals for child to evaluate.

Subtest VI - Interpersonal Comparator Discrimination of Sounds. In this test, the examiner said, "I will say two words (no pictures used). Sometimes they will be the same. Sometimes they are not the same. Tell me if they are not the same. Tell me if they are the same." For example, the examiner may say, "poy - boy," the child indicates "same" or "not the same."

Subtest VII - Intrapersonal Identification Perception of Sounds. Holding pictures in front of the child, the examiner instructed the child, "You name the pictures and tell me if you said them right."

Subtest VIII - Intrapersonal Comparator Discrimination of Sounds. Using no pictures, the examiner said, "I'll say the words two times, then you say it and tell me if it sounds like mine."

Although Stevenson, Myers, and Schalk developed normative data for these tests on children in kindergarten, first, second, and third grades, the age range appeared to be too wide to be as definitive as desired. Additional normative data was secured using only a two-month range for each of five age groups, 5 to 8. Mrs. Nickles did the testing for this study.

PROBLEM

It was the purpose of this study to standardize the Ohio Tests of Articulation and Perception of Sounds.

METHOD

The Subjects

Since it was expected that the results of this study would provide normative information on certain speaking and listening skills, specific criteria were established for the selection of the children. The following factors were considered in the choice of the 200 children who were to serve in this study: age, sex, intelligence, and distribution of paternal socio-economic level. Children with interfering factors,, such as hearing or visual problems, brain damage, or physical deviations were excluded.

Age. Although it was recognized that the growth of language is rapid during the years preceding the age of 5, the earlier years were not included as the materials and procedures used in this study were not suitable for testing children younger than 5. Moreover, the ages, 5 to 8, were considered of primary importance to the speech clinician or the teacher.

The 200 children, ranging in ages from 4.11 to 8.1 years were equally distributed in five age levels. An age level was represented by only a two-month range. Each child was tested within one month of his designated ages. Those in the 5-year level were tested within the 4.11-5.1 range; the 5½-year level was 5.5-5.7; the 6-year level was 5.11-6.11; the 7-year level was 6.11-7.1; and the 8-year level was 7.11-8.1.

Sex. An equal number of boys and girls was selected for each of the ages chosen for study. Of the 200 children, 100 were boys and 100 were girls. Forty children (20 males and 20 females) were tested at each of the five different age levels.

Source of Sample. The population of 200 children was chosen from the Columbus Public Schools and Parochial Schools (Ohio) and several registered preschools in Franklin County, Ohio.

Socio-economic level. The total sample and each of the sub-samples were selected according to the father's occupation, so as to be representative of the urban population (U.S. Bureau of Census, 1964). The distribution of subjects according to the socio-economic levels may be found in Table 1.

Intelligence. Intelligence was tested by the Ammons Quick Test of Vocabulary Recognition. The means for the sub-samples by ages, sex, and socio-economic levels are given in Table II. Any child who did not fall within the normal range (85 to 120 IQ) was not used in the study.

The Administration of the Tests

The battery of tests was always administered in the same order: Ammons Quick Test (Form 1), Speech Subtests, and Auditory Perceptual Subtests. Each child was tested individually in a quiet room.

Instructions were standardized for each subtest to insure accuracy of results. The examiner recorded the results as quickly and inconspicuously as possible so as not to distract the child. The specific types of errors were recorded as follows: an omission was indicated by a dash (-); if there were substitutions, the phonetic symbol for the substituted sound was noted; a distortion was signified by a (x). If a plosive sound was not released, it was considered an omission. Every slight distortion, such as "whistling" sibilant, was recorded. In the Auditory Perceptual Subtests a check mark after the number of the item indicated an error.

RESULTS

Since this was a normative study, the means and standard deviations were determined for each of the four speaking and four listening tests at each of the five age levels. For comparison of the development of speaking and listening skills at the various levels, significant differences between the various age levels were ascertained. Correlations between speaking and listening tests were also made in order to establish relationships between the various tests.

Table 1. Means for Intelligence of Subsamples by Ages and Sex.

Subjects	N	Ages 5	5½	6	7	8
Male	20	103.3	104.1	98.9	105.9	105.5
Female	20	103.8	107.2	103.6	93.4	97.9
TOTAL	40	103.5	105.6	101.2	99.6	101.2

Table 11. Occupational Breakdown on Whites and Non-Whites in an Urban Population with Theoretical Percentages* and the Specific Occupational Breakdown for the Population of Twenty for Each Age Group Used in this Study.

GENERAL DIVISION OF POPULATION (1960)		
	Percent of Population	Number in Present Study
White	88.2	18
Non-White	11.8	2
TOTAL	100.0	20

SPECIFIC OCCUPATIONAL BREAKDOWN FOR POPULATION OF TWENTY

Occupational Levels	Whites		Non-Whites	
	Percent of Pop.	Number in Present Study	Percent of total Pop.	Number in Present Study
I. Professional, Technical Kindred Workers	12.9	2	4.5	0
II. Managers, Officials, Proprieters	12.9	2	2.7	0
III. Clerical, Kindred Workers	17.2	3	8.1	0
IV. Craftsman, Foreman, Kindred Workers	21.2	4	11.3	0
V. Operatives, Kindred Workers	19.2	4	25.0	1
VI. Service Workers, Private Household Workers	6.1	1	17.3	0
VII. Farm Workers, Foreman, Laborers	5.7	1	20.7	1
VIII. Unknown	4.6	1	9.9	0
TOTAL	99.8	18	99.5	2

* Descriptions of occupational levels and percentages obtained from the 1960 census (U.S. Bureau of the Census, 1964).

Scores for each of the four subtests on articulation were obtained by weighting types of errors as follows: correct sound as 1; distortion as 2; substitution as 3; and omissions as 4. The perfect score for each of the tests on articulation was 67. For the four listening subtests, the score consisted of the total number of errors.

Articulation of Sounds

The mean total weighted articulation scores and standard deviations by ages for each of the four tests of articulatory production appear in Table III. Since the types of errors were weighted, the higher the scores, the poorer the scores. The ages at which specific phonemes were produced accurately by 75 per cent of the children at each age level are shown in Table IV.

Age. As will be noted by Table III, the poor scores were obtained by the younger subjects. The scores improved progressively as the ages increased. The five-year-old children, for example, made a mean of 88.1 for Subtest I, whereas, the eight-year-old children obtained a score of 75.3. The differences in means between the various age levels for each of the tests were evaluated. Highly significant F ratios were obtained for each of the four speech tests at the one per cent level (Table V). Critical differences occurred between 5 and 5½ for all four tests, between 6 and 8 for two of the three speech tests, and between 5 and 7 for Subtest IV on Stimulability.

Tests. Except for the seven-year-old children, the most difficult test was the nonsense word test; and the easiest test, or the one in which the children achieved the most accurate productions of sounds, was Subtest IV in which the children ~~was~~ were asked to respond to two stimulations of the nonsense words.

Sex. Although there were an even number of boys and girls (20 each at each age level), no significant differences occurred between the sexes at any age level.

Perception of Sounds

The means and standard deviations for the total number of errors by ages for each of the four tests on sound discrimination are found in Table VI. As will be noted, the errors decrease as age increases. The five-year-old child, for example, in the test for the interpersonal identification of sounds, made 5.4 errors whereas the eight-year-old child made only 1.8 errors on the same test.

Differences among the listening tests at the various age levels were also significant at the one per cent level (Table VII). Significant F ratios were obtained between 5 and 6 and between 6 and 8 for Subtest V (Interpersonal Identification of Sounds), between 6 and 8 for the two comparator tests, and between 5 and 7 for the intrapersonal identification task.

Comparisons of Speaking and Listening Tests

As will be noted by the examination of Table VIII, significant correlations (one per cent level) occurred for all comparisons between the various articulation and sound discrimination subtests. For the auditory perceptual tests, the highest correlation (.89) occurred between Subtest VIII (Intrapersonal Identification Auditory Perception). For the speech tests, the highest correlation (.83) occurred between Subtests I (Word) and II (Phrase). For the relationship between speech and

Table III. Means and Standard Deviations for the Four-Way Picture Articulation Tests for the Five Age Levels.

		TESTS							
		1 WORD		2 PHRASE		3 NONSENSE WORD		4 STIMULABILITY OF NONSENSE WORD	
CA	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD
5	40	88.1	10.2	90.5	13.2	92.5	12.4	78.1	10.1
5½	40	81.7	10.2	83.7	11.8	85.5	10.3	72.9	7.9
6	40	82.8	14.5	85.6	12.1	85.8	10.8	74.4	8.3
7	40	76.7	5.1	78.3	6.2	77.6	9.3	70.9	3.4
8	40	75.3	5.1	75.7	4.7	78.7	6.1	70.4	3.4

Scoring: Perfect score for articulation tests, 67. Score is obtained by weighting correct sound as 1, distortion as 2, substitution as 3, and omission as 4.

Table IV. Age Levels at Which 75 Per Cent of Children Correctly Articulated Consonant Sounds Listed (Subtest 1 - Sound In Word).

	Age Levels (Years)	N	Consonants
*	5.0	40	w m n h p d g k l f
	5.6	40	b ŋ dʒ r ʃ tʃ
	6.0	40	s z
	7.0	40	t v θ
**	8.0	40	ð

* According to study by Templin (1957), the following sounds would have been spoken correctly by 75 per cent of the children by age 4½: w, m, n, h, p, f, ŋ, b, d, k, g, r, s, ʃ, tʃ

** /hw/ and /ʒ/ not accurate at this age.

Table V. Significant Effects of Age on Articulatory Productions of Children, Ages 5 to 8, on Four-Way Test.

Tests	AGES 5	5½	6	7	8	Critical Value(a)	F***
Words	88.1	81.7	82.8	76.7	75.3	6.178	10.97
Phrases	90.5	83.7	85.6	78.3	75.7	6.508	13.12
Nonsense Words	92.5	85.5	85.8	77.6	78.7	6.315	14.34
Stimulability of Nonsense Words	78.1	72.9	74.4	70.9	70.4	4.554	7.32

*** Significant F at one per cent ≥ 3.48 (df. 4,120)

(a) Critical Values for Multiple Comparisons at one per cent level. Lines are drawn between ages which are significantly different.

Table VI. Means* and Standard Deviations of Errors for the Four-Way Sound-Discrimination Tests for the Five Age Levels.

		TESTS							
		1 INTERPERSONAL IDENTIFICATION		2 INTERPERSONAL COMPARATOR		3 INTRAPERSONAL IDENTIFICATION		4 INTRAPERSONAL COMPARATOR	
CA	N	Mean	SD	Mean	SD	Mean	SD	Mean	SD
5	40	5.4	4.3	6.0	5.1	7.2	5.2	6.4	4.6
5½	40	5.8	5.3	5.6	5.9	6.4	6.9	4.3	7.3
6	40	3.9	2.7	4.3	3.8	5.1	4.6	4.5	4.7
7	40	2.9	2.2	2.3	2.0	3.1	2.2	1.8	1.9
8	40	1.8	1.3	1.7	1.2	2.4	1.4	1.2	1.4

* Means are presented in terms of number of errors.

Table VII. Significant Effects of Age on Interpersonal and Intrapersonal Perception of Sounds by Children, Ages 5 to 8, on a Four-Way Test.

	AGES						
	5	5½	6	7	8	Critical Value (1)	F**
Interpersonal Identification (V)	5.4	5.8	3.9	2.9	1.8	2.162	9.19
Interpersonal Comparator (VI)	6.0	5.6	4.3	2.3	1.7	2.519	9.15
Intrapersonal Identification (VII)	7.2	6.4	5.1	3.1	2.4	2.887	8.20
Intrapersonal Comparator (VIII)	6.4	4.3	4.5	1.8	1.2	2.867	8.68

** Significant F at one per cent level ≥ 3.48 (df. 4,120).

(1) Critical Values for multiple comparisons at one per cent level. Lines between ages represent critical values.

Table VIII. Significant Correlations Between Speech Tests, Listening Tests, and Between Speech and Listening Tests.

		1	2	3	4	5	6	7	8
--Speech--	1. Word		.83	.64	.67	.34	.44	.65	.61
	2. Phrase			.68	.65	.39	.46	.68	.63
	3. Nonsense Word				.67	.40	.50	.58	.54
	4. Stimulability of Nonsense Word					.36	.48	.62	.65
--Auditory--	5. Interpersonal Identification						.80	.61	.61
	6. Interpersonal Comparator							.68	.74
	7. Intrapersonal Identification								.89
	8. Intrapersonal Comparator								

Significant Correlation at one per cent level $\geq .254$ (df, 100).

listening tests, the highest correlation (.68) was between intrapersonal identification of a sound and the production of sound in a phrase. The lowest correlation (.34) occurred between Subtest V (Interpersonal Identification Auditory Perception) and Subtest I (Sound Production in a Word).

RELIABILITY AND VALIDITY OF THE TESTS

The reliability of the first three subtests of the Ohio Tests of Articulation and Perception of Sounds (OTAPS) was determined by Stevenson (1966) through the administration of the tests to two randomly selected subpopulations in each of two grades: second and third. The total number of times each sound element was missed on all three subtests for each of the subpopulations was tallied. These two populations for each grade were then compared by means of the Pearson Product Moment Correlation Coefficient. A reliability coefficient of .96 for the second grade was obtained and a reliability coefficient of .95 was obtained for the third grade.

Nickles, the research associate in the study, determined the validity of Subtest II (Sounds in Phrases) by comparing the results of this test with those of the Templin-Darley Screening Test (1960). The Pearson Product Moment Correlation was .976 (.01 level of confidence, N-32).

Reliability of the Examiner

For the results of the tests to be reliable, the acceptance of the examiner as a reliable administrator of the particular test must be established. To insure reliability, the examiner took the film-test (Form A), "The Ohio State University Audio-Visual Test for Evaluating the Ability to Recognize Misarticulations," (Irwin and Krafchick, 1965). The average percentage of total correct responses (558 items) for this film for fifty experienced clinicians was 83.4 per cent. The examiner identified 87.3 per cent when total responses (sounds in words, phrases, trios, or words) were considered. The examiner's agreements for words of 84.8 per cent was the same as that of the experienced clinicians; for sounds in phrases, the examiner's agreement with the right answers was 88.4 per cent which was much better than those of the experienced clinicians (94.0). Since the above test involved only right-wrong judgments, it was considered necessary for the examiner to betrained in making judgments as to type of error (substitutions, omissions, distortions). This was done through training sessions with four other trained and experienced clinicians who observed the test films repeatedly (15 to 20 hours of training). The examiner then took the film-test (Form A) and made judgments according to type of error. Her agreements were similar to those of another trained observer. For the purposes of this study, the examiner was considered to be a highly reliable observer of defective articulation.

DISCUSSION

As expected, the accurate articulation of speech sounds improved progressively as the children increased in ages. Developmental changes occurred for all four speech subtests, with the greatest growth occurring between ages 5 and 5½ and between 6 and 8 (first three tests). Except for the seven-year-old children, the most difficult test was the nonsense word test (The big dog can boodge. The little dog can boodge.). It is believed that possibly the auditory interfering stimuli of "The little dog can" between the stimuli "boodge" and the expected response of "boodge" may contribute to some of the difficulty of the nonsense-word

test. Inadequacy of auditory memory span may be another factor among the young children. Furthermore, it may be that children are trying to make meaningful words out of the nonsense words. The easiest test or the one in which the fewest errors were made by children at all age groups was the stimulability test, in which the nonsense word from the previous test "boodge" was repeated twice by the examiner with the expected response of "boodge" said once. Stimulability or the oral stimulation of the word has been found to elicit more accurate responses than spontaneous responses to pictures only.

The auditory perception of speech sounds also increases progressively with age, with the most significant growth occurring between 5 and 6 and between 6 and 8 for the identification of speech sounds spoken by someone else. There was also significant growth in perception of speech sounds between 6 and 8 when the child was asked to compare two words as spoken by someone else or as he compared his own production with that of another. In judging how he produced his own sounds when speaking a word, the child made the most significant growth between the ages of 5 and 7. This coincides with his growth in stimulability (the ability to produce the sound correctly after hearing the word two times).

Contrary to some of the studies on the growth of speech and language of children, there were no significant differences between the males and females in this study at any age.

The relationships between tests of articulation and perception of sounds were significant for all comparisons with the highest correlation between the two tests in which he had to judge his own productions.

The results of this study would seem to indicate that both the speaking and listening skills increase with age. Since standardized procedures were used in the selection of the population and administration of tests, it would appear that the normative data obtained in the study could be accepted with some degree of reliability. Furthermore, the Ohio Tests of Articulation and Perception of Sounds (OTAPS) could be used an as effective standardized tool for the evaluation of the articulatory and auditory perceptual skills of young children, ages 5-8.

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Recent Developments in Psycholinguistics:

Implications for Therapy

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The last few years have been most productive in terms of informational output regarding psycholinguistic behaviors of children. While much of the research has not been impressively stringent in design nor extensive in sampling procedures, we have gleaned some grains of wisdom with regard to the acquisition of oral verbal behaviors of the child devoid of intellectual, emotional, or sensory handicaps. Psycholinguistic research has at times been inclined to contradict postulated theory with regard to the nature of oral language acquisition. Therefore, models of language acquisition, whether they be learning theory in nature or descriptive of emerging intrinsic structures have been confronted with disquieting data. However, from these data, which continue to reaffirm developmental trends, we as clinicians should be able to derive and implement a therapeutic procedure for the training of the language impaired child which is consistent with what we know about the manner in which the majority of youngsters acquire verbal behavior.

The dilemma we clinicians face in attempting to teach oral language to clinical groups is that we are working with a subject matter that is not <u>taught</u> in a systematic manner to normal children as is reading, mathematics, and written language. Further, we are most often presented the task of teaching oral language to youngsters at a much later date than linguistic structures are acquired by normal speakers. Lenneberg suggests that language learning is an epigenetic process. At each state of maturation, the growing organism is capable of accepting a particular input. This it breaks down and resynthesizes, developing the organism into a new state. This new state then makes the organism sensitive to new and different types of input. As the child grows older chronologically without input assimilation, the adults in his environment expand their models before the child has utilized previous information; e.g., early communication between parent and child makes great use of exaggerated intonational patterns. Much of early child utterances express variance through intonation including early imperative, interrogative, and negative forms. Later, however, the parent does not emphasize his intonational pattern to the older child. Therefore, the task of teaching oral language to children is very challenging.

The importance of research into the sequence of complexity in oral language learning or emergence, if you believe as does McNeill that the basic operations need not be taught, but only given the opportunity to emerge, is vital to the pursuit of therapeutic techniques with predictive productivity. Let us view in the next few minutes some of the truths, in quotes, emerging from psycholinguistic research of the "sixties."

First of all, we know from our research that children quite early in their generation of word combinations apply linguistic rules to extend their verbal repertoire beyond that which they hear from adult productions. These early word combinations appear to represent reductions of adult utterances as well as unique combinations and permutations of the child's semantic repertoire.

Brown and Fraser have found that all children reduce adult utterances in the same manner. Utterances could be shortened by omitting any sentence elements and it appears possible that children would deviate in their reductions. This is not true in children's utterances; however, there is a consistent tendency to retain particular morphemes. Morphemes that are in the final position in sentences, that are reference-making forms or noun, verb, or adjective part-of-speech and morphemes that receive heavier stress are retained. Brown believes that possibly children reduce language first on this basis and then generalize and construct new utterances on the models of their own reductions.

These early utterances represent, according to Menyuk, an understanding of the topic-modifier relationships of grammar. Earlier this was referred to as the Pivot-Open distinction by Brown or the operator construction by Ervin. Regardless of how we label this two-word combination made by the child, it appears to be the precursor to the acquisition of the Noun Phrase, Predicate Phrase, and later the kernel sentence. If this be so, the language impaired child should first be guided to comprehend and later stimulated to produce utterances demonstrative of the topic-modifier grammatical relationship. He should receive emphasized input of reduced sentences prior to the introduction of kernel constructions.

Second, we are increasingly presented with data which suggest that early phonemic development is no more imitative in nature than is grammatical learning. The combined works of Menyuk, Halle, Jacobson, Winitz, and Irwin demonstrate that the youngster in his first year and a half is not learning the phoneme /m/, but is learning the distinctive features of that phonemic production which would be +nasality, +grave, +voice, + continuent, - strident, and - diffuse. Children apparently in their phoneme learning deal with distinctive acoustic features which they must learn to discriminate. In so doing, they not only must identify distinctive phonetic features, but learn to ignore nondistinctive features and assign a sound to a "phoneme bin" as Winitz calls it. Once again, the child does not commit to memory a phoneme which we can identify by the phonetic characters /p/, /+/, or /k/, but rather a pattern of distinctive features to which he must attend to produce a sound. Therefore, as therapists we must commit ourselves to making these distinctive features salient to the child and realize that our presentation of phonemes to the child should be determined on the basis of what acoustic perceptions and distinctions he is currently capable of detecting.

Third, a very great impetus to the study of linguistic behaviors of children was the work of Chomsky who presented to us a tripartite theoretical model for describing the grammatical rules from which a child may generate the sentences of his language. This model appears to encompass three levels of performance; namely, a Phrase Structure level, a Transformational level, and a Morphophonemic level. Each of the three levels

of grammar has a sequence of rules which generate the form of sentences within that level. Research to date has indicated that the Phrase Structure level from which the simple active declarative sentence is generated emerges first in the child's linguistic performance. With the exception of the imperative construction, the simple active declarative sentence dominates the verbal production of the young child. The more complex sentences, such as interrogative and negative, are formulated by the sequence of rules at the second or Transformational level of the grammar. These, therefore, are later acquired models in the child's grammar.

Further, we see from the research of Brown, Bellugi, and others that acquisition of Transformational structures is not a one-step operation nor is it independent of the emergence of other linguistic forms. For example, the development of well-formed interrogative and negative is dependent upon the acquisition of the auxiliary modal verb. Therefore, there appear to be stages in the development of these grammatical forms over about an 18 month period. Brown suggests that a large part of the dialogue between a parent and child consists of questions and answers. There are two operations which allow a child to pose relative questions. Preposing moves the wh word from the final to the initial position in the sentence; e.g., "You are doing what" is preposed to read "What you are doing." Transposing interchanges the subject of the sentence and the auxiliary verb; e.g., "What you are doing" then becomes "What are you doing." There is evidence to suggest that preposing and transposing operations should not be taught simultaneously.

Bellugi also suggests stages in the emergence of negative forms. At early stages negatives are simply expressed by prefixing a 'no' to the word string. Later 'no' is generated as a negative morpheme and attached to the verb, but not until the auxiliary verb becomes functional do we see well-formed negative sentences. It has been suggested by Menyuk and Lee that in teaching these linguistic forms to the language impaired child we follow these stages rather than initially introducing adult constructed negative and interrogative forms.

If the normal child permutes strings with Phrase Structure into new strings by the use of Transformational rules to which morphophonemic rules can be applied, the language impaired child must first develop competence at the Phrase Structure level.

Transformational structures are of two types: Simple transformations are those which contain only obligatory transformations and are derived directly from the kernel sentence of the Phrase Structure level. Generalized transformations are those which are derived from two or more kernel sentences. Menyuk and Adams both found the simple transformations to be more frequent in the child of three to four years of age while the generalized transformations did not appear as frequently until four to five years of age. This would suggest that the obligatory simple transformations should precede the generalized transformations in therapeutic programs.

Morphophonemic learning, or the acquisition of inflected verb and noun forms to express person, tense, plural and possession, interacts with learning at the phonemic and syntactical levels of language. The perception of distinctive phonemic features;

e.g., + voicing as in the distinction between /t/ and /d/, /s/ and /z/ are primordial to the acquisition of correct morphophonemic inflection. The child who does not utilize this distinctive feature in his speech is unlikely to realize that in pluralizing the word 'hat' we attach the voiceless phoneme while in inflecting 'ball' we attach the /z/. Language learning is progressive and the phonemic, grammatical, and semantic aspects are so interrelated and dependent that any attempt to work with a single aspect is a fractionary approach at best.

The errors normal children make in acquiring structures at all three levels lead us toward ways of introducing these structures to the language impaired youngster. Youngster's mistakes may be as informative to us as clinicians as are his correct productions. His mistakes may suggest that he is indeed applying rules rather than imitating adult models and moving through stages in the acquisition of linguistic forms.

Fourth, the most recent work of Carol Chomsky has emphasized the close relationship between language competence, as opposed to language performance, at the later stages of development and human cognitive capacities. Linguistic performance does not always reflect linguistic competence. Chomsky has demonstrated that even at the age of five or six many children still do not comprehend all of the syntactical information imparted in some simple English sentences though they demonstrate competence with the semantic structures of that sentence. For example, given the following sentences: (a) Mother promised Jane to make her bed. (b) Mother told Jane to make her bed. While speakers of five or six years of age comprehend all of the words of those sentences, including promise and told, many still do not understand that in sentence (a) it is mother who will make the bed and in sentence (b) it is Mary who will make the bed. The juxtaposition of the sentence elements 'Jane' and 'make' being identical in both sentences confuses the child. The child has not understood this violation of the linguistic minimal distance principle. The clinician must constantly be aware that a child's use of a word does not confirm his understanding or command of it in varying syntactical contexts. Language training does not terminate when the child demonstrates an efficient sentence length or a complexity of Transformational operation.

Fifth, the advances in the field of behavior therapy suggest to us a therapeutic methodology repeatedly demonstrated to improve oral language performance. A systematic manipulation of stimulus materials, responses and consequences so that linguistic performance is improved is most effective. Materials organized and paced within a sequence dictated by the developmental progression of normal language acquisition allow the child who does not automatically abstract the linguistic rules, perhaps because of hearing disability, to have them presented in a manner salient to him and thus conducive to learning.

Language learning begins early, progresses rapidly and expands to express multiple denotations and connotations. Each period is critical to the development of the next and contingent upon its proficiency. Further, it is at every stage related to cognitive development.

In conclusion, linguistic learning is basically rule learning. Language to be functional must be generative; i.e., the child must acquire a finite set of rules by which he may formulate infinite strings of phonemes and morphemes. A generative grammar,

not just imitated semantic strings, must be the goal of language therapeutics. The rules of the language, not just well-formed adult grammar, must be presented to the language impaired child systematically. If we assume that our current information is correct with regard to the development of phonemic and syntactic structures in normal children, this information can be most useful in dealing with clinical groups. We must systematically present to the language impaired child:

a. intonational patterns as informational bearers,

b. distinctive phonemic features and feature patterns,

c. topic-modifier relationships in two-word combinations,

d. Noun Phrase, Predicate Phrase, etc. in Phrase Structures,

e. early kernel sentences in the simple active declarative mode,

f. simple obligatory transformations accompanied by morphophonemic alterations,

g. generalized Transformational structures,

h. and finally increasing complexity of syntactical and semantic relationships as demanded by maturing cognitive development.

Research has not told us just how language is learned, but it has yielded a great deal of information with regard to the inevitable and ordered developmental patterns. Our task as clinicians is to lead the language impaired child by expanding his immature grammatical structure, thus directing him to discover the more complex grammatical rules.

Newer Speech Techniques with the Neurologically Impaired: Some Implications of Current Linguistic Research

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For many years speech therapists have been concerned about language disorders of the neurologically impaired child. It has only been in the last 15 or 20 years, however, that testing procedures and normative data have been available for evaluation of these problems. While our present state of information regarding the development of language is far from complete, there are certain scales and measures of language performance that are routinely employed by speech therapists, and there is a growing list of other tests which are becoming part of routine diagnostic procedures. A listing of these measures of language performance would include scales and inventories of general level of language functioning such as the communication items from the Vineland Social Maturity Scale (Doll, 1947), from The Infant Schedule and The Preschool Schedule (Gesell, 1940, 1947), and from general tests of intelligence such as the Stanford-Binet Intelligence Scale (Terman and Merrill, 1960). Other tests which consist for the most part of items from these three sources would include the Verbal Language Development Scale (Mecham, 1959), the Houston Test of Language Development (Crabtree, 1963), and the Utah Test of Language Development (Mecham, Jex, and Jones, 1967).

Various other tests attempt to evaluate more specific language abilities. The Peabody Picture Vocabulary Test (Dunn, 1959), although often used as a test of intelligence, is probably better employed as a measure of receptive vocabulary. Nation (1964) devised an adaptation of the Peabody test for measuring expressive vocabulary. Evaluation of mean length of response, expressive vocabulary, and sentence complexity can be made by obtaining a sample of 50 utterances from the child and comparing his performance to the normative data presented by Templin (1957). The Michigan Picture Language Inventory (Lerea, 1958) tests expression and comprehension of singular and plural nouns and verbs, personal pronouns, possessive forms, comparative and superlative adjectives and adverbs, demonstratives, articles, prepositions, and certain verb auxiliaries. The Northwestern Syntax Screening Test (Lee, 1969) tests both receptive and expressive use of prepositions, pronouns, possessives, singular and plural verbs and nouns, demonstratives, negatives, yes/no questions, use of subject and object in active and passive declarative sentences, and use of direct and indirect object in active declarative sentences. The Assessment of Children's Language Comprehension (Foster, Giddan, and Stark, 1969) tests understanding of 50 words in phrases of varying lengths and construction. The Berry-Talbott Language Tests (Berry, 1969), based on an article by Berko (1958), tests the child's ability to use certain morphological rules including those required to form plurals and possessives of nouns, third person singular of verbs, progressive and past tense, and comparative and superlative forms of adjectives.

Tests such as these are valuable in determining whether a child is functioning at about his age level in auditory receptive and oral expressive language. They also reveal the general area requiring remediation, such as receptive or expressive vocabulary, understanding and use of pronouns, ability to form plural nouns and verbs, etc. However, especially in the evaluation of syntax and morphology, these tests do not give us enough information concerning the degree of severity of a language disorder. For example, two children might obtain about the same score on a test of syntax, but one might be much closer to correct usage of the rules of grammar than the other. Although the test may not reveal a difference in the language disorder of the two children, there might be a real disparity in their language performance requiring different remediation procedures.

There are probably at least two reasons why we have failed to develop tests of syntax and morphology that would reveal the child's stage of development of the rules for generating sentences:

1. Although there has been an explosion of information concerning grammar in the field of linguistics in the past 15 years, many of the principles of English grammar that we use in understanding and speaking sentences are still unknown (Chomsky, 1966). It is difficult to devise a test to evaluate an individual's knowledge of the rules of grammar if the rules are not known.

2. Inspite of great research effort by linguists, we still lack much information about the child's development of rules of grammar. For example, Menyuk states that little is known about the early period of acquisition of language except that the child does not simply repeat what he hears others say (Menyuk, 1969).

There have been, however, a few studies of the child's development of syntax and morphology that have important implications for those of us interested in language disorders in children. For example, a longitudinal study of three young children was undertaken by Brown and his associates and reported in various publications from 1964 to 1968 (Brown and Bellugi, 1964; Klima and Bellugi-Klima, 1966; Bellugi, 1968). In this study the three children, aged 18 months, 26 months, and 27 months were studied for periods of about 8 months, 20 months, and 20 months respectively. Two hour tape recordings were made every two weeks of the conversations between the child and his mother in the home setting. The study was divided into three periods: The first period was the first month of the study when each child evidenced a mean length of response of about 1.75 morphemes. The second period extended from end of the first month to the beginning of the last month of the study, and the third period was the last month when each child had a mean length of response of about 3.5 morphemes. Klima and Bellugi-Klima analyzed the negative statements and questions and suggested the manner in which these two forms develop. I will briefly review the results of this study and suggest some ways in which we, as speech therapists, might use this information to evaluate the performance of children who evidence language disorders.

Klima and Bellugi-Klima reported that during the first period of the study the children expressed negation in statements such as:

"More...no."
"No singing song."
"No the sun shining."
"No money."
"No sit there."
"No play that."
"No fall."
"No heavy." (Klima and Bellugi-Klima, 1966)

These statements were typical of a large number of utterances, not isolated examples. The researchers pointed out that there were no negatives within the utterances, nor any auxiliary verbs. The words "no" and "not" were used for negation, and these words either preceded or followed the rest of the utterance.

Other characteristics of these utterances might be noted: The sentences consisted largely of nouns and verbs without indication of tense or number. Prepositions, articles, adjectives, adverbs, and auxiliary verbs were not generally present. At this stage the children did not embed the negative element in the auxiliary as an adult would in speaking. The study also revealed that the mothers often reinforced the negative element of the sentence by adding the word "no" before the statements in speaking to a child: "No, you can't have it." It appeared that not only did the child fail to embed negatives in sentences, but that his mother knew that he did not understand sentences in which the negative was embedded, and, therefore, she added an extra "no" to the beginning of the

sentence.

In the second period the children produced sentences such as:

"I can't catch you."
"I can't see you."
"We can't talk."
"You can't dance."
"I don't want it."
"I don't like him."
"Book say no."
"Don't leave me."
"That no fish school."
"That no Mommy."
"He no bite you."
"Touch the snow no."
"I no want envelope."
"I no taste them." (Klima and Bellugi-Klima, 1966)

It was evident that the children retained some elements of the first period while adding new forms. At this period the children began to use auxiliary verbs, but only when accompanied by a negative element such as "can't or "don't." The auxiliaries "can" and "do" did not appear in questions or declarative utterances at this time. Another new development was embedding of the negative element "no" in the sentence: "He no bite you." The negative imperative appeared in sentences such as "Don't leave me." Very few sentences contained indefinite determiners or pronouns, but personal and impersonal pronouns, possessive pronouns, articles and adjectives began to appear. At this time the children appeared to understand negatives embedded in sentences such as "He doesn't have a ball."

In the third period the children used such sentences as:

"Paul can't have one."
"I can't see it."
"This can't stick."
"We can't make another broom."
"I didn't did it."
"Because I don't want somebody to wake me up."
"No, it isn't."
"This not ice cream."
"That not turning."
"I not see you anymore." (Klima and Bellugi-Klima, 1966)

As this time the auxiliaries "do" and "be" appeared in declarative sentences and questions as well as in negatives. The negative auxiliary verbs were not limited to "don't" and "can't." Indeterminates started to appear as in "I don't want some supper." These sentences were not imitations of adult speech, since an adult would say: "I don't want any supper." They indicated that the child had learned some of the rules of grammar, but not all.

One might list the steps in the development of negation that were suggested by this study as:

1. Negative element "no" or "not" added to the rest of the utterance, but not embedded in the sentence. No use of tense or number of verbs. Little use of prepositions, articles, adjectives, adverbs, or auxiliary verbs.

2. Negatives are embedded in sentences. The child begins to use the auxiliaries "can" and "do," but only when accompanied by a negative element as in "can't" or "don't." "Can" and "do" do not appear in declarative or question sentences. Negative imperatives of the type "Don't leave me" are used. Very few indefinite pronouns or determiners appear, but personal pronouns, possessive pronouns, articles and adjectives have begun to be used.

3. The auxiliaries "be" and "do" appear in declarative sentences and questions as well as in negatives. The negative auxiliary verbs are not limited to "don't" and "can't." Some indeterminates are used.

Another important study that gives us insight concerning the development of negation is that of Menyuk (1969). In her study of 150 children in the age range from 3 to 7 years she obtained tape recordings of three stimulus situations: Responses to a projective test, conversations with an adult generated by questions, and conversations with peers while role playing. She described five stages in the development of negation in children's speech:

1. Conjunction of a negative element and a sentence. This stage would be similar to the first stage described by Klima and Bellugi-Klima. Menyuk noted that when negative sentences first appear, the word "no" is used much more frequently than the word "not." She suggested that the reason for this phenomenon was that when the child first uses negation, he merely adds a negative element to a sentence rather than expanding part of the underlying string. He is, therefore, more likely to use a morpheme such as "no" which is an independent element than a word such as "not" which is dependent on other parts of the sentence. When the negative element is embedded in sentences, the word "not" appears with greater frequency.

2. Development of subject and predicate sentences.

3. Negative element "hops" over the subject. Instead of "No I do this," the child says "I no do this."

4. Development of auxiliary verbs.

5. Attachment of the negative element to the auxiliary. Instead of "I no do this," the child says "I can't do this."

Menyuk also presented the results of a study in which she compared the grammatical performance of a group of 10 normal speaking children, ranging in age from 3 years to 5 years, 10 months, with a group of 10 children in the same age range whose speech had been diagnosed as deviant (1964). She noted that the deviant speakers did not simply use more immature forms in speaking, but used different forms than the younger normal speakers. This observation led her to reject the use of the term "infantile" in describing the language of the deviant speakers. The sentences of the 3 year old deviant speakers were very similar to the sentences of the 6 year old deviant speakers, suggesting that these children did not improve in their use of grammatical constructions. She noted that the negation sentences seemed to be basically of the form Noun Phrase plus Negation plus Verb Phrase, with the negative element simply hopping over the subject as in:

"Him not feel good."
"He not like Tippy."
"Him not try." (Menyuk, 1964)

As Menyuk noted, these sentences convey meaning quite well, although they are not grammatically well formed. One reason for their persistence over the time span from 3 to 7 years in speech deviant children may be that they are useful in communicating with other persons.

How might information concerning the development of negation be employed by the speech therapist to evaluate the performance of children who evidence language disorders? I would like to suggest some possibilities. The results of the two studies reviewed indicated essentially the same progression in development of negation in children's speech. Although there may be other intermediate steps as yet unknown and some children may skip some stages in the progression, it would still be possible to compare the performance of a particular child with the order of development of negation suggested in the studies.

Suppose that we wished to compare the level of language development of two children, or of the same child at two different ages. Let us say that the first of the following samples represented the typical negation utterances from one child and the second sample was obtained either from another child or from the same child at a later age.

Sample One
"No goes uh work."
"No books in."
"No write dis."

Sample Two
"That not cowboy."
"I not touch." (From Menyuk, 1969)

Although both samples would be judged as ungrammatical, the first would represent an earlier stage of development of negation since in the first sample the negative element is simply conjoined to the utterance and in the second sample it is embedded. Evaluation of these utterances would suggest that the first child was operating on a more immature level than the second child, or that, in comparison of two samples from the same child at different ages, the child had progressed in his development of this grammatical form. One might also note that in the first sample the child used the independent negative element "no" and in the second sample, he had not only embedded the negative element, but used the word "not" which is used more frequently when children learn to embed negatives. One might also expect the second child to use such forms as "can't" and "don't" in imperative statements, but would not expect the first child to use these forms.

A somewhat similar progression of development has been noted by Klima and Bellugi-Klima, 1966, Bellugi, 1968, and Menyuk, 1969 in the development of children's questions. There seems to be general agreement that questions may be indicated by intonation in their earliest appearing form. Menyuk suggested that the utterance may consist of only one word which indicated the "topic" plus proper pitch inflection as a marker for a question sentence. The use of stress and intonation continues to mark the early two and three morpheme question utterances as in:

"Mommy try it?"
"Diane uh school?" (From Menyuk, 1969)

"Mommy eggnog?"
"See hole?"
"Have some?" (From Klima and Bellugi-Klima, 1966)

These sentences appear to be formed simply by conjoining a question morpheme to a sentence. Menyuk noted that there seems to be some restriction on the choice of question morpheme employed. She noted that the child might say "Where daddy go?" but not "What daddy go?" Auxiliaries are not usually present in these sentences,and there is no inversion of the subject and verb. Menyuk also suggested that children at this stage of development do not understand questions in which the auxiliary verbs are inverted with the WH element such as "What did you do?"

Klima and Bellugi-Klima stated that the use of interrogatives such as "what" in early utterances may not mean that the child understands the operation involved: Replacement of the object of the verb by the word "what" as in "What did you hit." They noted that the child may not respond correctly to a question of this type because he does not understand this relationship, and suggested that the next stage of development of questions involves learning to understand this construction.

After the child begins to develop the use of auxiliary verbs, he uses forms such as the following:

"Where the wheel go?"
"This is powder?"
"He's make it?" (From Menyuk, 1969)

In these sentences the words "do" and "is" have appeared, but are not inverted with the subject. Bellugi (1968) noted that when children begin to use inverted auxiliaries, they appear first in yes/no questions and later in questions employing the WH interrogative. A child might use the following two statements at the same time:

"Can he ride in a truck?"
"What he can ride in?" (From Bellugi, 1968)

After the inversion of auxiliaries, question sentences used by children may still be ungrammatical because of difficulty in marking tense properly. Tense may be indicated by both the auxiliary and the main verb as in "Does he makes it?" or "Where does the wheel goes?" (Menyuk, 1969).

Although the results of both studies indicated that children tend to retain residual use of immature patterns as they progress to more mature ones, an adequate sample of a child's speech over a period of time should reveal approximately the following sequence of development of questions:

1. Single words with intonation indicating that the utterance is a question.
2. Two and three morpheme utterances with questions indicated by intonation.
3. Attachment of a question morpheme to a sentence with no auxiliaries present.
4. Presence of auxiliary verbs but no inversion with the subject.
5. Inversion of auxiliaries in yes/no questions followed by inversion in questions employing a WH interrogative.
6. Development of proper marking of tense in question sentences.

Here again it would be possible to compare a child's use of question constructions at one time to his use of these constructions at a later time to determine whether he had advanced in his use of these forms. A child whose only question forms are of the type "Where the kitty go?" is not as mature in his development of questions as the child who produces "What he can hit with?" and neither is as advanced as the child who typically uses forms such as "Why does he makes it?" although none of them could be said to produce well formed grammatical sentences.

The traditional types of language tests tell us whether a child is using certain grammatical constructions, but do not tell us enough about his stage of development of, for example, negation or questions to allow us to plan effective therapy. However, several of the linguistic studies of children's acquisition of language have provided us with a way to obtain some of this needed information. We as speech therapists need to utilize the findings of linguistic research in diagnosis and therapy for children with language disorders.

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Bobath Neurodevelopmental Treatment in Speech Therapy

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The manner in which any problem is approached stems directly and logically from the way in which it is assessed. The types of observations which are made during the assessment stem, in turn, from the basic philosophy or underlying premises which the observor holds regarding the problem. What he sees is determined, in part, by what he believes. Both major and minor differences can be found among treatment programms for cerebral palsied children. These differences stem either from different underlying philosophies about the nature of cerebral palsy, or from differing emphases on one or more features of the same general philosophy.

The approach to treatment which I will discuss with you today was developed in the late 1940s by Karel and Berta Bobath in London, England. For the past 20 years Dr. and Mrs. Bobath have cnntinuously re-evaluated and modified both the theoretical and practical aspects of their rehabilitation framework. In recent years it has been given the descriptive title: Neurodevelopmental Treatment.

Let us look initially at the basic rationale and premises upon which this system is based. Since cerebral palsy is basically a disorder of the central nervous system, one must observe how the normal CNS functions in motor learning. The central nervous system operates in terms of patterned responses. Muscles are activated in patterns in the performance of even the most selective movements. One cannot separate out the discrete action of one part of the body or a single muscle without considering and observing the interaction of many parts and areas. Muscles work together in patterns. One has the pattern of tongue tip elevation, for example, rather than simply a given contraction and force of the styloglossus muscles. Even the specific muscles involved in a pattern wi l depend to some extent on the position of the part in space and the general state of muscle tone in the body. Thus, the CNS interacts and affects the body as a whole.

Normal movement patterns require a) a normal postural reflex mechanism and b) adequate postural tone. The two are inter-related. The postural reflex mechanism consists primarily of the righting and equilibrium reactions which allow for smooth adjustments to changes of posture, and combine these with a more static fixation and stability of the proximal parts of the body making weight bearing with mobility possible. These reactions cannot function when muscle tone is either too high or too low. And it seems to be the action of these very responses which serves to inhibit a tone which is too high.

Automatic movement patterns are similar in all people. We each roll over, sit up, stand up, chew, swallow etc. using much the same patterns and progressions of movement. These seem to be innate in the species and will develop spontaneously in the normal nervous system. These patterns of movement follow a predictable sequence of normal development. They change as the cortex of the brain matures and allows for greater voluntary control of movement and the development of functional skills. They are never totally lost, and set the framework in the adult for automatic movements. It is a mistake to identify normal, constructive motor activity only with volition.

There is a disruption and distortion of this sequence of automatic movement development in the cerebral palsied child due to CNS damage. This creates a delay in the developmental profile of automatic reactions and is seen in a retention of primitive normal patterns which would be common in a non-cerebral-palsied child of a younger age. These include reactions such as the Moro reflex, grasp reflex, sucking reflex, and total patterns of extension or flexion. In addition, abnormal reflex patterns associated with increasing or fluctuating postural tone are seen. These tonic reflexes are highly stereotyped in nature and influence the distribution of spasticity or athetosis. These are not seen in the normal infant at any time. They include the symmetrical and asymmetrical tonic neck reflexes, the tonic labyrinthine reflexes and various Associated reactions. Each of these obligate patterns is elicited by the movement or position of the head and neck or by effort. The child exhibits total mass patterns and cannot break them down and combine parts of several patterns.

His tone may be so high that he is unable to develop the righting and equilibrium reactions, or it may be so low that he has no stability and these automatic reactions may not have a chance to function. This distortion of the postural reflex mechanism is seen as the greatest problem in cerebral palsy.

It is extremely important to remember that in order to learn any normal motor skill, you must have normal patterns of sensation which can only occur when there is normal muscle tone. In 1949 Goody stated, "We do not learn movements, we learn the sensations of movements." Motor learning is basically sensory learning. The system learns a movement by actively experiencing movement and organizing and storing the tactile and kinesthetic patterns which are produced. These patterns become a template against which subsequent sensory patterns are compared. In the learning of speech an auditory component is added to this sensory model creating an auditory-motor model. Movement involves a feedback loop in which there is a constant comparison with the "correct pattern"..i.e. the pattern which through repetition has been laid down in the central nervous system. Correction and closer approximation to that pattern occurs if there hasn't been initial success.

In the normal child the normal sensations of movement are learned automatically from innate patterns such as righting reactions, feeding reactions, and balance reactions. These are repeated over and over again without having to be learned. The overt motor developmental landmarks (a la Gesell) occur at specific times in all children because they are related to the normal development of automatic response patterns. For example, a baby begins to roll over from his back to his stomach at approximately 7 months. At this time, the body righting reaction acting on the body develops, allowing for rotation between trunk and pelvis. This development of axial rotation enables the infant to get onto his stomach from his side. Without it, he becomes stuck on his side when he attempts to roll over using another of the righting reactions which develops earlier. There are many automatic reactions which may be familiar to you from studies of infant development. Patterns seen in the grasping reflexes, automatic stepping and walking, the parachute reaction, Landaau reaction,

head righting reactions, sucking reactions, and the like, prepare a child for the more volitional aspects of reach and grasp, standing and walking, and speech. One might speculate that from their repeated elicitation, the child develops an internal sensory model of rolling, head raising, eating, sound production and articulation which serves as the target of comparison as his behavior becomes more volitional and less automatic. What is learned automatically at these very early stages becomes the standard of correctness and normalcy for the youngster. His ability to change or alter that standard depends on many factors and is extremely important for us to consider in a therapy situation where the child's model for movement production happens to be different from that of his therapist.

Because the nervous system of the cerebral palsied child is different due to damage, he has repeated a different pattern of movement or non-movement which is normal and comfortable to him. If his postural tone is too high, he will experience movement only in the presence of sensations of effort and tension. He will be denied many of the experiences of movement which are rehaarsed over and over in the developing system by the elicitation of automatic reactions which depend on normal postural tone for their functioning.

If he is an athetoid with tone which tends to fluctuate (so that at one moment he is rather floppy, at another relatively normal, and at a third very tense), his repetitions of a movement really aren't repetitions at all. They feel different every time he performs the movement. Thus, his internal target for correctness in the feedback model will probably be very different from that of the non-impaired child. In summary, when normal postural tone is not seen due to reflex distortion, the child can only learn the abnormal sensations of faulty movement.

If we accept the above assumptions as a working description of normal sensory-motor learning and the major motor difficulties of the cerebral palsied child, then the goals of treatment would involve: 1) the normalization of postural tone through stopping or inhibiting abnormal and primitive postural reflexes, and 2) the stimulation or facilitation of normal postural reactions which provide the major contribution to a sensory model of normal movement patterns.

In the earliest periods of Neurodevelopmental Treatment there was a great deal of emphasis upon the inhibition phase of treatment. The child was placed into positions (called RIPs or Reflex Inhibiting Positions) which were exact opposites of the typical positions his body normally assumed. If he was totally extended, treatment involved holding him in total flexion. Following this type of manipulation, which did reduce muscle tone for increasing periods of time, the child was expected to begin moving more normally. Mrs. Bobath, however, found that she had to move the youngster and stimulate the automatic postural reactions which did not occur spontaneously. The initial approach was too static and did not allow the child to feel movement normally and assume control of it in a gradual manner. It was during this period that a great deal was written on the Bobath Method, and even today some widely used textbooks describe treatment as a very static process.

During the next ten years treatment emphasized more and more the facilitation phase as a second step in the therapy sequence. Treatment has become increasingly active and dynamic, both for the therapist and for the child. In the mid-1960s Mrs. Bobath realized that inhibition and facilitation were not two separate phases of treatment, but could and should procede simultaneously. The therapist reduces abnormal tone and spasticity throughout the body by changing part of the abnormal pattern at the most important points only. These points are called "Key Points of Control". They are primarily proximal and involve the neck and spine, and the shoulder and pelvic girdles. Spasticity in the limbs and tension in the throat, lips and tongue can be influenced and reduced from these proximal key points (slide #1).

The therapist simultaneously does something with sensory stimulation which causes the desired motor response to occur automatically and without thought from the child. A child is never asked to do something voluntarily which he has not experienced many many times on an automatic level. A response is elicited again and again. Gradually the child's attention is directed toward "what he has just done", not toward "doing something you want him to do". In other words, the child is only asked to replicate voluntarily a motor pattern which you know he has experienced many times in his system. This experience is not attained through the passive manipulation of an arm, leg or tongue. It is an active movement experience achieved through the

inherent automatic reactions which are present in the child's nervous system. The movements which the patient performs should not be done with undue effort. Effort leads to increases in spasticity and athetosis and causes widespread associated abnormal reactions. A feeling of effort may even become part of the child's sensory model of movement. This would make it even more difficult for him to develop smooth, easy movements.

The success of treatment does not depend upon the child's ability to understand and follow directions. The therapist controls the child at the Kep Points in order to make his body adjust itself and respond more normally as she stimulates higher developmental reactions. Simply through her physical handling of the child she gets the movements she wants and then channels them into basic, useful skills. Neurodevelopmental Treatment lends itself beautifully to the treatment of the c.p. infant, the young retarded child, the cerebral jpalsied deaf youngster and others who are unable to understand words and follow verbal directions. The child's body follows the directions of the therapist's hands as she stimulates and guides movement in constructive directions.

"Following the Normal Pattern of Development" has become a cliche guide for a vast majority of therapists. To most this means teaching sitting before standing and standing before walking....or to the speech therapist, sounds before words, and words before sentences ...i.e. the sequence of overt skillls. In the Neurodevelopmental Traatment Approach the concept goes much deeper and treats the cause of the normal development and not just the overt symptom. It constantly attempts to ask why and how a child learns to roll over, or to control his head, or chew, and what is preventing this child from doing so. It looks at the development of the automatic responses in the CNS and tries to follow the guideline of its progression. Thus, we are dealing with the normal development of the ingredients of overt skills. We try to teach the child (on an involuntary level) the basic patterns which he can later combine into many specific skills.

In relationship to speech development, where do the sensory-motor models come from? What are the ingredients of clearly articulated speech?

(In this discussion I will not attempt to include aspects of conceptual, auditory and linguistic development which offer major contributions, but will limit myself to the motor patterns which are involved.)

There is no physical structure of the body which developed solely for speech. We often refer to speech as an "overlaid function" on the automatic reflexes and reactions of feeding, respiration, and other survival mechanisms. The following automatic patterns form the foundation upon which the motor aspect of speech is built: 1) head control, 2) coordinated respiration and phonation, 3) the normal development of feeding patterns and 4) babbling or "automatic speech". Any or all of these specific motor pre-requisites for speech development may be interfered with in the cerebral palsied child by 1) abnormal postural tone, 2) abnormal patterns of coordination produced by released tonic reflex activity, or 3) the lack of selective movement due to the retention of primitive patterns. Let me give you a number of examples which show how what we see specifically in areas related tp speech production are basically a reflection of a more generalized CNS dysfunction.

The hypertonic child frequently shows a stiff or rigid chest and spine which affects the development of mature breathing patterns. Hypertonus of the lips, tongue and palate create a slow and inefficient feeding pattern. The hypotonic child lacks the fixation against which the breathing muscles can work effectively. Chest deformities such as rib flaring, and an indented sternum may develop as a consequence. The child may show an extremely shallow, rapid breathing pattern. There is generally poor head control and a paucity of phonation in these children who tend to be rather floppy.

The specific distortions of movement and tone seen in the speech musculature of the cerebral palsied child are frequently a small part of a total bodily response seen in the pattern of released tonic reflex activity. The jaw may deviate to the right along with the asymmetrical tonic neck reflex (slide #2). Retraction of the lips, jaw and tongue may be seen as part of the pattern of neck and shoulder retraction (slide #3). Tongue and jaw thrusting are frequently observed as a part of the total extensor thrust (slide #4).

Flexor spasms of the pectural muscles may accompany flexion of the hips and knees (slide #5). This affects both breathing and head control. Phonation may only be possible as part of a total extensor pattern which includes jaw and head extension (slide #6).

We must remember that the feeding reactions are slow and primitive. They involve total undifferentiated movements. In a sense they represent a Gestalt or total pattern which is different in many ways from its component parts. Gradually the total patterns become fractionated or broken down so that the individual can utilize the movements selectively. This allows for independent movement of the lips, tongue and jaw. The cerebral palsied child may retain the primitive feeding patterns and be unable to perform isolated movements of the articulators. He may not be able to move his tongue without simultaneous movement of the jaw. He may not be able to close his lips without a total closure of the jaw.

The speech therapist following this concept of treatment ideally becomes a part of a team with the occupational and physical therapist. All implement the same basic program. Ideally the speech therapist has received special training in this approach which makes her more than just a speech therapist working with the cerebral palsied. She becomes a "cerebral palsy therapist" with a speciality in speech and language development.

Speech therapy is primarily concerned with the development of the motor pre-requisites for speech, particularly with the younger children. Most of the work centers around developing patterns of head control, respiration and phonation, feeding patterns and babbling which will later be modified into articulate speech. The principles of inhibition through use of the Key Points of Control combined with facilitation of more normal, automatic responses are basic to the Speech Therapy Program. The emphasis is on stimulation capable of facilitating normal movement (primarily kinesthetic, tactile, temperature and taste stimuli), fed into a system which has been prepared to utilize this sensory information in a normal manner. The child has a chance to appreciate and learn the sensations of movement and more normal speech.

As in any good treatment program, therapy begins with a thorough assessment of the problem. Careful attention is paid to abnormal and primitive reflex patterns and the implications of their presence for normal speech and language development. We are not concerned with reflexes from an academic standpoint or as a measure of the severity of neurological impairment. Our interest is highly pragmatic. We constantly ask: "What will this reflex prevent the child from doing?" Let me give you one example. (Slide #7). This child shows a strong asymmetrical tonic neck reflex pattern. Every time she turns her head to the side, the face-arm and -leg extend and the skull-arm and-leg flex. Her shoulders are retracted. Her trunk is also flexed on the skull side so that she is asymmetrical all over. How will this affect her development? She cannot turn from her back to her tummy since the skull-shoulder is pulled backwards into the mat every time she turns her head to the side. She cannot get her hands to her mouth for oral stimulation and exploration. She cannot develop hand-eye coordination. She may eventually develop permanent deformities of her spine and hip sockets, making it impossible for her to ever stand or walk. Because she shows a great deal of extension in her spine and neck, she also shows an oral pattern involving jaw extension (or thrusting) and retraction of the tongue. This makes it very difficult for her to eat and develop tongue and lip movements for sound play and babbling.

Because most of the tonic patterns are activated by stimulation of the labyrinths in the inner ear or proprioceptors in the neck musculature, their presence and degree will depend a great deal upon the child's position. He will probably be more bound by reflex activity in certain positions. There will be other positions in which tone is more normal due to non-activation of the abnormal tonic reflexes. The therapist making the assessment should carefully evaluate the child's abilities to chew, suck and swallow, produce phonation, use his hands etc. in a wide variety of positions. Treatment would begin by moving the child in the positions or patterns of movement which are easiest for him and gradually working into more difficult positions. Each child is different, and there are few rules of thumb. We find, however, that the child who shows primarily an extensor pattern will have more normal tone in side-lying or prone; while the child who is totally flexed, may be better in supine. The therapist should also carefully assess the child's

responses to a wide variety of sensory stimuli. This is particularly true in the evaluation of feeding abilities. The consideration of such things as temperature, heaviness, texture, combination of textures, degree of milkiness, etc. will give many insights into the child's abilities as well as directions in which treatment can procede most effectively. The same principle applies to the less severely involved child as one assesses articulatory ability. We like the concept of McDonald's Deep Test of Articulation because of its compatibility with the philosophy of Neurodevelopmental Treatment. Articulation is movement made audible and should be assessed in a framework of oral movement patterns and sound contexts. In addition, with some children it is also important to compare a child's ability to articulate sound patterns in different physical positions (i.e. sitting, supine, prone, standing etc.).

In addition to the general principles of inhibition and facilitation which I have already discussed, treatment includes the following guidelines:

1) We program what we want the child to do in a series of very small steps, each one leading to the next. This grading of difficulty can be handled either by increasing the amount and difficulty of the stimulation which is given to the child, or by reducing the amount of external control at the Key Points. As the child masters the task in one position, his position is changed so that eventually he is able to succeed in prone, supine, sitting, kneeling, standing etc. With some of the milder children we may work on speech during waling or use of the hands which is extremely difficult. A continual assessment of the child's reactions to our handling occurs during therapy so that at any moment the therapist should be able to know what she can do to help the child succeed if he has not responded as he should, and what step is next if he does succeed. The therapist must know why she is doing what she is doing, and what she is preparing the child for.

2) The parents are a vital part of our treatment program. We see the mother as a co-therapist, and much of the therapy session is devoted to teaching her how to handle the child so that his movement will be more normal. The general principles of the child's treatment are related to daily activities of caring for him. Goals such as reducing extensor spasticity, getting the child more symmetrical,

reducing jaw thrusting, increasing trunk rotation etc. can all be incorporated into the way in which a child is picked up, carried, bathed, positioned for sleep, dressed, fed etc. The child actually receives therapy all day long because the family has learned that there are ways of handling him physically which can increase the problem, and ways which are theraputic. This is particularly true with infants and children under 3 who are not yet in school and receive a great deal of parental handling during the day.

Series of slides demonstrating various aspects of treatment

This type of treatment is quite compatible with the earlier programs in speech therapy for cerebral palsied children developed in the late 1930s by Martin F. Palmer and Harold Westlake. There are also many commonalities with procedures proposed by Stinchfield and Hawk for facilitating different sounds in their Motokinesthetic method, and by McDonald in his concepts of articulation. Observations on perceptual-motor development contributed by Kephart and others are also highly pertinent. What then, are the features which make Neurodevelopmental Treatment different?

I feel that the major difference involves the manner in which the therapist can utilize control of abnormal tonic reactions in the trunk, hips, shoulders, arms and legs to influence what is going on in the more inaccessible oral mechanism. It is difficult to directly manipulate a larynx or tongue; and we welcome an approach which allows us to affect their functioning indirectly. Many feeding and phonation problems are sharply reduced or eliminated by a general reduction of tonic reflex activity through general handling techniques.

A second, but related aspect is the manner in which the child's system is prepared to utilize all types of sensory stimulation. Stimulation is carefully graded in type and intensity and is not continued if abnormal reactions occur in other parts of the body. When this happens, the therapist must re-assess what she is doing and change the types of controls or stimulation which she is using.

Treatment is begun as early as possible. We do not have to wait until a child is 18 to 24 months old and has not developed speech. We know that a child with a feeding problem or incoordinated respiratory and phonation patterns will have a speech problem. At the Illinois State Pediatric Institute we are accepting children for treatment as early as 4 months old. Our biggest problem is finding physicians who are willing to refer a child that young. We feel that treatment is much more successful when it can be begun under 15 momths.

Neurodevelopmental Treatment is a philosophy and approach to treatment of the cerebral palsied child which with the right patients appears to be one of the most effective tools a therapist can utilize.

Effects of Sensory Modality Stimulation on the Disarthria of Cerebral Palsy

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Cerebral palsy may be defined as a disorder of movement and posture due to a defect or lesion of the immature brain (Bax, 1964). If the disorder involves the muscles of respiration, phonation, resonation or articulation, the resulting speech or voice problem is called dysarthria. The paralysis, weakness, or incoordination of the speech musculature may be mild to severe, but the usual result is some degree of unintelligible speech. Although the child with cerebral palsy may have other problems caused by cerebral dysfunction - such as disorders of sensation, perception, concept formation and symbol formulation - which will disturb or limit his use of speech and language, dysarthria usually is the major communication problem. (Ingram, 1966, Love, 1964, Lencione, 1966).

Estimates of incidence and severity of dysarthria in the cerebral palsied population vary. Using intelligibility of speech as an indicator of incidence, most investigators (Lencione, 1966, p. 229; Wolfe, 1950) suggest that athetoids are more unintelligible than spastics. Wolfe (1950) reports that 40 per cent of the athetoid group he studied was unintelligible while 30 per cent of the spastic group could not be understood. Lencione (1966) found that 70 per cent of the spastic group had intelligible speech, whereas only 31 per cent of the athetoids were intelligible. Ingram (1966) indicates that dysarthria varies also with extent of paresis. Dysarthria is more common among diplegic children than among hemiplegic children, and it occurs more often in quadriplegia than in triplegia or paraplegia.

Various therapeutic approaches have been utilized to improve the movement patterns of the speech musculature of the dysarthric child. These range from techniques based on principles of neuromuscular re-education to techniques of direct stimulation of articulation through sensory channels. The "stimulus method" described by Travis (1931), using sensory channels to improve articulation, is the traditional approach in speech pathology for correcting the motor patterns for sound production in speech disorders of a nonorganic origin (Van Riper, 1963).

Techniques having a foundation in neuromuscular re-education have been more widely advocated for the improvement of dysarthria than have the traditional techniques of sensory stimulation. For example, Westlake and Rutherford (1961) have suggested that physiological readiness for speech can be developed through stimulating oral motor activities, before and after speech has emerged. By utilizing and improving the movement patterns in chewing, swallowing and sucking, they attempt to modify them to establish those movement patterns basic for the production of sounds. They also emphasize the utilization in speech therapy of special techniques common in physical therapy. The passive-to-resisted movement continuum is employed for developing strength, speed and skill in the speech muscles. In addition, the

principles of relaxation, stabilization, special posturing, and the use of confusion and antigravity movements are stressed in the program for the development of motor patterns for speech. When movement patterns are finally established, traditional direct sensory stimulation techniques are employed.

This intensive emphasis on the training of non-speech activities to improve speech production in the cerebral palsied has been criticized by Hixon and Hardy (1964). They provide evidence to indicate that speech defectiveness in the cerebral palsied is highly correlated with speech movements of the articulators and not strongly related to non-speech movements. They suggest that therapy for dysarthria employing speech activities may be more effective than that using non-speech activities. On theoretical grounds, they assert that movements associated with speech emission may be more actively facilitated through sense modalities which monitor the speech act than those which monitor non-speech activities. This raises the question of whether relatively short-term sensory modality stimulation of those channels which monitor speech movements can, in actuality, facilitate more effective motor patterning for speech in the dysarthric children. A related question is: what sense modality or combination of sense modalities is most effective for improving motor speech patterns?

A model of the relative effectiveness of various types of sensory modality stimulation on phoneme production in the physically normal child with an articulation disorder has been presented by Milisen and associates (Scott and Milisen, 1954, a and b). It was found that combined aural-visual stimulation was superior to aural or visual stimulation alone in facilitating correct phonemes in isolation, nonsense syllables and words respectively. However, no evidence has yet been reported to establish the effectiveness of this model of sensory stimulation when the critical variable in the speech disorder is disturbed motor coordination of the muscles of speech rather than the presumed faulty learning of phonemes as in the nonorganic articulation disorder.

METHOD

Subjects: Twenty-two cerebral palsied individuals, between the ages of 7 years, 6 months and 19 years, 0 months, enrolled in Cavert Metropolitan Public School for the Physically Handicapped in Nashville, Tennessee, served as subjects. The average age of the group was 13.14 years. To be considered as a subject, hearing acuity of at least 30 dB (ISO) in the speech range (500 to 2000 Hz) was demonstrated. A minimum intelligence quotient of 55, as defined by the Peabody Picture Vocabulary Test, was also a criterion for inclusion in the sample. The sample was composed of 14 males and 8 females. Sixteen were clinically diagnosed as spastic, two as athetoid, one as ataxic, and three as mixed. Two were hemiplegic, and the remaining twenty were quadriplegic. For the most part, subjects were medically diagnosed by J.

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Dysarthric subjects, for the purposes of the study, were defined as presenting at least 6 errors on a standard articulation test, plus a history of chewing and swallowing problems. To rule out a speech disorder on the symbolic level rather than the motor level a subject was excluded from the sample if he was unable to formulate an utterance of four words in length. No attempt was made to rank the extent of motor involvement in the respiratory, laryngeal, palatopharyngeal, lingual, masticatory, or facial muscles. The extent of motor involvement in each of these muscle groups, comprising the vocal mechanism, was judged to be highly variable for individual subjects.

Sensory Stimulation Materials: The eighty-seven words of the Irwin Integrated Articulation Test (1961) were selected as material for presentation under three conditions of sensory stimulation: aural; visual, and combined aural-visual stimulation. Articulation test words were chosen as stimuli because they insured a representative sampling of consonant and vowel sounds in the English language in a variety of positions in words. Moreover, this articulation test material had the added advantage of being pretested for appeal and usability on a population of cerebral palsied children.

Stimulus Presentation: The eighty-seven stimulus words of the articulation test were randomized to reduce the effect of increasing motor complexity involved in sound production of the words as they appear on the test. Four words were presented each day to the subjects for 21 consecutive school days. Three new words were introduced on the twenty-second day. Each word was initially presented under the three conditions in the following order: A-V, V, A. The sensory modality conditions were counterbalanced over 6 more presentations of each word to increase and equalize practice effects. This design resulted in 36 imitations per daily session. The number of elicited responses were limited to 36 per session to reduce fatigue that might counteract practice effects. Of the nine imitated responses elicited daily, only the last three, one per sensory modality condition, were used for analysis; this final series was thought to assess best the cumulative effects of short term imitation. The responses elicited on the third, ninth, fifteenth and twentieth days were selected for analysis on the assumption that they systematically sampled the responses of the 21 days.

The aural stimuli were presented in a normal conversational voice to each subject by the examiner. The following directions were given to the subjects on the first day of stimulation:

> Today I'm going to ask you to imitate some words after you have heard and seen me say them. We will see the same words over and over again. Do your best to say the words just as I say them.

Under those conditions in which the subject was asked to reproduce the stimulus word under combined aural and visual stimulation, the following directions were given:

> I want you to watch my mouth very closely and to listen very carefully. I am going to say some words, and I want to see how well you can say what I do.

The following directions were given for those conditions in which a visual stimulus alone was presented:

> Now watch my mouth very closely. I'm going to whisper a word and I want you to say the same word out loud after me.

The words were not actually whispered but focal articulations points were formed without any aural characteristics of the word said.

In that condition where an aural stimulus alone was presented, these directions were given:

> Now listen very carefully. I'm going to hide my mouth so that you can not see. I want to know if you can say the same word after me just as I do.

The examiner's lips were hidden by holding a 3 x 5 white card in front of the mouth. The series of directions were repeated as necessary prior to word stimulation to orient the subject and maintain motivation.

Each of the thirty-six daily responses were tape recorded on an Ampex portable 601 tape recorder for further analysis.

Evaluating Stimulation Effects: The effect of modality stimulation was assessed in two ways. A phonemic analysis in terms of error sounds in the test words was completed. Phoneme errors in words were recorded using traditional classifications of sound inaccuracies: substitutions, omissions, and distortions. A second analysis seemed imperative for two reasons. First, as Darley (1969) points out, dysarthric speech is more than misarticulation of sounds; it is also the result of motor disturbance of any or all of the five basic processes: respiration, phonation, resonation, articulation and prosody. Second, as McDonald (1964) argues, the individual overall motor pattern produced for a word as a whole accounts for the ultimate intelligibility of the word, rather than does the ability to produce the individual motor pattern for a single sound. Therefore, it seemed reasonable to measure the effect of stimulation on the motor patterns of speech by obtaining ratings of overall adequacy of the speech in the test words in

addition to the effect of stimulation on phoneme errors. To obtain these ratings, a group of five sophisticated listeners, defined as individuals having a Master's degree in speech pathology and at least two years of experience, were asked to rank each word in terms of general adequacy of communication on a thirteen point scale, ranging from totally inadequate speech to superior communication ability. The midpoint of the scale was defined as average speech adequacy for communication purposes. An example of the rating scale is in Appendix A. General adequacy of communication was defined as the effectiveness of the cerebral palsied child's speech attempts in an every day communication situation in which the listener does not know the speaker. Recent studies (Garrott, 1967; Coffey, 1967) have indicated that this scaling is applicable to the speech of cerebral palsied children and they further demonstrated that there are no statistically significant differences between the reliability of sophisticated listeners, as herein defined, and unsophisticated listeners, defined as those who have no training or experience in speech pathology. The judges repeated their rating after one week to obtain measures of both interjudge and intrajudge reliability.

To obtain judgments of speech adequacy, the following procedures were followed: The critical responses on the four evaluation days were selected from the speech recordings of each subject and spliced together on a master tape in random order. For identification, each sample of words was preceded by an identification code number matched to an identification code number on the scoring sheet of printed responses. The word imitations were separated by 30-second intervals to allow the judges to mark their rating sheets. The prepared master tape was played for the judges in a sound treated room with the judges seated equidistant from the loudspeaker of an Ampex 350 tape recorder. A second listening session was held for each judge a week to two weeks after the first session. A set of standard directions were read to the judges before each listening session. These directions will be found in Appendix B.

RESULTS

Modality Effects: To determine whether there were systematic differences between improvement in motor patterns for phonemes under the three types of modality stimulation for speech, the number of errors in sound production for each of the three conditions were tabulated. Initial inspection of the data revealed that errors could not be meaningfully tabulated for the visual condition. When the subjects were required to imitate a word from visual cues alone the response was frequently in the category of misnaming. Therefore, the traditional categories of sound inaccuracy could not be applied to responses from visual stimulation alone. This clearly indicated that visual modality imitation was the least effective means of controlling the motor pattern for individual sound production.

Next the total number of sound errors produced in the imitations under aural stimulation alone were compared with those produced under combined aural-visual stimulation. Table 1 indicates that the mean difference is 5.50 errors between the two conditions. This difference is statistically significant at the .01 level of confidence. Inspection of articulation tests data showed that only one subject did better under aural stimulation, and two subjects showed no change under aural stimulation, and two subjects showed no change under combined aural-visual stimulation. The remaining eighteen subjects produced from one to seventeen fewer errors under combined aural-visual stimulation than aural stimulation. This clearly demonstrates that combined aural-visual stimulation more effectively controls motor patterns for sound production in imitation than does aural stimulation alone.

The second measure of the effect of stimulation, speech adequacy, also revealed improvement with stimulation over time. On third day, the five judges assigned a mean speech adequacy rating to the cerebral palsied subjects of 3.67, placing the group as a whole between the "below average" and "poor" levels on the 13 point scale. Ratings on the twentieth day revealed a mean 4.37 indicating the speech adequacy was closer to the "below average" level. In retest data after one week or more, similar relations were maintained. The average ranking on the third day under retest was 3.68 and on the twentieth day it was 4.21, suggesting that the cumulative effects of three types of modality stimulation improved the speech adequacy of the dysarthrics.

Reliability of Judgments: To obtain an index of interjudge reliability in both test and re-test situations, Ebel's (1951) interclass correlation for estimation of reliability ratings for each of the four critical days for test and re-test were completed. (Table 2). It appears the intra- and interjudge reliability was systematically high, thus giving support to the validity of these ratings.

Age: A series of variables were explored to determine their effect on the most efficient mode of sensory stimulation. The first variable considered was age; one might assume that the number of errors might decrease with age. The results of a Pearson's produce moment correlation yielded a r of -.04, indicating that as age increased the number of errors did decrease. However, the correlation is a modest, non-significant one.

Intelligence: One might also assume a negative relationship between the intellectual level of the subjects and the number of errors under the aural-visual stimulation modality. When the IQ on the Peabody Picture Vocabulary Test was correlated with the number of errors, a r of +.03 resulted. This low, non-significant positive correlation suggested a negligible relationship between intelligence and articulation error. When one considers that mean IQ level of the group was 80.81, this finding might not seem unreasonable.

Table 1. Means, Standard Deviations, Mean Difference, and Results of t-ratio for Related Measures between Number of Sound Errors under Aural-Visual and Aural Conditions (d.f.=21)

Condition	Mean	S.D.	Mean Difference	t
A-V	28.09	16.76	5.50	4.96*
A	33.59	17.36		

*Significant beyond the .01 level.

Table 2. Interclass Correlations for Reliability of Judges on Test and Re-test on 4 Selected Days.

Day	Test	Re-test
3	0.73	0.75
9	0.78	0.83
15	0.80	0.82
20	0.84	0.83

Considerable evidence (Simon, 1957) suggests that when intelligence is within the normal range, correlation with the number of articulation errors is minimal.

Sex: The literature of articulation development in normal children (McCarthy, 1954) has suggested that there are differences in the rate of achievement of articulation proficiency between boys and girls; however, these systematic sex differences have not been apparent in the cerebral palsied (Lencione, 1966). The difference in number of errors between sexes under the aural-visual condition and the aural conditions were submitted to t test and the results were not significant. (Aural-visual: $t = .14$; d.f. $= 20, p < .05$; aural: $t = .14$; d.f. $= 20, p < .05$) Thus, these findings corroborated other reports of lack of sex difference in articulation proficiency in the cerebral palsied. The critical variable appears to be degree of motor involvement of the speech mechanism (Lencione, 1966).

Manner and Place of Articulation: Irwin (1963) has suggested that a fruitful way of analyzing the articulation errors of cerebral palsied children is to study the manner and place of articulation. For the purposes of this report, it was thought that applying this approach to the errors produced under the aural-visual and visual stimulation conditions might yield further information as to the specific effects of different types of stimulation. The method proposed by Irwin (1963) for analyzing and classifying the phonemes into manner and place of articulation and a mean percentage was obtained for each of the categories of phonemes in each of the three positions. Table 3 gives the orders of difficulty of the several categories of consonants according to manner of production for the aural condition. Table 4 shows similar data for manner of production for the aural-visual condition. With the exception of some minor variation, it appears the order of difficulty under the two conditions is similar. One would expect this finding, since the addition of a combined aural-visual stimulation over an aural stimulation alone should affect place of articulation more dramatically than manner of articulation. A place of articulation analysis highlights the visual aspects of the focal articulation. It should be noted that with exception of the sounds in the medial position, the order of difficulty in manner of production was similar to that of Irwin's data on a larger sample of cerebral palsied children (Irwin, 1963).

Like comparisons were also made between the aural and aural-visual conditions for the order of difficulty according to place of articulation. Table 5 displays this data for the aural condition, while Table 6 gives data for the aural-visual conditions. Inspection of this data shows no major differences between the two modes of stimulation in rank order of difficulty. However, one can isolate effects that might be the result of the added visual component in the aural-visual condition by comparing percentages. Those sounds which have the highest visual components, the labials, do show a smaller percentage of errors in all three positions in words under aural-visual

Table 3. Order of Difficulty of Consonants According to Manner of Articulation under Aural Stimulation.

Initial	Mean %	Medial	Mean %	Final	Mean %
Stop	9%	Nasal	27%	Nasal	44%
Nasal	16%	Glide	30%	Combination	49%
Glide	17%	Stop	45%	Stop	56%
Combination	50%	Fricative	60%	Fricative	64%
Fricative	62%	Semi-Vowel	63%	Semi-Vowel	70%
Semi-Vowel	70%	Combination	70%	Glide	-

Table 4. Order of Difficulty of Consonants According to Manner of Articulation under Aural-Visual Stimulation

Initial	Mean %	Medial	Mean %	Final	Mean %
Nasal	2%	Nasal	14%	Nasal	35%
Stop	8%	Glide	22%	Combination	40%
Glide	8%	Stop	27%	Stop	59%
Combination	29%	Combination	45%	Fricative	60%
Fricative	52%	Fricative	52%	Semi-Vowel	73%
Semi-Vowel	63%	Semi-Vowel	59%	Glide	-

Table 5. Order of Difficulty of Consonants According to Place of Articulation under Aural Stimulation.

Initial	Mean %	Medial	Mean %	Final	Mean %
Labial	8%	Glottal	5%	Alveolar	53%
Velar	11%	Labial	26%	Labio-Dental	56%
Glottal	14%	Lavio-Dental	38%	Velar	56%
Alveolar	38%	Velar	44%	Dental	60%
Labio-Dental	43%	Alveolar	52%	Labial	67%
Dental	62%	Palatal	74%	Glottal	-

Table 6. Order of Difficulty According to Place of Ar iculation under Aural-Visual Stimulation.

Initial	Mean %	Medial	Mean %	Final	Mean %
Labial	5%	Glottal	9%	Alveolar	48%
Glottal	9%	Labial	12%	Velar	50%
Velar	9%	Velar	20%	Labio-Dental	54%
Alveolar	29%	Labio-Dental	36%	Dental	55%
Labie-Dental	36%	Alveolar	40%	Labial	60%
Dental	49%	Dental	51%	Palatal	71%
Palatal	50%	Palatal	60%	Glottal	-

stimulation than they do under visual stimulation alone. The other two categories of sounds that have high visual components, the labio-dentals and dentals also tended, in general, to show less error under aural-visual stimulation.

Voiced-Voiceless Production: Another parameter that has interested investigators of articulation in cerebral palsy has been the problem of voicing. No consistency in the order of difficulty has been reported (Lencione, 1966). Tables 7 and 8 reveal no clear cut differences are apparent in all three positions in the present data. However, aural-visual stimulation produced less error in the sample. This is difficult to explain in terms of the added visual component, because voicing is primarily an accoustical event. It may be that improved motor patterns under aural-visual stimulation effects tend to affect articulation as whole, and that a comparison between aural-visual elements and aural elements is artificial in the voicing problem.

CONCLUSIONS AND RECOMMENDATIONS

Clearly this study demonstrates that under conditions of immediate imitation with combined aural-visual stimulation disturbed motor patterns for articulation can be brought under better control. In other words, intensive stimulation improves dysarthria despite an often severe neurological impairment. The most striking aspect of the findings is that brief periods, often less than fifteen minutes, per each school day for less than a calendar month can produce improvement in motor patterns for phonemes as well as the other aspects of speech production presumed under the rubric of overall speech adequacy. These findings, plus the clinical observation that long-term neuromuscular training of the speech mechanism does not always greatly improve the speech adequacy of the cerebral palsied, might suggest that intensive combined sensory stimulation is a panacea for dysarthric problem. However, it should be noted that the group as a whole did not improve dramatically between the third and twentieth day. Although there was a significant upward shift in speech adequacy, the mean rating was at a "below average" level. In other words, the speech attempts never reached those of excellent, good, or average normal speakers. This suggests that no one single method will reverse dysarthria, but it does indicate that intensive combined sensory stimulation merits further research as an approach for improving disturbed motor speech function.

It is not particularly surprising that the hierarchy of effectiveness of stimulation for improvement of articulation in the dysarthric child parallels that of the physically normal children with articulation disorders. It merely supports the contention of Hixon and Hardy that sensory channels are probably of prime importance in controlling motor speech processes in the physically handicapped child as well as the normal child. It suggests that speech learning does not follow

Table 7. Difficulty of Voiced and Voiceless Consonants under Aural Stimulation.

	Initial	Medial	Final
	Mean %	Mean %	Mean %
Voiced	29.54	43.23	53.27
Voiceless	29.20	41.90	57.75

Table 8. Difficulty of Voice and Voiceless Consonants under Aural-Visual Stimulation.

	Initial	Medial	Final
	Mean %	Mean %	Mean %
Voiced	23.18	30.69	52.72
Voiceless	24.10	36.70	52.75

unique principles in the cerebral palsied, and that the traditional "stimulus method" for correcting phonemes must not be under-emphasized in relation to neuromuscular training. The lack of differences in terms of the normally critical variables of intelligence, sex, and age support the findings of other investigators dealing with cerebral palsy, who suggest the degree of motor involvement in the speech articulators determines the number of sound errors.

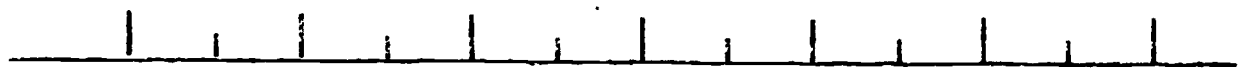
It also becomes apparent from this study that a single measure of improvement of dysarthria is too limiting; both the articulation measures and judgments of speech adequacy were necessary to assess the effects of stimulation. No doubt sound proficiency is the prime contributor to speech adequacy, but global measures of speech are needed to provide an index of the extent of impairment of oral communication. Even these two measures may not fully assess the level of sommunication. Some of the judges who have worked with the cerebral palsied noted that they employ visual lip-reading cues to understand the severely involved cerebral palsied child; others noted that the facial grimaces and involuntary movements of the cerebral palsied child often were distracting and diminished the communication as compared to judgments of speech adequacy based on tape recordings of speech. Possibly, future studies of dysarthria in cerebral palsy should employ audio-visual evaluation techniques.

A crucial issue concerns the child's ability to project an improved motor pattern for speech when more than relatively short and discrete responses are required. Projecting complex motor patterns over long time durations apparently may be another matter than brief imitation. A third issue involves the ultimate effects of aural-visual stimulation to speech behaviors that are under a program of operant control wherein schedules of rewarding reinforcement are applied to correct imitations. The results of work by McLean (1969) in improving the articulation of mentally retarded children without gross motor impairment suggest techniques that might be fruitful with the cerebral palsied. A program of organized research to explore these critical variables is now being planned.

APPENDIX A Sample of Rating Score Sheet for Judgments of Speech Adequacy

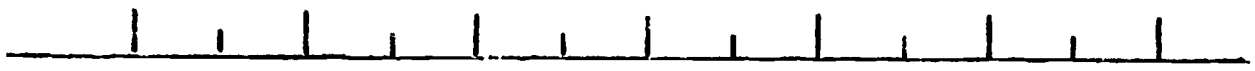
SPEECH RATING FORM

CODE NUMBER: DATE:



Excellent Superior | Good | Above Average | Average | Below Average | Poor | Completely Inadequate

Why 

Dish 

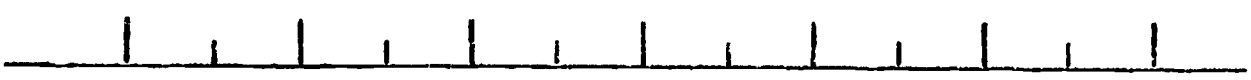
So 

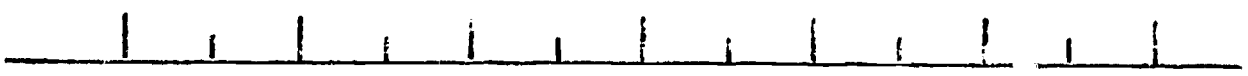
Kitten 

Why 

Dish 

So 

Kitten 

Why 

Dish 

So 

Kitten 

APPENDIX B Instructions to Judges on Scale of Speech Adequacy

The recording which you will hear is made up of speech samples composed of words taken from 22 subjects. You will hear a set of four words at a time. Each set of four words will be uttered three times in the same order, resulting in twelve words per subject. The examiner will say the cue word, followed by the subject's utterance of the same word. It is your task to evaluate the general speech adequacy of <u>each single word</u>. Often the responses are uttered very rapidly, your scoring must be computed quickly. The tape will be stopped after each set of four words to provide more time for scoring. This means you are to decide how effective each utterance would be in an every day communication situation in which the listener did not know the speaker. General speech adequacy includes articulation, pitch, quality, intensity, rate and rhythm of speech. Your rating reflects the total effect of the person's speech.

Rate each speaker on the scale provided using the descriptive words and phrases as guidelines. Make your ratings only at the specific points or mid-points shown on the scale.

Each speech sample is preceded by a recorder code number. Please check that the code number in the upper left hand corner of your rating sheet and the code number uttered on the tape are in agreement.

OCCASIONALLY, A SPEAKER WILL NOT IMITATE THE WORD CALLED FOR BY THE EXAMINER. PLEASE RATE THIS AS INADEQUATE EVEN THOUGH THE SPEECH PRODUCTION MIGHT OTHERWISE RECEIVE A HIGHER RATING.

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