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Cognitive Control Functioning and Spontaneous Speech:
Intensive Case Studies of Audio-Psycho-Phonological
Remedial Training with Five Dyslexic Boys

Joan Neysmith-Roy

Thesis submitted to the School of Graduate Studies
of the University of Ottawa as partial fulfillment
of the requirements for the degree of Doctor of
Philosophy in Psychology.



Joan Neysmith-Roy, Ottawa, Canada, 1981

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CURRICULUM STUDIORUM

Joan Maureen Neysmith-Roy was born April 29, 1936, in Montreal, Quebec. She received the Bachelor of Arts degree from the Thomas More Institute of Adult Education in Montreal, Quebec in 1964. She was granted the Master of Arts degree in Psychology by the University of Ottawa in 1970. She received a Teaching Diploma from St. Joseph Teachers' College, Montreal, Quebec in 1959.

ABSTRACT

Cognitive Control Functioning and Spontaneous Speech: Intensive Case Studies of Audio-Pscho-Phonological Remedial Training with Five Dyslexic Boys

The study for effective remediation of dyslexia remains plagued with ambiguity despite a long history of diagnostic and remedial investigations into the underlying problems and possible treatment programs for such children. Reading problems of such a severe nature at the academic level are sometimes seen as the end result of poorly developed underlying pre-academic skills. The heterogeneity of the problems found in these children has contributed to the inability to delineate effective treatment programs at the academic level. The present study examined the effectiveness of the Audio-Pscho-Phonological (APP) remedial training program for language related problems, one of which is dyslexia. The cognitive control functioning and spontaneous speech patterns of change were carefully assessed, via cognitive control tests and language development tests, in five dyslexic males as they pursued their individual APP remedial training programs. The four boys considered successfully remediated according to APP standards all demonstrated positive change in cognitive control functioning and spontaneous speech in line with age/grade expectancy and intellectual potential. Cognitive control reorganization occurred mainly in the first or Passive Phase of the program while spontaneous speech measures showed their greatest improvement during the second or Active Phase. The one lad who was not successfully remediated showed only small positive changes during the course of the APP training program. The pattern of test results are discussed in terms of the theories of Alfred Tomatis and Sebastiano Santostefano as well as relevant literature on the importance

of language mediation in the control and monitoring of attention. Overall the results of this study suggest that in remediating auditory-vocal control of language APP training remediates important pre-requisite skills necessary for success in reading at the academic level.

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INTRODUCTION

In our modern world the attainment of the skill of reading is so very essential for economical survival that an individual who cannot read is likely to have severe difficulty finding a self fulfilling niche within our present day society. Reading is the most serious task presented to children in school. They need this facility in order to attain information. Initially the art of reading must be learned as a skill for its own sake, but eventually the skill is important to the learning of almost all other academic subjects. Naturally a child experiencing difficulty in learning to read is of major concern to his teachers, his parents, medical personnel, and himself.

A history of the study of children with difficulty in reading indicates that late in the nineteenth century the medical profession and the educationalists became aware of the fact that there did exist children who seemed to be of average or better intellectual ability; were capable of performing adequately on school related and non school related tasks; but, who seemed to have a particular difficulty in relation to reading. This handicap became known as dyslexia. While the medical profession observed and attempted to diagnose the problem from a neurophysiological point of view the schools, who were given the job of teaching these children on a daily basis, became more concerned about the treatment and management of such children. By the mid twentieth century parents became involved and supported research and the development of programs to assist their children who did not appear to be improving under the medical and educational thrusts of the first half of this century. (Critchely, 1970; Thompson, 1966)

Over the years, from the late nineteenth century to the present day, countless investigations in the diagnosis and/or treatment of dyslexia have been conducted. True, many children have been assisted but there still remains a certain core who fall by the wayside, so to speak. These are the children of average or better intellectual potential; who have had ample opportunity to learn; are free from specific organic impairments and emotional problems yet do not improve adequately with the current remedial reading programs.

A more recent investigator of the problems of the dyslexic is Dr. Alfred Tomatis of France. This man's keen interest in the language-listening aptitudes of people led him to develop the Audio-Psychophonological (APP) theory of language development and language related problems. By way of this interest he fell upon dyslexia as one of the possible outcomes of faulty early language learning. His treatment of dyslexia, via native language development, hits at the basis of many of the modern theories of reading. That is, several of the most recent theories (Bannatyne, 1971, 1973; Fries, 1972; Gibson, 1972, 1975; Goodman, 1968, 1972; Wiener & Cromer, 1967) describe reading as a language related subject rather than simply a visual perceptual task. Tomatis perceives both as important but sees one's native language as the link that brings it all together. That is, perceptual systems enable one to relate to the environment from within and without while mature language development permits the cochlear system to become the integrator that pulls this all together via its neurological connections with the cerebellum and the cortex. (Tomatis, 1978) The attainment of early reading skills depends upon certain visual and auditory perceptual functions which should develop in the pre school years

along with the early development of language as communication within a social milieu. Then, to obtain accurate information from what is read, the child needs to have language, as a tool for communication, available to him.

Although Tomatis' definition of dyslexia is broad (Tomatis, 1978) it explains in part the heterogeneity of the symptoms found in dyslexic children. The APP remedial training program purports to allow the individual to reexperience his language development as it should have been and thereby gives him a second chance to build the pre school foundation to oral and written language.

Two areas of development which have frequently been seen as pertinent to the understanding of the dyslexic child's problems have been cognitive development and language development. The present study attempts to investigate the influence of an APP remedial training program on the cognitive control and spontaneous speech functioning of children throughout a remedial program. This hopefully will shed some light on the developmental importance of these two prerequisites to reading as well as on the role that APP training plays in their remediation, if at all.

In order to study the nature of this controversial treatment plan and its possible influence on cognitive control functioning and spontaneous speech, five intensive case studies have been conducted. This particular research project was carried out in conjunction with two other doctoral students who studied the same five dyslexic boys. One examined the changes in perceptual processing and academic skills, and the second assessed the changes in psycho-social and personality variables.

The first chapter of this thesis deals with the history of the problem of identification and remediation of dyslexia. The second chapter describes the design used to carry out the present study. The third chapter gives a detailed account of the APP treatment and its outcomes on each of the five boys chosen for this research project. The fourth chapter presents the results of the cognitive control and spontaneous speech tests while the fifth chapter discusses these results.

CHAPTER 1.

Review of the Literature

The present study proposes to investigate the nature of changes in cognitive control functioning and spontaneous speech of five dyslexic boys enrolled in a ten month Audio-Psycho-Phonological remedial treatment program. This first chapter consists of five main parts. An initial section reviews the problem of dyslexia as it has evolved through history, leading to an operational definition for the present study. The second section considers a number of current theories of reading in order to understand the many prerequisites of this socially important skill which are being investigated in the present study in the form of cognitive control and spontaneous speech functioning. A third section explains Dr. Alfred Tomatis' theory of dyslexia showing how such a theory proposes to explain the underlying dynamics and the gradual evolution of the many prerequisites to successful reading. The concept of the Tomatis Audio-Psycho-Phonological remedial training program is also explained at this time. The fourth and fifth sections of this chapter deal with Cognitive Controls and Spontaneous Speech respectively. Adequate functioning in these two areas is considered to be an essential prerequisite for successful reading when the child reaches his formal academic years. The writer expects that both these areas will be influenced either positively and/or negatively by the Tomatis Remedial Training Program. The present study tries to demonstrate and evaluate these expected changes.

History of Dyslexia

Since its beginning, during the last quarter of the nineteenth century, the field of Dyslexia has been carefully and minutely scrutinized by three major professions: Medicine; Psychology; and Education. Each has understandably approached the problem with its own biases and imposed its own terminology upon symptoms it considers pertinent. While no profession lost sight, at any time, of the importance of assisting the "Dyslexic", the emphasis and driving interest did shift from one profession to the other.

At the risk of oversimplification, the following account divides the history of dyslexia into three main stages or periods. The first extends from the final quarter of the nineteenth century up until 1917. This was a period of observation and an effort to delineate the etiology of specific reading difficulties. The second stage was ushered in with Hinshelwood's 1917 treatise on Congenital Word Blindness and continued until the early 1960's. During this time there was considerable analysis and discussion of the syndrome of reading difficulties with the emphasis shifting from the earlier observational techniques to efforts at differential diagnosis and treatment programs. The third and most recent stage extends from the early 1960's to the present. This period is marked by an early overexpansion or oversimplification of the specific problem and too many hastily developed remedial techniques brought about partly by intensive parental participation and interest as well as government funding. In more recent years however there has been a definite trend toward a new look at the entire field of Learning Disabilities as well as

a continued examination of the specific field of backwardness in reading of which Dyslexia is one subsection.

Early Period

Adolph Kussmaul, writing as early as 1877, is credited as being the first to specifically isolate an aphasic loss of the ability to read using the term "word blindness". Professor Berlin of Stuttgart, also in 1877, was the first to use the term "dyslexia". But words such as "alexia" and "dyslexia" derived their origin from the aphasic tradition when the loss of the ability to read was thought to have been the result of a specific organic injury of some kind. Hence these earliest interests were dealing with a "loss of" rather than an "inability to learn" the skills of reading. The traditional definition of dyslexia, suggested in 1890 by Bateman, was: "a form of verbal amnesia in which the patient has lost the memory of the conventional meaning of graphic symbols" (Critchley, 1970, p. 1).

James Hinshelwood, a Glasgow eye surgeon, wrote on the topic of visual memory and word blindness as early as 1895 and 1896. This prompted Dr. Pringle Morgan, an English general practitioner, to describe the case of a fourteen year old boy who was incapable of learning to read. This was probably the first recorded case of "congenital word blindness" and was also the first child oriented, non organic description (Critchley, 1970).

By 1909 some forty one cases of such congenital word blindness had been reported in the literature. Neurologists and Ophthalmologists in Britain, Holland, Buenos Aires, Germany, America and France were all actively observing and reporting patients. While these "patients" had

no known history of specific organic problems, it was presumed that there must have been a brain defect of some sort. Interestingly enough Freud, in his preanalyst days, made reference to the possible innate or developmental factors involved but it seems to have been ignored at the time (Thompson, 1966).

While the main thrust of this observational period was carried out by the medical profession there are accounts of at least two educational psychologists who were astutely aware of children experiencing unusual difficulty in learning to read. As early as 1896 James Kerr, going on little more than intuition, decreed that it was possible for otherwise normally intelligent children to discover that they could not learn to read (Thompson, 1966). Since the idea was interesting, but intuition not convincing, this set the stage for Binet, Simon and others to get into the test construction business which permeated the second stage of this historical account. Augusta Bronner, a psychologist with the first Child Guidance Clinic in Chicago, as early as 1909 noted the important link between hearing and reading. This is an important concept that has been too often overlooked and which will reappear for discussion in the reading theories of Bannatyne, Goodman, Tomatis and others. At the beginning of the century Bronner had noted that a child hears and speaks words long before he/she reads and writes them and that reading is therefore the transition of symbols of sound (letters and words) into blocks of sounds that make sense. Although Bronner's interest was on an observational level, she appears to have been one of the first to wonder about the nature of perceptual defects and their association with reading disability.

Middle Period

Hinshelwood's treatise on Congenital Word Blindness in 1917 ushered in an important new stage forcing the emphasis to shift from "identification of the problem" to an "analysis and discussion of the syndrome". Doubt, indecision and confusion blossomed forth and those who insisted on structural brain damage as the cause of "word blindness" began to be in the minority. By 1924 Apert and Potzl were speaking of congenital word blindness as a developmental delay of a functional rather than anatomical nature (Critchley, 1970). With this change in attitude the main concern for the problem of backwardness in reading shifted from the hands of the medical profession into the laps of the educational psychologists. The testing boom sprang up in answer to the need for a differential diagnosis both to determine the child's learning problems and the possible root of these problems. Backwardness in reading was considered to be the end result of a diversity of factors. Little reference was made to the specific organically determined defects originally hinted at by the neurologists. During the 1930's, 1940's and the 1950's children noted as "unable to read" formed a spectrum on a continuum from dullard to intelligent but disturbed.

During this period there were many noteworthy contributions made to the field of children with problems in learning. The term "problems in learning" is used here to clarify the fact that the children "of concern" in reality covered a large scope of problems and were analysed by a varied group of professionals who used their own terminologies to describe and label the children who were of interest to them.

Dr. Samuel T. Orton (1879-1948) psychiatrist, neurologist and neuropathologist, started his work in 1925 formulating eventually the

Orton Society which has continued to be a significant contributor in the field of Learning Disabilities to the present day. He worked with doctors, psychologists, teachers and social workers in developing testing and remedial programs for children with language related problems. Since his death in 1948 his philosophy and ambitious programs of research, teaching and clinical services have been carried on by the Orton Society.

Orton's initial interest in the problem of a specific reading disability was aroused by a group of supposedly retarded adolescents whom he observed as especially retarded in the language arts while seemingly capable enough in other areas. From close observation of these lads' reading, writing and spelling efforts, Orton began to find some rather important phenomena. He found correlations between left-handedness or ambidexterity and a tendency towards reversals when reading or writing sometimes resulting in mirror reading or mirror writing. He believed these problems to be caused by an ambiguous occipital dominance which was physiological in nature causing the brain to produce faulty patterns. He termed this problem "strephosymbolia" (twisted symbols). Although the term never caught on, Orton's observations on handedness, brain patterning etc. focused attention on factors which even today are believed to be important in the understanding of delayed reading ability.

Persons such as Laretta Bender and Paul Schilder were direct followers of Orton. While Orton himself considered strephosymbolia to be caused by a physiological developmental delay rather than a specific lesion, his aforementioned followers championed the cause of the "maturational lag" theory. Bender, a psychiatrist herself, saw this as the basic cause of many childhood unexplainable difficulties from the most

severe form of childhood autism to the child who experienced difficulties in learning to read. Probably because of her global view of a developmental lag, Bender (1957) was one of the first to insist that the "problem reader" could be predicted in the pre-school years.

Paul Schilder (1944) emphasized the fact that delays in maturation are the essential problem in language disorders in children. Schilder was a neurologist, psychiatrist and psychoanalyst whose varied research led him to believe that there was insufficient development of the cerebral centers upon which reading depended. He also emphasized the important link between hearing and reading.

There were others both in Europe and America who, although not directly connected with the Orton School, carried on the same tradition under the name of "congenital word blindness". In Germany we had such people as Bachmann 1927 and Solms 1948; in France, Ajuriaguerra 1951, Lauenay 1953, Cassagny 1954 and so forth. All were following the ideas expressed by Morgan, Hinshelwood and Orton (Thompson, 1966).

The effort to adequately analyse and label the precise difficulties of the children of concern had brought about a whole vocabulary of labels. In all good faith each researcher was, in his or her own way attempting to pinpoint the problem area by finding a label to best describe the core of the problem as he or she saw it. Hence throughout the historical literature we find such terms as: alexia, dyslexia, specific dyslexia, specific developmental dyslexia, congenital word blindness, strephosymbolia, word amblyopia, amnesia visualis verbalis, script blindness; which does not exhaust the vocabulary, used to label children with problems in learning to read.

Paralleling this intense interest in the analysis of the underlying causes of reading problems in children who otherwise appeared normal, were two other streams of research. One of these was the ongoing work with children that were known to be brain damaged. Strauss and Werner (1942) related the work of Goldstein's concepts of the brain damaged adult to children. They tried to describe the psychological characteristics of the brain damaged retarded child. Strauss and Kephart (1955) later related these findings to the Learning Disabled population. From this stream developed the psychomotor theories and remedial programs of such people as Frostig, Kephart, and others.

The third stream of research was that of spoken language development of both organic and non organic children and its effect on the learning capacity of children. Such people as Kirk (1940, 1963); Myklebust (1954, 1960); Osgood (1953, 1957); Osgood and Miron (1963); and Wepman, Jones, Bock and Van Pelt (1960) played important roles in this area.

While each of these streams had its origin within a specific field of interest (Language, Reading, Perceptual Motor) all eventually became involved with the effects of its particular field on the learning potential of the child and, remedial educational programs were formulated based on theoretical assumptions. At the close of the 50's a major push for assistance came from the schools who were faced with handling these "troubled" children on a day-to-day basis. The educationalists began to search for "cures" to specific behaviors rather than explanations and causes. The schools were concerned about children from each of the aforementioned streams. They noted some similarities in behavior amongst all the children with problems, one of which was certainly backwardness in

learning. As the concern for help began to encompass more than the restricted field of specific reading difficulty, a more all encompassing term of "Learning Disability" was introduced by Samuel Kirk in 1963 and became popular to describe a somewhat heterogeneous group of children (according to their basic problem) but all exhibiting the common behavioral manifestation of learning disabled:

Modern Period

The period of "Learning Disability" ushered in the third major developmental phase in the history. At this time, the early 1960's, parents became involved and The Association for Children with Learning Disabilities was formed in 1963. Federal finances were made available for study in the area. Hence, many researchers found themselves forced to describe their work under this title in order to take advantage of the funding available. With this new money easily obtainable many instant cures, based on insufficient knowledge and research, sprung up overnight. The terms "dyslexia" and "learning disability" became catch-basket phrases or coverup categories for mentally deficient or brain damaged children as well as those with serious emotional problems. Dyslexia tended to become a political issue used to gain government grants so that researchers could carry on their specific treatment procedures. Publishing houses took advantage of these often vaguely defineable terms by printing an endless variety of remedial aids and resource materials that were very quickly consumed by concerned parents and teachers.

Hence the period that started out to analyse and assist a rather specific group of problematic children ended up in confusion brought about by vague terminologies and overspecialization of diagnoses and treatments.

By the mid sixties the symptoms used to diagnose and describe a child who had difficulty in reading were almost endless: they varied with the child or group of children, as well as the professional's or researcher's particular orientation.

This feeling of overexpansion and fragmentation had become so obvious by the late sixties that one begins to find in the literature several articles making an effort to organize, categorize and generally make some sense out of the available information on learning disabilities. There were attempts to gather information historically and to group or classify learning problems according to their symptoms. By the early seventies there emerged a new effort to take a fresh look at the whole field of children with learning problems believed to compose anywhere from ten to twenty five percent of our school population (CELDIC, 1970). Even more specifically, by this time there emerged a recognition of the fact that "reading problem" children are not easily lumped together.

A first distinction is to be made between children who fail to acquire the skills of reading and those who lose the skill once it has been acquired. The second is very rare and generally not of concern to those dealing with reading problem children. The first type is our main concern. Johnson and Myklebust (1967) note the importance of subdividing the total group of learning disabled children into homogeneous subgroups. The criteria for inclusion within a specific subgroup, according to them, should reflect the basic cause of the learning disability. Hence they see the organic, the mentally deficient, the emotionally disturbed, and the sensory handicapped as forming individual subgroups of the total population of learning disabled children. They reserve the title

"psychoneurological learning disability" for that group of children who have adequate motor ability, average to high intelligence, adequate hearing and vision and adequate emotional adjustment together with a deficiency in learning. They reject the word "dyslexia" as an appropriate diagnostic category because they feel it relates to deficiencies in reading and inaccurately implies that all children with deficits in learning have a reading disability.

Goldberg (1968) divides all readers into three groups: 1) Developmental Readers who read commensurate with their intelligence level independent of the technique; 2) Corrective Readers who read usually one to two years below their grade level, who can be remediated by correcting the home or school problem; and 3) Remedial Readers, children of normal or superior intelligence who may be good in arithmetic but display one or more of the following characteristics: male, left handed, poor dominance, poor laterality, reversing of letters, symbols, words, reading from right to left, poor form discrimination, slow bloomer and the like.

Rabinovitch (1968) in an attempt to isolate dyslexia as one of several causes of reading retardation, offered the following classification: 1) Primary (Developmental Dyslexia) versus 2) Secondary (Symptomatic) subdivided into a) Reading Retardation secondary to brain injury and b) Reading Retardation secondary to exogenous factors.

McGlannan (1968) attempts to make a classification by differentiating genetic dyslexia, specific dyslexia and complex dyslexia.

Bannatyne (1971) sees language and reading disabilities as inter-related and breaks this total population of poor readers into six major groupings one of which he calls "Dyslexia". As he classifies

characteristics rather than children, a specific child may fit into more than one category. The problem of dyslexia he sees as stemming from one of four causes: Primary Emotional Communicative causes; Minimal Neurological Dysfunction; Social, Cultural or Emotional Deprivation; Genetic Dyslexia.

Sapir and Nitzburg (1973) take cognizance of the fact that the field of Learning Problems has become too specialized and segmented. They strive to reintegrate the child and to establish the view that all children, including those in trouble, have normally developing processes and that it is not therefore possible to isolate the child's learning problems from every other aspect of his daily developing self. Their book attempts to give a more thorough understanding of the complete child so that a teacher (classroom, remedial or therapist) can provide opportunities that will make the most of the child's circular growth process toward greater learning power and inner strength.

Rutter and Yule (1975) distinguish between General Reading Backwardness and Specific Reading Retardation. The former describes the child who is behind in reading for his age, regardless of intelligence. Retardation, on the other hand, is a term used to describe a specific disability in reading that is not explainable in terms of the child's general intelligence.

It is not the purpose of this study to make an exhaustive review of the many definitions of the term "dyslexia" but rather to point out the long history of concern about children who experience difficulty in learning to read; the many efforts that have been made on their behalf; and, to attempt a clarification of the concept of dyslexia.

This review of the literature does suggest that certain facts and trends are emerging which gain support and recognition from the respected professionals in the field:

1. A special type of reading problem, often referred to as dyslexia, emerges as different from other reading problems. Johnson and Myklebust (1967) call it Psychoneurological Learning Disability; Goldberg (1968) refers to Remedial Readers; Rabinovitch (1968) to Primary Developmental Dyslexia; McGlannon (1968) to Specific and Complex Dyslexia as different from Genetic Dyslexia; Bannatyne (1973) discusses causes of Dyslexia; while Rutter and Yule (1975) use the term Specific Reading Retardation.

2. Dyslexia has many possible expressions. This critical aspect has been too often ignored in the usual "specific deficit analyses" type of research (Klassen, 1972; Shankweiler, 1964).

3. Dyslexia is developmental in nature whether this be viewed as a blocking, a maturational lag or a lack of necessary integration (Orton, 1937; Bender, 1957). Early prediction assessments that focus on preschool "antecedents" point in this direction. Pertinent research by Satz, Friel & Boebel (1957); Money (1962); and Klassen (1972) discloses how symptoms or correlates change with time. For example, Bender Gestalt signs are relevant at five years of age but no longer at ten years when thought and language deficits become more significant.

4. In most, if not all cases, dyslexia is a language related phenomenon (Bannatyne, 1971; Goodman, 1968; Tomatis, 1978).

5. A genetic or familial loading seems to be at issue in approximately one third of the cases (Rutter & Yule, 1975).

6. Males outnumber females four to one in moderate cases; ten to one in severe cases (Rutter & Yule, 1975).

It would appear that when the total group of children with learning problems has been subdivided and assisted with special remedial techniques and those with low IQ, emotional problems, poor teaching experience, low social status etc. have been weeded out, there still remains a small group of children who are unable to learn to read. These children tend to have average to above average intelligence; come from middle to high social economic background; seem to have had the benefit of good educational instruction; are free of specific brain damage and apparently live within a "normal" family setting. Despite these advantages, and often years of traditional remedial help, they are still unable to learn to read in accordance with their capabilities.

Joseph Torgesen (1975) takes a critical look at the research carried out in the previous fifteen years. He carefully points out three main issues that have led to confusion rather than clarity in this field of Learning Disability. First, the title Learning Disabilities was never intended to describe a specific diagnostic group of children but rather was introduced, by Samuel Kirk in 1963, to somehow loosely organize a large group of children with problems in learning. It was also introduced as a more positive term than such handicapped loaded phrases as: minimally brain damaged; perceptually handicapped etc. Over the years it has come to define a category of its own. This was an unfortunate turn of events because as such it has little use in diagnosis and research since it may include any child from a poor listener to a schizophrenic. One must narrow down the definition not only to the subject such as reading, but to which specific type of child as well.

Secondly, Torgesen points out that the goals of all the remedial reading research have been to: obtain knowledge necessary to attribute the failure to certain causes; obtain data useful for the prediction of learning failure; and, obtain information relative to the remediation of learning problems. While such goals sound very pertinent, Torgesen points out the lack of a theoretical understanding of the relevant psychological processes involved both in learning and consequently in learning failure. While many correlational studies have been done these are only useful in terms of prediction and are not useful in building theoretical remedial programs.

The third issue that Torgesen feels has led to confusion has been the lack of making the clear distinction between ability and performance. The research, he cautions, should be clearly investigating ability deficits and not simply performance details. We infer that ability is being tested but scores themselves are the result of a specific performance on a specific task. Therefore construct validity is extremely important and is far too often ignored. That is, we tend to assume too readily that our tests are tapping particular abilities/disabilities.

Keeping these three central issues in mind, Torgesen reviews studies in all the areas of Specific Reading Disabilities from 1960 to 1975. This thorough investigation lead him to formulate certain implications for research and practice:

- General terms must be broken down. Ex: Instead of relating "perception" to reading we must identify the particular subtests of perceptual skills which are important in the reading process at different stages of reading.
- Since we do not have precisely defined dyslexic groups, treatment by "groups" becomes a risky business. We need to look at individual cases.

- Training the "disability" has not helped the dyslexic learn to read. Ex: Does perceptual motor training really help reading or does it help other skills such as attention and memory which may in turn prepare the child to learn to read.
- Established treatment programs are very questionable as they intervene at the skill level rather than directly at the level of deficient processes or abilities. (Torgesen, 1975, pp. 412-432)

This brings us to the close of the historical review of Dyslexia and leaves this researcher with the challenge of contributing in some meaningful way to this very complex history. In keeping with Torgesen's cautions, the issue of "definition of dyslexia" will be handled first.

Operational Definition

For the purposes of this study an operational definition of dyslexia was formulated on the following basis: Dr. Samuel Kirk's definition of Learning Disability (1977) was slightly reworked to include Eisenberg's (1966) concept of Specific Dyslexia as well as Rabinovitch's (1968) concept of Primary Developmental Dyslexia. Dyslexia thus defined is a psychological and/or neurological impediment to perceptual and/or communicative behavior manifested in (1) significant discrepancies between estimated potential and academic achievement (discrepancy criterion) (2) that is not primarily due to severe mental deficiency, brain damage, sensory handicaps, emotional problems or lack of opportunity to learn (exclusion criterion) and (3) that requires remedial procedures over and above that which is offered in the classroom (special education criterion). From Yule and Rutter's concept of Specific Reading Retardation (1975) we have considered in this operational definition: the fact that dyslexia occurs at all socio-economic levels; incidence of males is much higher than females; that mathematics are frequently stronger than reading or spelling; that despite good intelligence progress is slow.

The Reading Process

The review of research on Learning Disabilities over the last ten years or so, in this writer's view, has consistently pointed to the need for a deeper understanding of the reading process itself. While the concept of remediation of specific problem areas may be very useful in the medical field it has been of limited value in the understanding and/or remediation of the dyslexic child. Some learning disabled children have been assisted by these remedial programs because they have learned techniques to bypass their difficulties. But, there remains a core of children who do not seem to be helped sufficiently by such programs. The more recent research, for this reason, has pointed out the need to understand the natural processes involved in learning how to read as a prerequisite to effective remedial programs. In short, the need emerged to understand the "normal" before hypothesizing about the "abnormal". And so the question now is: How do successful readers learn to read?

The reading process is itself a developmental process with the more advanced level of "information receiving" being dependent upon a solid foundation of skill learning; that is, the ability to turn those printed letters on a page into a sound which will become recognizable auditorially. There is some controversy as to exactly what reading is. While there is a general agreement that reading and language are interrelated some researchers wish to retain the term "reading" for the actual skill of learning to associate a specific sound with a specifically shaped letter, while others seem to insist that comprehension of the written material is essential. For the purposes of this study however, the writer uses the term "reading" to define that process which interpretes

the printed letters on a page into a meaningful message. Since reading/writing was originally invented to record messages for future generations of people, this researcher believes one cannot say he is reading until he receives the message from those printed words. The following theories of reading have been chosen because they consider this total process.

Wiener and Cromer (1967) having reviewed the literature on reading and reading difficulties prior to 1967, emphasize the importance of clearly distinguishing both the independent and the interdependent aspects of reading and language before entering upon any discussion of reading difficulties. They feel that only in the light of these clear distinctions can one assess whether a problem is reading based or language based. Reading is conceptualized and discussed by Wiener and Cromer as a two step process: identification followed by comprehension. The former refers to a word-naming process whereby the visual input is transposed into an auditory form; the later refers to the addition of some form of meaning associated with the identifications.

Identification demands that the child discriminate, but even prior to that he must attend to the task in order to receive the sensory input. It further demands that he can discriminate on the basis of figure group relationships, brightness, curves, amount of white space etc. These forms of discrimination are seen as antecedents of identification. Given this ability to discriminate, the child can then identify sounds and words from his spoken vocabulary, on the basis of angles, curves, word length, variations in relationship of letters, spatial orientation etc. To identify novel words, according to this theory, the child needs specific strategies for organizing the sound sequences from beginning to end of a word. This

demands the knowledge of phonetics with its rules for organizing sounds as well as the ability to scan in a left to right sequence so as to organize the input in a particular way. At this first level language is interrelated in the sense that knowledge of words and their particular sequences will often reduce the amount of scanning necessary for identification to take place.

Comprehension in Wiener and Cromer's explanation of the reading process, refers to the addition of some form of meaning associated with the identifications. In short, once the visual forms are transformed to auditory forms, there is a possibility of comprehension, given the presence of appropriate language skills. If the readers' auditory transformation (identification) corresponds to his already available auditory language forms then meaning can be associated with the visual forms.

In her keynote address to a conference on The Relationship between Speech and Learning to Read Eleanor Gibson (1972) emphasizes the need for a good psychological theory of reading. She states "Reading is a cognitive process. It starts with perception, it requires perceptual learning of many things, and it ends up as a conceptual process, a tool for thinking and learning that can take the place of first hand experience" (Gibson, 1972, p. 3).

Over the past ten to fifteen years Gibson has evolved a schema which includes both the perceptual and conceptual aspects of the reading process. The perceptual tasks used in reading are seen by Gibson (1975) as an outgrowth of a child's preschool perceptual experiences in his everyday environment. The three important perceptual features learned early in life and later transposed to the reading task are:

1. Distinctive features of things--on the level of reading/writing one discovers that there are distinctive features of line, loops etc. that designate a symbol as one specific letter of the alphabet.

2. Invariants of events--invariant properties of reading/writing are learned through observation of events thereby allowing the experienced reader to recognize the written letter irrespective of penmanship or type.

3. Hierarchies of sets--learning to perceive these ordered structures is particularly important to language and language related activities where things like spelling patterns, phrases, sentences, paragraphs etc. are pertinent to correct interpretation.

These three perceptual features are learned, according to Gibson, through three developmental cognitive processes: differentiation by abstraction, or taking out what is essential; filtering, or learning to ignore irrelevant detail; and, attention, whereby an individual actively explores the environment and tunes in to the task at hand. According to Gibson, "We do not just see, we look; we do not just hear, we listen" (1972, p. 7).

It seems that Gibson applies her theory individually to language development on the one hand and reading/writing development on the other. She refers to her theory of reading as a Psycholinguistic Theory but flatly states that she is not clear as to exactly how language assists the higher levels of reading although apparently she is quite sure that they do.

I am aware of three glaring deficiencies as I contemplate this research to date. Even though I call it theory-based research it seems to me that we have done far too little by way of developing a good theory. One of the deficiencies is how the correspondences between spoken and written language make contact with each other. Finding the subordinate structure in

written language is a crucial problem for the reader. How does this happen? The answer must include knowledge of how already learned rule structures in speech are put to use or activated in reading. The second deficiency ... is our failure to come to grips with the problem of meaning in reading. A third, we must ask how a young reader learns to assign priorities as the (reading) task changes. (Gibson, 1972, p. 17)

From her studies, Gibson concludes that the skilled reader is assisted in his task of reading by good language development but cannot account for the cause of this.

In his text Linguistics and Reading, Charles Fries (1962) tries to make the important link between language and reading. His theory includes three developmentally progressive stages. The following quote spells out very accurately a process that starts with the learning of a new skill, the phonics of reading, which is assisted by the learner's presently available linguistic knowledge; through a stage where again it is the linguistic knowledge both semantically and syntactically that allows the reader to more rapidly interpret the written words and where the supra-linguistic structures assist the more formal semantic and syntactical rules; onto a final stage where the written word is supplying the "food for thought" where it remains the individual's spoken/heard language capacity that supplies the translation of the printed material into "thinking material" via an auditory (vocal or subvocal) translation.

The first stage in learning the reading process is the "transfer" stage. It is the period during which the child is learning to transfer from the auditory signs for language signals, which he has already learned, to a set of visual signs for the same signals. This first stage is complete when within his narrow linguistic experience the child can respond rapidly and accurately to the visual patterns that represent the language signals in this limited field, as he does to the auditory patterns that they replace.

The second stage covers the period during which the responses to the visual patterns become habits so automatic that the

graphic shapes themselves sink below the threshold of attention, and the cumulative comprehension of the meanings signalled enables the reader to supply those portions of the signals which are not in the graphic representation themselves.

The third stage begins when the reading process itself is so automatic that the reading is used equally with or even more than live language in the acquiring and developing of experience - when reading stimulates the vivid imaginative realization of vicarious experience. (Fries, 1962, p. 132)

It seems that Fries is very much aware of the interdependence of language and reading but at the same time he describes reading as a skill that must be learned and with time will become as fluent as spoken language; the language or spoken messages reaching the human nervous system via sound waves in the ear, written messages arriving via light waves in the eye. Although he hints at, he does not spell out, how faulty language development hinders development in reading. He appears to start from the assumption that language is adequate.

Alexander Bannatyne (1971, 1973) describes reading as an auditory vocal process. It is the process of learning to break the phonetic code and change the printed word into an auditory word so that the reader's auditory-vocal language experience can supply the meanings.

Bannatyne's psycholinguistic approach to the teaching of reading brings us closer to the importance of the underlying language processes. He carefully points out that in a phonetic language visual symbols represent sounds not meaning. The visual symbols must first be recorded into sound then decoded into meaning. According to Bannatyne reading itself is a non meaningful visual to auditory process. It is a decoding skill which functions automatically once learned. Understanding is a quality of language (not just reading) as a communication system and it

is in the auditory/vocal system that meaning resides. The cover summary of his latest book is well worth quoting:

A language which is phonetic (as is the English language) has sounds or phonemes which are represented in printed form by graphic symbols ... thus printed words are substitutes for spoken words and only spoken (or heard) words represent actual objects ... a child who has difficulty processing spoken language or in articulating it adequately will have even more difficulty decoding the printed form of that spoken language ... most reading disability children have deficits in auditory sequencing memory, discrimination, closure and/or phoneme blending... (Bannatyne, 1973, cover)

Bannatyne points out very succinctly the importance of the individual's linguistic communication as the cornerstone to effective communication through reading/writing. Through his own and other research he has determined the effects that deficits in auditory sequencing memory, discrimination, closure and/or phoneme blending have on a child's ability to recode and decode a written message. His remedial techniques however work on these particular deficits by practicing exercises which hopefully will improve these deficit areas. His theory of reading and language does not account for the "why" of such deficits in seemingly normal children, hence his remedial techniques use a training model that presupposes such language related skills are habits to be trained without concern for causal background.

Kenneth Goodman (1968, 1972) also presents a psycholinguistic approach to the theory of reading. His theory relies heavily on what our knowledge of linguistics has added to the psychology of the reading process. He particularly points out the delicate interplay between "being taught" and "learning through experience" based on one's general knowledge of his native language. Reading, according to this model of communication,

includes both the skill of interpreting the symbols into sounds, and comprehension of the message conveyed by the written communication.

The initial step in Goodman's theory of reading is the recoding of the written words into oral words whereby the reader simply pronounces the words on the page without necessarily including the correct intonations, phrase breaks or even word units. It is this initial stage, Goodman feels, that must be taught to the beginning reader; that is, grapheme-phoneme equivalents.

A second stage calls upon language skills or a certain facility with one's native language. Here the reader can link sounds together with a certain degree of intonation, stress and word grouping so as to produce an oral output that fits his knowledge of what is acceptable language. This is based on preschool experience and language exposure. As there are many exceptions in the grapheme-phoneme relationships an overemphasis on the teaching of phonetic skills might well deter a child from listening critically to his oral output and matching it to his experiential knowledge of the language.

The next and probably most meaningful phase in the reading process, according to Goodman, is the "decoding" phase whereby the reader actually obtains meaning from the written text. Successful decoding depends entirely upon how closely the reconstituted language (the phonetic interpretation of the graphic print) resembles real language. This being accomplished comprehension is deterred only by limitations of vocabulary or experience in relation to the subject matter.

Goodman feels that we probably progress gradually and almost imperceptively through three levels of proficiency as we learn more and more

efficiently to obtain meaning from the graphic message. At a first level one very laboriously and consciously recodes individual phonemes, phonetic patterns and word names to an oral output which may have to be restated before it can be decoded into a meaningful message. At a second level of proficiency one recodes larger graphic sequences into oral language more efficiently, which in turn can be decoded almost immediately. At the third and most proficient level Goodman feels that the efficient reader perceives large graphic sequences which he immediately decodes into meaning. It is like the "Oral Language" phase becomes so subvocalized that it is imperceptible. The meaning of the passage becomes more important than the actual words.

Goodman perceives reading as an extension of the preschool language skills of the child and flatly states that children have frequently been hampered in their progress by teaching methods that have failed to take into consideration the present knowledge of psycholinguistics. "We have been teaching reading as a set of skills to be learned rather than as a language process to be mastered. We have been teaching children who are competent users of oral language as if they were beginners in language learning. We have ignored the language structure and in the name of teaching fed children strings of letters, or strings of words" (Goodman, 1972, p. 506). In short, Goodman's message is that we must build upon children's existing language competence and motivate them to read by building up a need to communicate through the written-reading form.

Each of the above five theories has pointed to the importance of the child's native language development in the successful mastery of the reading process. Weiner and Cromer talk of language skill prerequisites to identification; Gibson discusses the necessary link between spoken and

written language, still a theoretical puzzle even though an obvious fact; Fries emphasizes the necessity of language knowledge to close the gap between sounding letters and obtaining meaning from a written passage; Bannatyne places emphasis on the auditory function of reading showing that if the written material is not transposed to meaningful oral language it is useless; and Goodman stresses communication, which is first accomplished through language, as the underlying stimulant in learning to read. Each in its own way has recognized a skill learning level whereby graphemes are transposed into phonemes; followed by a later stage where meaningful communication becomes the center of focus while the grapheme-phoneme skill becomes so automatic that it could be called subconscious. Wiener and Cromer, Gibson, and Fries place their main focus on the reading process using language as an explanation for the development of their reading stages. Bannatyne places his emphasis on the importance of the auditory channel which, when adequately developed, will permit the various reading stages to take place. Goodman underlines communication as the central driving force in learning to speak as well as learning to read.

Such comprehensive theories not only emphasize the importance of language in the reading process but they shed a different light on reading problems. These theories have carefully spelled out the many underlying prerequisites essential for both the perceptual and conceptual skills required to "learn to read". A theory of reading disability must take cognizance of all of these underlying prerequisites some of which develop in earliest childhood.

The early history of dyslexia and learning disabilities has shown us that remedial techniques for children with severe reading problems have

remained predominately at the level of academics --or the reading acquisition itself. While the psychomotor therapists and many remedial reading teachers have attempted to remediate prereading or readiness skills there has been no therapy, that this researcher is aware of, which has attempted to remediate the native language prerequisites for a successful reading experience at the level of formal education. The Audio-Psycho-Phonological (APP) approach to language development and the remediation of language related problems (Tomatis, 1978) proposes to fill this gap.

APP theory emphasizes the role of proper listening attitudes in the acquisition of one's native language. Poor listening attitudes therefore are seen as the cause of faulty language acquisition which in turn leads to difficulties in learning at the level of formal schooling. The next section discusses this theory in greater detail.

Tomatis and Dyslexia

Dr. Alfred A. Tomatis, a French otolaryngologist by training, has over a period of thirty years, developed the APP theory of language development and language related problems--one of which is dyslexia. The term APP describes the interconnections that exist between a human being's listening and hearing potential (Audio); his psychological attitudes (Psycho); and his ability to control his speech and language output (Phonology). This theory is the result of Tomatis' personal discoveries in the treatment of people afflicted with language related problems. It has led him to the discovery of many new aspects of the human ear's functioning. Among these are a new understanding of how the ear listens and how one's listening habits influence speech, communication, reading, spelling as well as physical, neurological and psychological well being.

The history of APP stems from Tomatis' work in Industrial Medicine in the late 1940's. In these years he became interested in the relationship between hearing and phonation. His discoveries while treating patients, led to the formulation of three basic hypotheses which later became known as the Tomatis Laws.

The first of these laws states: "The voice contains only what the ear hears" or in more scientific terms: "The larynx emits only the harmonics that the ear can hear". (L. A. Tomatis, 1970, p. 6) Initially Tomatis had noticed that hearing problems in his industrial workers were always accompanied by vocal distortions. Later experimentation led him to discover that the absent vocal frequencies were identical to those which were poorest in the hearing test. This relationship between hearing and speaking was later verified scientifically by R. Husson (1957) in his laboratory.

Further experimentation by Tomatis whereby he was able, through a device called the Electronic Ear, to provide the missing frequencies to the voice of an individual led to the formulation of the second hypothesis or law. This law states: "If a defective ear is given the capability of hearing the lost or impaired frequencies correctly, these are instantly and unconsciously restored to the vocal emission" (L. A. Tomatis, 1970, p. 7).

The third law deals with the retention effect or the possibility of reeducating the listening capacity of the individual to the point where the phonation is actually changed and no longer requires the assistance of the Electronic Ear. This law is stated thus: "Auditory stimulation maintained for a determined period modifies, by the retention phenomenon,

the self listening faculty of the subject and consequently his phonation" (L. A. Tomatis, 1970, p. 8).

These three hypotheses or laws describe the complicated relationship between audition and phonation that is essential to the APP Remedial Training Program.

To understand the importance of the ear in the total language growth of an individual, Tomatis (1978) feels that one must appreciate four main functions of this sensory system based on complicated neurophysiological structures.

1. The first of these functions could be referred to as a "generator function" whereby the ear transforms sensory stimulation into energy to keep the cortex alert and functioning properly. The ear can provide up to ninety percent of the energy required to keep the cortex active by paying selective attention to the richer high frequencies which stimulate that section of the organ of corti where the receptors are more densely populated hence providing more neural energy.

2. The second function of the ear, according to Tomatis, is to assist in the development of the vestibular system. Phylogenetic evolution indicates that the ear and the vestibular system form an inseparable unit (Tomatis, 1974). Therefore in stimulating the ear one also stimulates the vestibular system in its functions of verticality, equilibrium, muscle tone and body awareness.

3. A third function of the ear is to listen and actively seek out the sounds that are pertinent to language and energizing. It should be emphasized at this point, that proper language-communication development according to Tomatis' theory is dependent upon good listening as opposed

to adequate hearing. In Tomatis' new theory of hearing, he emphasizes the adaptive and intentional quality of the tensory muscles of the middle ear. That is, tensing or relaxing of these muscles allows for greater or lesser transmission of sounds. Sound transmission, according to Tomatis, occurs via cranial vibration which affects the bone encased cochlear and vestibular systems rather than through the little bones of the middle ear as held by traditional theories of hearing.

4. The fourth function of the ear is its directing force in the establishment of laterality. Tomatis emphasizes the importance of the right "leading ear" for "self listening" (Tomatis, 1978) as the attainment of a Right leading ear is considered to be the catalyst in developing other lateral preferences such as eye, hand and foot. According to Tomatis, the right ear should assume the leading role in controlling vocal output. This favors a smoother flow of vocal and verbal expression, better timbre, intonation and articulation.

Tomatis Theory of Language Development

The interaction between the neurophysiological readiness of a human being to receive his native language and the social and physical environment in which he lives and develops, forms the basis of the Tomatis theory of normal language development. Tomatis (1978) states that the ear is functioning in utero by four months of age where it is picking up many sounds and sensations particularly those of the mother's bodily functions and voice. If the mother's voice is poor during this period (low in timbre or unusually silent) Tomatis feels that the foetus will not receive the stimulating vibrations that permit it to distinguish and familiarize itself with this figure with which it will try to reunite

itself after birth. For Tomatis, this prenatal conditioning is the driving force in giving the child the desire to communicate in his early post natal years.

During the birth process the child is transmitted from the warm secure liquid medium of the womb into a cold wide air environment. This is both an auditory and a physical shock since the air medium transmits a much wider variation of sounds. There is a ten day gradual adjustment period as the ears, in particular the eustachian tubes, gradually empty themselves of the amniotic fluid. During this period the baby slowly assimilates the lower tones of the mother's voice so that he learns to recognize this one central figure via the air medium.

After this early post natal opening to the medium of air acoustics the child begins to play a gradually differentiating role within his environment. His normal physical development interacts with the environment; with his dawning awareness of his surroundings; and with his efforts to communicate physically and verbally with things and people. Thus he gradually evolves first laterality of action and eventually laterality of language.

Between three and four years of age, according to APP theory, the child gradually moves away from the close relationship with its mother to a wider social world. The father, or father substitute, is the first "other than mother" relationship that a child usually has. If the child's encounters with this other figure are positive, the child will desire a communication and attune his body to listen, thereby strengthening the auditory control of speech via the right ear. This in turn will enhance clear articulation and self listening. If the relationship is negative

the child will shut out the outer world and remain at the early postnatal stage preventing the proper development of the neurophysiological system and blocking the emergence of language as an expression of oneself. (Tomatis, 1978) The inner part of the tympanus is innervated by the tenth cranial or vagus nerve which links this surface to many bodily and visceral functions thereby creating psychosomatic loops that can explain the positive or negative reactions to certain sounds or voices. These functions add richness and meaning to one's own body image and to self expression; but, if they become the focus of listening and concern they prevent one from attending to the real world of other people which forms the basis of good communication.

Language viewed this way is a total human phenomenon drawing from linguistics, psycholinguistics, sociolinguistics, neurolinguistics as well as the psychological study of language. Even one's own body language, that is one's posture and coordination of movements in the act of self-expression, yield important clues to listening habits for the informed observer. Communication, as explained by Tomatis, refers to: discourse with others, discourse with self, being fully in touch with the outer world and inner life. This, for Tomatis, is the communication that must be adequately developed before one can hope to benefit from or be able to learn and effectively use the skill called "reading". To achieve this sign-sound match Tomatis feels that one must be able to differentiate auditorally and to articulate adequately the various sounds in his/her native language and then to read smoothly one must be aware of the syntactical structures of the native language.

Dyslexia then, for Tomatis, is a problem in language communication. The reading difficulty is the symptom that has been recognized in the academic setting. As such it is simply a late indicator of a language communication problem. Tomatis' view of dyslexia is a much broader view than those described earlier in this chapter. As such it might be criticized by some as being too all inclusive. Tomatis frequently makes reference to "mild" and "severe" dyslexia, suggesting degrees of dyslexia, again not according to reading problems, but according to the stage at which the child's normal APP communication development was interrupted. Dyslexia therefore extends to every relationship or to everything an individual has to integrate. The dyslexic does not only not know how to read, he cannot correctly decipher and comprehend the world around him. (Tomatis, 1978)

Such a definition of dyslexia goes far beyond the operational definition of dyslexia used for this research project. One might expect therefore that Tomatis' selection of dyslexic children would be far more inclusive than children who might fit the operational definition outlined in this chapter.

APP Remedial Training Program

The APP Remedial Training Program is a direct outcome of Tomatis' theory of language development. This treatment program starts with a thorough assessment which includes a Listening test, an Audiometerometry test, and a Personal Interview whereby the individual's voice parameters and bodily reactions are assessed. During remedial training a program assistant, in conjunction with an instrument called the Electronic Ear, works with the dyslexic.

This remedial training program consists of two main phases: Passive and Active, each divided into two subphases. The Passive Phase consists of the subphases called Filtered Sounds and Sonic Birth. In the first of these the subject experiences listening to his mother's voice filtered at high frequencies, believed to simulate the prenatal stage. In the second subphase the subject experiences listening to the mother's voice as the lower frequencies are permitted to enter it in much the same way they would have done during the first ten days of post natal life. According to theory, the subject is seen as having a second chance to complete the mother-child relationship within the acoustic medium of the wider world. Upon successful completion of the Passive Phase, the subject is introduced to the Active Phase of the program.

The first subphase of the Active Phase is called Performance. Here the dyslexic is given the opportunity, via the Electronic Ear, to hear sounds, words, phrases etc. in much the same way that the non-dyslexic person experiences them. He is then encouraged to repeat these as he now hears them. It is believed that this new listening posture and repetition begins to strengthen the audio-phonological connections that lead to right ear listening with all its important implications as described earlier under "functions of the ear". The final subphase is one of Training. The individual, now open or attuned to listening, has the opportunity to practice language both with self and others to firmly establish the neuro-physiological loops that will permit continued development.

Controversial Issues

The writer does not wish to enter into a detailed critical analysis of the Tomatis theory as it would constitute a complete theoretical research

of its own. Rather she wishes to take cognizance of the fact that the theory and its remedial technique are of a controversial nature and to emphasize the fact that much further experimental research is needed to verify the theoretical claims of Tomatis as well as the assessment techniques used in the APP Remedial Training Program.

In the literature there is some support for Tomatis' developmental approach to language which he bases upon an integration of phylogenetic (Hebb, 1973; Lenneberg, 1967) psychoanalytic (Freud, 1913; Peller, 1964) and sociological (Kell & Burow, 1970; Parsons, 1954) perspectives. However his statements are frequently overgeneralized and without sufficient verification. At times his theorizing deviates from present knowledge in the areas of audiology and neurophysiology whereby he invites severe criticism from practitioners and researchers in these fields. The writer therefore wishes to draw the reader's attention to some of the controversial issues.

Tomatis (1978) claims that the left hemisphere is critical in the mediation of speech and therefore right ear control of speech is inevitable because of its direct anatomical connections with the left hemisphere.

However experimentation by Bryden, 1963; Kimura, 1961; Milner, 1962; Penfield & Roberts, 1959; Zangwill, 1962; and others has demonstrated that while for the majority of people speech is mediated by the left hemisphere there does appear to be a small number of people in whom speech is mediated either bilaterally or by the right cerebral hemisphere. If such is the case then one might question what the nature of the result of the APP Remedial Training toward right ear dominance (left hemisphere) would have on their neuro-psychological organization.

Recent research by Geshwind and Levitsky (1968, 1970) has demonstrated an anatomical difference in the auditory cortex of the two hemispheres of the brain. It provides structural evidence for the superiority of the left hemisphere in matters pertaining to the organization of language and laterality. This would appear to be in contradiction to Tomatis' (1978) assertion that the two hemispheres are anatomically symmetrical and that it is the vagus nerve with its visceral afferents to the vocal apparatus; which imposes asymmetry on the hemispheres through phonation and language.

Both in his theory and in his APP Remedial Training Program Tomatis insists that right ear self-listening is important not only for speech but for musical expression as well. This would appear to be in contradiction to the work of Bryden, 1963; Kimura, 1964; Kinsbourne, 1971; Milner, 1962; who have demonstrated a left ear dominance and right hemispheric superiority in matters related to melody and musical stimulation. However a single recent study by Bever and Chiarello, 1974 indicates a right ear superiority when musically experienced listeners are involved in singing or playing as opposed to a left ear superiority for musically naive subjects. This research needs to be replicated but points to a possible distinction, on the hemispheric level, between a global and an analytical approach to musical listening.

Tomatis bases his remedial training program on his theorizing that two of the main functions of the ear are to supply cortical energy to the brain, and to establish equilibrium and integrate the bodily systems via a cochlear vestibular hierarchy. However, Tomatis does not supply sufficient research evidence to support these intriguing important theoretical claims which underly his APP Remedial Training Program.



Tomatis' theory of language development emphasizes the initial role of the mother in supplying a desire to communicate in the early years of life. Further he points out the father's role in supplying a good language model for the child beyond three or four years. In our time of family break up, greater father participation in early child care, and female occupational interests outside the home one wonders if there are not other viable theories or models to explain effective language development.

From the technical point of view, the Tomatis assessment tools still require experimental verification for method of presentation; validity and reliability studies; as well as more precise guidelines for interpretation. Some of these issues will be addressed in more detail in chapter two.

Despite the aforementioned theoretical issues the APP approach to language and language related problems emphasizes the complex and hierarchical development of language as communication. It also accounts for various types of language related problems depending upon the stage of development an individual had reached prior to encountering a break in socio-affective communication. Tomatis' emphasis on the neurophysiological functions of the ear seems to account for many of the pre-reading perceptual skills that are often faulty in the dyslexic child. It would seem that poor development of one's listening skills could very easily lead to a lack of energy for attention and concentration on tasks; poor posture and laterality of control over motor functioning; as well as the many problems encountered in pronunciation, articulation etc. One might therefore expect that a remedial program based on APP theory could have

an influence on any of the underlying processes essential for adequate reading.

The present research examines two developmental areas that are seen as important prerequisites to reading. These are Cognitive Control Functioning and Spontaneous Speech. The writer wishes to evaluate the changes that occur in these two areas as five dyslexic boys (so defined by the operational definition) progress in an APP remedial training program.

Cognitive Controls

Several researchers have concerned themselves with the role cognition plays in reading particularly at the higher level of comprehension. Numerous have been the studies between IQ and reading ability/disability. This review of the literature has pointed out the interest that has existed in the relationship between perceptual abilities and reading. Cognitive Control theory deals with a slightly different approach to the matter of environmental intake. It refers to an individual's uniqueness in taking in or absorbing the information available in his environment. They are "controls" or "limits" placed on the use of cognitive/intellectual abilities in the face of particular situations. It has little to do with actual comprehension or intellectual abilities as such; other than inhibiting or freeing them to work.

Biodevelopmental Framework

Santostefano, in his work, takes the cognitive controls described by Klein, formulates a biodevelopmental model of these controls and adapts them to clinical work with children. In his work he has managed to go beyond the mere presence or absence of certain traits by demonstrating stages or levels of cognitive functioning through which a child can move,

progressively or regressively, in development and in dealing with changing environments. Santostefano describes both his concept of Cognitive Controls and their functions thus:

Cognitive controls have the status of intervening variables which define principles by which perception, memory and other basic qualitative forms of cognitive functioning are organized as an individual coordinates himself with his environment. Specifically cognitive controls are defined as mechanisms or principles which: (1) govern and determine the amount and organization of information which become available to an individual perceiver; (2) are activated by specific classes of stimuli which cause the individual to experience some intention to use and adapt to the information; (3) vary in the extent to which they operate in the cognitive functioning of the individuals; (4) evolve, in part, as a function of maturation and life experiences and become independent (autonomous) from their origin of development; (5) mediate the influence of personality and motivation in the individual's cognitive encounters with the environment; (6) become enduring aspects of the individual's cognitive functioning and adaptive style and, thus give shape to his subsequent cognitive experiences. (Santostefano, 1978, p. 100)

In his work Santostefano has tried to integrate cognitive psychology with biodevelopmental principles, psychoanalytic concepts and the child clinician's need for new technology. In short, the cognitive controls of George Klein are elaborated by Santostefano to include pertinent issues of development and adaptation. The biodevelopmental frame he develops from: the psychoanalytic theories of ego psychology expressed by Hartmann; the cognitive developmental theory of Piaget; and, the organismic developmental theory of Werner. Cognitive controls are seen as information processing strategies that change slowly during childhood in a direction of greater or increasing differentiation and integration defining five levels of organization during this course of development. Tests were constructed to diagnostically assess each level.

Body Schema-Tempo Regulation is the first of these levels. This was introduced by Santostefano himself as a result of his attempts to formulate a complete schema of development from earliest childhood (body percepts) to mature adult behavior (conceptual thought). The Body Schema-Tempo Regulation Test diagnostically assesses this level of cognitive control development.

Focal Attention defines the second level of cognitive control functioning and is assessed by the Scattered Scanning Test. This level of cognitive control development concerns the manner in which an individual directs his/her attention to the stimulus field and scans it.

Field Articulation is the name given to the third level of cognitive control development. It is assessed by the Fruit Distraction Test. This control deals with the selective deployment of attention.

Leveling-Sharpening, the fourth level, is assessed by the Leveling-Sharpening House Test. This level describes an individual's ability to manage material that remains stable and changes over time.

Equivalence Range or conceptual differentiation forms the fifth and final level of the schema. It describes the manner in which an individual relates, categorizes and conceptualizes information. This level is assessed by the Object Sort Test.

At this point in time Santostefano has limited his research to the pre-defined controls of George Klein (Biodevelopmental levels two, three, four and five) plus Body Schema-Tempo Regulation, level one. At the time this research was initiated Santostefano had reformulated Klein's work and had completed construction of tests to measure levels two through five thereby allowing one to assess cognitive control functioning developmentally

in young children. Figure 1 attempts to illustrate the developmental process both within each level and between levels. It is important to note that one level is not superseded by the next but that each higher level is built upon the previous levels. Also the adequately maturing individual will have all ranges within levels and all five levels available to him. In normal populations Santostefano has found that all five levels are available to children by eleven years of age (1978, pp. 320-322). In a clinical or abnormal population of any kind one finds very peculiar patterns. Depending on the circumstances and/or age of "derailment" one may have very inadequately developed earlier levels of control with the later ones being more maturely developed yet unable to function adequately due to restricted experiential intake. In other cases the earlier developmental levels may have been very adequately developed but circumstance has hindered development of later levels.

Studies with the Learning Disabled

In a study dealing with learning disabled children Denny (1974) compared good and poor readers (grades two to five) on several cognitive tasks, one of which was Santostefano's Fruit Distraction Test measuring the level of Field Articulation, or the ability to focus in on pertinent and relevant material. He found that of the tests used, it was the Fruit Distraction Test that discriminated good and poor readers.

In 1965 Santostefano, Rutledge and Randall examined the relationship between reading disabilities and three cognitive controls. Again it was the Fruit Distraction Test that separated the learning disabled from the normals at the .05 level of significance.

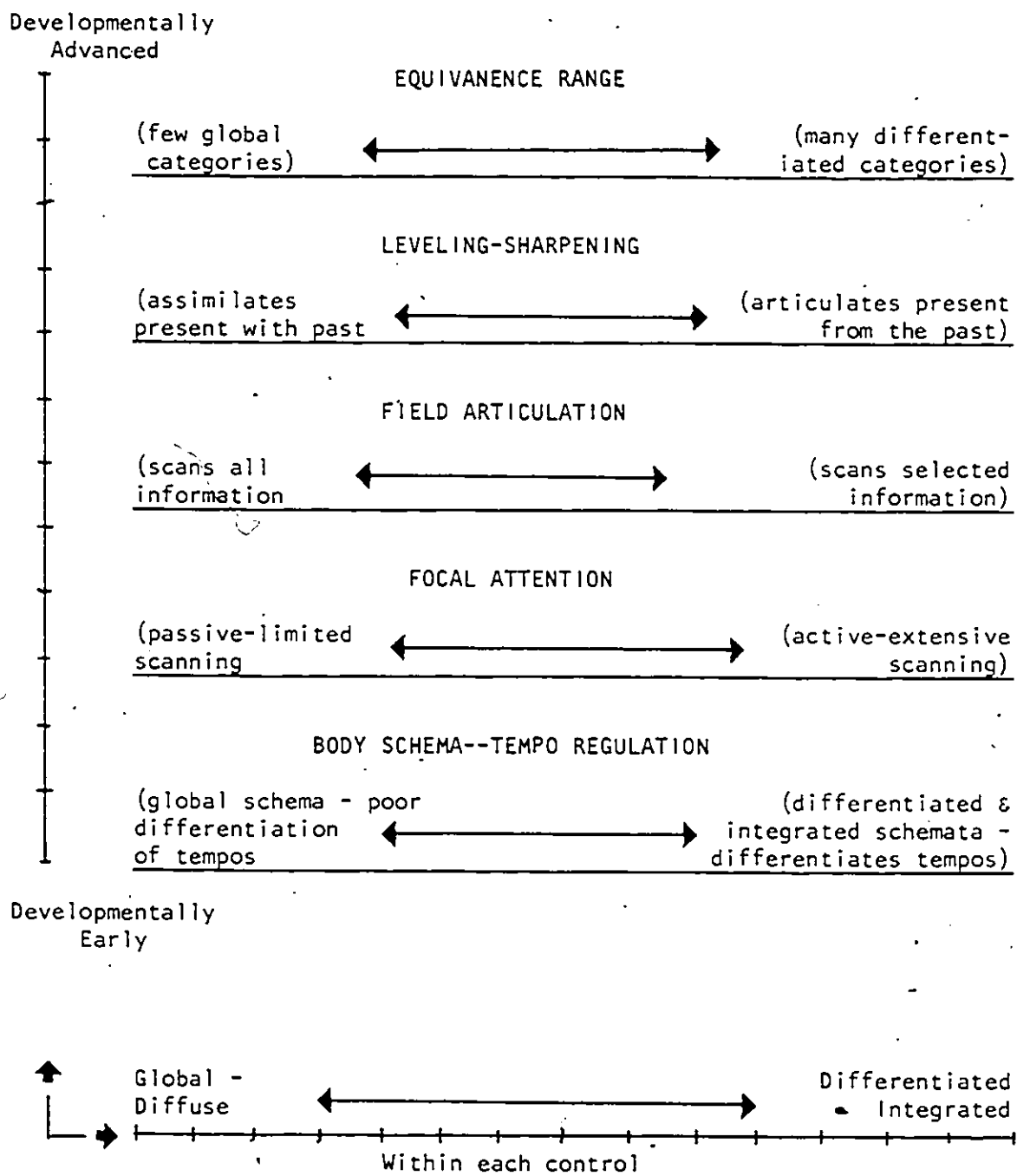


Figure 1. The Biodevelopmental Framework

Santostefano's work is of particular interest to this writer because theoretically it logically accounts for the individualized nature of the child's perceptual intake of the environment. The dyslexic is unable to assimilate his educational environment in the usual fashion. In the field of perceptual development Biodevelopmental theory attempts to account for the influence of early life experiences on later life experiences and likewise attempts to throw light on the reasons why a child who is encountering difficulties in the academic environment may already be perceptually fixated in such a way as to prohibit learning. APP Remedial Training purports to allow an individual to re-experience, in a developmental sequence, his early environmental experiences and thereby reopen or initiate a new contact with his environment. If this were the case one might expect to see a change in cognitive control functioning as the dyslexic has the opportunity to reintegrate early life experiences.

In defining dyslexia as an individual problem with various root causes it seems feasible to expect some, if not all, of the children in the present research study to have their own individual unique pattern of cognitive control functioning. For this reason the cognitive control functioning of each child is assessed at the beginning of therapy and reassessed periodically throughout remedial training in order to analyse the processes of change these controls take during the remedial program. The work of Santostefano leads one to expect immature development in some, if not all, levels of cognitive controls. These should show maturity in a positive direction as remediation progresses.

It is important to mention that Santostefano has found that pathological cases have frequently demonstrated marked instability in their

pattern of cognitive control functioning whereas the "normal" individual's pattern of cognitive control functioning is consistent over time provided there are not unexpected emergencies in the environment at which time the normal person will regress or even progress depending upon the emergency to be dealt with. That is, there is a certain plasticity of controls necessary to deal with emergencies in the environment but the normal individual has a certain expected pattern of controls within the framework of gradual development. Pathological cases frequently do not possess a steady pattern and/or are frequently very restricted in their development on each of the levels.

Spontaneous Speech.

While the reading experts have been busy, in the last decade, trying to decipher how a normal child learns to read; the linguistic experts have been pondering how it is that small children develop the use of their native language (Braine, 1963; Brown & Fraser, 1963; McNeill, 1966; Miller & Ervin, 1964). Many reading experts appear to have concluded that language development is pertinent to reading while many linguists have concluded that learning, maturation and social cultural factors are all important in the development of language. Tomatis' Audio-Psycho-Phonological theory of language aims to encompass all of these important findings:

As we progress towards acquisition of reading and writing skills, the ear evolves until it becomes a complex machine for hearing, analyzing, retranscribing and reintegrating anything originally projected from it. As we have pointed out so often before, the royal way to language is through the ear. (Tomatis, 1978, p. 61)

While the measurement of a child's speech competence gives us some indication as to how well a child can understand what is spoken to him in his own native language, it tells us little, if anything, about how

effectively he uses his native language to express and communicate his ideas and feelings. For Tomatis, these are essential aspects in the development of language. In discussing speech he states:

What we are talking about here is the most complex act a human being can perform. To do it he must coordinate his entire body to achieve a single goal; the act of speaking. To speak is to be, to verbalize thought, to pattern thought in the body's image; when we speak we speak of and to ourselves, we listen to ourselves, we exist. (Tomatis, 1968, p. 67)

Since the voice is a reflection of what the ear hears first directly as to the sounds heard and spoken; and indirectly since ideas, feelings, grammatical constructions are a reflection of better neural organization, this researcher feels that the child's spontaneous speech should best reflect language development.

In the writer's opinion, the tests available for assessing language production and/or competence in children, were not suitable for measuring a child's ability to put his thoughts, feelings and experiences into words. The best tests scrutinize minute pieces of grammar that indicate the linguistic developmental status of the individual according to a norm of expected development. The worst tests, in the writer's opinion, are those that require the child to fill in blanks to complete an already partially expressed idea. To best understand or capture an individual's effort to place thought into words, one must examine his spontaneous speech under everyday circumstances with his peers and/or adults. In the present research, to best simulate everyday situations, structured, semi-structured, and unstructured situations were set up in which the child was required to communicate with either an adult and/or peer. It was felt that spontaneous speech samples taken in these three situations

periodically throughout the remedial training phase of this study, would reflect the process of change in language development as remedial training progressed.

Analysis of such material becomes a very difficult task especially in the light of such little work having been done on the spontaneous speech of children beyond five years of age.

The spontaneous speech samples are extremely rich in material but, for the sake of research restrictions, the analyses have been limited to three dimensions which will be described in greater detail in the chapter on Research Design. These analyses examine: development of syntax based on Laura Lee's (1974) work; Communication and Maze behavior based on Walter Loban's (1976) work; and, certain qualities of language style which were judged by persons familiar with child speech at these particular age levels. The present analyses have been determined partly by the availability or lack of availability of published norms or studies of children's spontaneous speech beyond five years of age; and partly by the knowledge that the three areas selected reflect the developmental maturity of one's native language.

Child language enthusiasts such as Brown (1973), McNeill (1966) and many others, have demonstrated that a child's native language development grows from a one word utterance through an ever expanding use of gradually more complex interrelationships of words to express an idea. Thus the complexity of the syntactical usage of a child reflects the growth stage of his native language. Most studies in child language assume that all the necessary structures are available to the child by five years of age. However, Carol Chomsky (1969, 1971) and David Palermo with Dennis Molfese

(1972) have demonstrated that more complex syntactical structures are learned beyond that age.

Syntax is the structure through which meaning is communicated (Chomsky, 1965) in speech. Therefore the complexity of one's syntactical structures should be a reflection of one's ability to transpose thought into language. Laura Lee (1974) has developed an eight point weighted system to assess syntactical development in children. Using this as a measuring stick the writer proposes to examine the syntactical structures of spontaneous speech samples taken periodically during the APP remedial training program. It is hypothesized that the maturing native language enhanced by successful remediation should be reflected in more complex syntactical usage by the child.

Loban (1976) has demonstrated that the length of a child's Communication Unit is indicative of the maturity of his language development. It is therefore hypothesized that a dyslexic child responding positively to an APP remedial training program should gradually begin to use Units of Communication that are equal in length to those typical for his age. Spontaneous speech samples taken periodically during the treatment phase of this study will be examined for "length of Communication Units". Loban (1976) discusses a second unit of measurement which is of interest in the present study. This is the use of Mazes which are defined as false starts, hesitations, partial words or any type of language tangle that does not express a thought. However, in his longitudinal study Loban found that these Mazes did not appear to be developmental in nature. That is, the children seemed to have the same percentage of Maze Words in their oral speech at the end of grade twelve as they started out with in kindergarten. Loban therefore suggests that Maze Behavior may be more

related to personality than to development or learning. The present study considers Maze Behavior in the spontaneous speech samples to ascertain what effect, if any, the various phases of the APP remedial training program have on the percentage of Maze words used by these children in their efforts to express their thoughts.

The APP approach to language development encompasses many aspects of language communication that cannot be tapped by currently available test materials. The writer therefore has developed a scale to measure eight aspects of language style that one would expect to be influenced by the APP remedial training program.

Summary

The review of the history of dyslexia has served to emphasize the breadth and complexity of the problem. What started out originally to be a symptom of a specific organic deficiency has developed into a complex syndrome indicating the individuality of the dyslexic's problems. The need for adequate therapeutic programs was recognized as early as the 1930's and while some of these have been very successful in assisting certain types of poor readers, they have been less successful with the group of children defined as dyslexic according to a definition such as the operational one in this chapter.

The diversity of definitions for children with problems in reading, plus the tendency to generalize treatment programs, led to a need for redefinition and classification of children with problems in reading. This brought out the fact that there did exist a group of children who, despite good intelligence, opportunity to learn, seemingly adequate emotional background, and freedom from organic deficiencies, were unable to



learn in line with intellectual expectancy. This however points to the heterogeneity of the problem. It seems that at this point in time, dyslexia is best diagnosed through elimination of factors rather than by the identification of specific symptoms.



The recognition of a need for more successful therapeutic programs led to an examination of the reading process as it is accomplished by successful readers. There is a general agreement that this consists of a two stage process: the first, a skill level whereby the child learns to translate letters and groups of letters into sounds and words; the second, a comprehension level where the child's grasp of his native language is essential to comprehend the message communicated through the printed symbols. Remedial techniques have tended to work on the first or skill level. It is generally believed that the second level will come automatically if the first functions adequately. While people such as Bannatyne stress the importance of language, his remedial program works on skill modification such as sequencing, memory, discrimination of phoneme blending etc. and not on the child's grasp of his native language as a tool to receive and communicate ideas.

Dyslexia is usually defined operationally in terms of a reading problem. Therapeutic programs are consequently designed on the basis of theories of reading and prereading skills. The APP approach to language and language related problems views dyslexia as one of several problems which may develop as the result of inadequate or underdeveloped use of one's native language as a vehicle of communication. As such it becomes basically a communication problem rather than a reading problem. Dyslexics, for Tomatis, suffer from any number of possible difficulties ranging from

the most profound dyslexic who has never formed the initial mother-child bond to the much milder, and perhaps more easily remediated, dyslexic with minor speech problems. As such Tomatis does not eliminate the possibility of emotional or physical causes of dyslexia. Although such a broad definition of dyslexia may be too all encompassing for our scientific type of research, the APP theory appears to account for the heterogeneous nature of dyslexia. The theory accounts for native language development, reading readiness skills such as attention, focusing, laterality; and reading skills such as sound blending and phonics. The APP treatment program aims to integrate all of these aspects as it assists the dyslexic in "tuning his ears" to human communication. Further, in conjunction with individual evaluation the APP Remedial Training Program can be and should be individualized to suit each individual dyslexic.

While Tomatis himself claims to have used the APP remedial training program with success on some 12,000 cases of dyslexia, the effectiveness of the various phases of the program have never been subjected to rigorous scientific investigation.

Rationale and Research Expectations

The APP theory of language and language related problems leads this writer to suspect that successful remediation via an APP remedial training program could assist each dyslexic with his own unique problems which are preventing him from reading as would be expected in accordance with his intellectual potential and grade placement.

Reading theorists such as Wiener and Cromer, Gibson, and Fries stress the importance of the many underlying perceptual prerequisites to reading. These include: attentional mechanisms; the need to actively

explore one's environment; an ability to discriminate and to select relevant from irrelevant material; as well as an ability to form classes or sets through observation of commonalities. These prerequisites to the first or skill level of reading are developmental issues which are in accordance with the various hierarchical levels of Santostefano's bio-developmental framework. Immature development on any of these levels leads to a skewed development of cognitive control functioning.

Bannatyne and Goodman start from a different tack by emphasizing one's native language as the essential prerequisite to a successful reading experience. Since the level of comprehension presented in school reading curricula is geared to meet the language development and interest of the average child in each academic level dyslexics cannot gain information from this written material. A successful APP remedial training program could assist the child in the development of his native language as a tool for communication so that he might reach a level whereby reading will become a pleasure and a tool for learning.

The reading theories presented earlier in this chapter all emphasized the two step process in learning to read: that is, a skill level whereby the auditory sounds are linked to the visual forms; and, a comprehension level whereby meaning or information is gleaned from the printed material. The writer likewise emphasized earlier the need to be efficient in both levels before one could be considered a "reader". Accordingly it would seem that cognitive control and spontaneous speech measures would be likely to show improvement before those measures used to assess academic or reading achievement.

APP theory is concerned with the development and remediation of an individual's native language as a tool for communication. It does not propose to remediate reading as such. However theoretically it recognizes that adequate development in language as communication should lead to a positive achievement in reading. Hence reading would be expected to show improvement only within the later phases of the remedial training program, and would be expected to progress slowly as the language facility matured.

The present research presents an in depth Case Study of five individual children who meet the criteria for dyslexia according to: the operational definition defined in this chapter; and, Dr. Tomatis' criteria for dyslexia. Since adequate development in both cognitive control functioning and spontaneous speech have been seen as vital to successful reading, the writer proposes to examine the process and pattern of change in cognitive control functioning and spontaneous speech in five dyslexic children as they progress through the various phases of an individualized APP remedial training program.

While such an approach prohibits the formulation of experimental hypotheses, certain research expectations can be formulated. The general research expectation developed from this review of the literature is stated as follows: Cognitive control functioning and spontaneous speech will demonstrate change during an individualized APP remedial training program.

The General Research Expectation must then be subdivided to ascertain the more subtle interrelationships of specific cognitive control strategies and spontaneous speech skills being evaluated as the individualized APP remedial training programs progress. These research expectations have

been formulated as follows:

1. Poorly developed levels of cognitive control functioning should manifest change in the direction of increased maturity as formulated within Santostefano's biodevelopmental framework..
2. Immature use of syntactical structures in spontaneous speech samples should develop in the direction of mature syntactical structures in accordance with age expectations.
3. ~~Vague~~ and undetermined expression of ideas in spontaneous speech samples, should demonstrate change in the direction of vivacious and clear expression of ideas..
4. The use of language tangles and hesitations in spontaneous speech samples should decrease in accordance with the percentage expected of fluent speakers.
5. Those aspects of Language Style considered to be immature in the spontaneous speech samples, should develop in accordance with expected performance. That is: concrete, unorganized and unrealistic story content should become more dynamic, organized and realistic; ego-centric and structured dependency in the interpersonal aspects of story telling should move towards social and self directed relationships; a halting, monotonous, mumbled voice should become more fluent, expressive and distinct.

The next chapter describes in detail, the design and procedures used to carry out these research proposals.

CHAPTER II

Experimental Design

The theoretical discussions presented in Chapter I have attempted to demonstrate the complexity of the syndrome called dyslexia with its network of possible underlying causes. The Tomatis APP remedial training program was presented as a possible effective remediation for dyslexia. This second chapter describes in detail, the research design used to assess the influence of APP remedial training on cognitive control functioning and spontaneous speech, both thought to be important prerequisites to a successful reading experience. The research project will be presented and discussed under the following headings: Single Subject Design; Identification of Subjects; Description of Assessment Tools; Procedures; and, Analysis of the Data.

Single Subject Design

The researcher was faced with the problem of finding an experimental design which would respect both the individualized treatment program required by each dyslexic and the requirements of scientific research. A Single Subject Design appeared to meet these qualifications. Dukes (1965) pointed out the fact that single subject research was not novel to the field of psychology, in fact it is probably as old as the science itself. However, its importance did wane during the forties and fifties when statistical quantifications for group research were seen as more informative. In recent years new interest has arisen in Single Subject Designs,

most particularly in the therapeutic fields where individual differences are most pronounced and often play an important role in the effectiveness of treatment programs.

Of the many quasi-experimental Single Case Research Designs described by Campbell & Stanley (1963) the Time Series appears to fit the needs of the present research project. The writer wishes to assess the pattern of change in Cognitive Controls and Spontaneous Speech as each of five boys progress through a four phase remedial program. The length of each phase, within the remedial program, is dependent upon the individual rate of maturation of each child in his APP remediation. The length of the various phases is likely to be quite different for each child. A continued series of regular assessments of the dependent variables should therefore indicate change in slope with the intervention of the various phases of the remedial program, if the program is influencing the dependent variable(s).

The particular design chosen for this research project includes a two month baseline period; a ten month remedial training period; and a two month follow-up period. A two month assessment schedule was selected for the dependent variables to ensure the recording of change in these variables for even the quickest to remediate of the children. A ten month remediation period was chosen in part based on the prediction by Dr. Tomatis, concerning the probable length of remediation for the various children, and in part by the realistic time constraints for the completion of the research project. Figure 2 depicts the fourteen month period covered by the three phases of this research design.

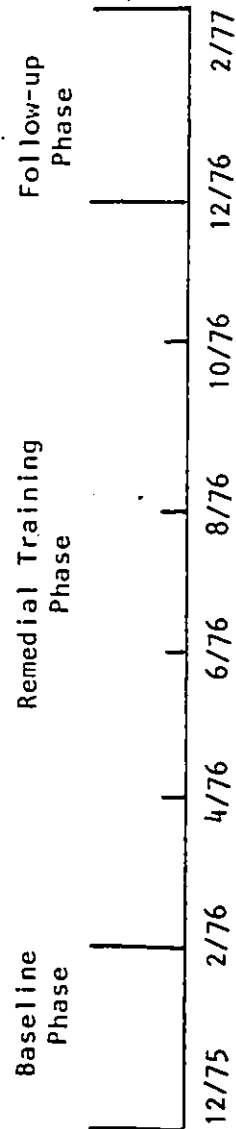


Figure 2. Time Series Design including a two month Baseline and a two month Follow-up period.

Identification of Subjects

Initially eight boys, who according to academic standards and teachers' reports appeared to be dyslexic, were selected from The Child Study Centre population as possible subjects for this research project. These boys were then assessed according to criteria selected on the basis of the operational definition outlined in Chapter 1; which states that dyslexia is a psychological and/or neurological impediment to perceptual and/or communicative behavior manifested in significant discrepancies between estimated potential and academic achievement. It is not primarily due to severe mental deficiency, brain damage, sensory handicaps, emotional problems or lack of opportunity to learn. All eight boys were also interviewed and assessed by Dr. Tomatis according to his criteria for dyslexia. Five of the eight boys proved acceptable on all accounts. These five were retained for the study.

Selection Criteria

Each child's estimated intellectual potential was assessed by The Wechsler Intelligence Scale for Children - Revised (1974) (hereafter referred to as WISC-R); and his academic achievement by combining the results from The Wide Range Achievement Test (WRAT) and the Gates MacGinitie Reading Test.

The discrepancy between potential and achievement was worked out in accordance with Myklebust's (1968) Learning Quotient.

$$\frac{\text{Achievement Age}}{\text{Expectancy Age}} = \text{Learning Quotient}$$

The Expectancy Age for this formula takes into consideration a child's intellectual potential, his physiological maturity and his opportunity for learning.

$$\frac{\text{Mental Age} + \text{Life Age} + \text{Grade Age}}{3} = \text{Expectancy Age}$$

In this formula Mental Age equals the higher of the Verbal/Performance IQ's; Life Age is chronological age; and Grade Age is based on the Mean Age/Grade Table by Year and Month as used in the Ottawa Separate School System (Appendix B). This gives a realistic picture of the child's potential as it takes into account the physiological, experiential and mental aspects of his maturity. A Learning Quotient below 90 is considered an indication of Learning Disability (Myklebust, 1968).

Traditional methods of calculating the discrepancy between intellectual potential and actual grade placement tend to inflate the discrepancy score. They fail to account for restrictions placed on a child simply by the state of his physiological maturity and his past opportunities for learning. In short, a bright younger child who has not had certain physiological experiences simply because of his chronological age and grade placement (usually based on chronological age) has not been exposed to certain skills more in line with his intellectual potential. On the other hand, the practice of calculating a learning discrepancy by simply taking the difference between the expected grade placement and the grade level achieved on a reading test does not pick out the bright youngster achieving at average level. This child too is a Learning Disabled Child. In this particular study, one child, of the eight originally chosen, did not have a Learning Quotient below 90.

Dr. Ronald Trites, Director of the Neuropsychological Laboratory at the Royal Ottawa Hospital, reviewed each of the eight cases to screen for possible organic involvement. One of the eight was eliminated because of possible left hemisphere damage.

A careful and detailed developmental history, including family and academic background, was taken of each of the eight children. From this one could screen the possible presence of sensory handicaps, emotional problems, or lack of opportunity to learn. The academic history demonstrated that the child had been unable to learn according to regular classroom procedures and would therefore require special remedial instruction. One child was eliminated from the group as his history indicated the presence of emotional problems.

The present study also used, as a further screening tool for dyslexia, Myklebust's Pupil Rating Scale (PRS) which takes into account factors other than academic achievement. This rating scale was evaluated by three staff members involved with the children in their everyday activities both in and out of the classroom. It was completed by mutual agreement to insure greater consensus. A cut off score of 70 was used to choose the dyslexic candidates. This figure was approximately the mid point between the Mean for the Learning Disabled Groups described in the manual, and the Mean for the Control Groups.

Dr. Tomatis himself interviewed the eight initial candidates and assessed them according to his own three fold criteria. This includes The Listening Test to assess listening attitudes as opposed to hearing ability; the test of Audiolaterometry for assessing auditory-vocal laterality; and, a Personal Interview which Tomatis uses to assess the behavioral and relational attitudes of the child in his social setting.

Of the eight children originally selected from the school population of the Child Study Centre, five were retained for the study. Three were eliminated because they did not meet all the criteria of the operational

definition. One was eliminated because he failed to meet the criterion for dyslexia on the Learning Quotient; a second because of suspected organic involvement and a third because of the presence of emotional problems. The socio-economic status of these five families ranged from average to better than average. Using Blishen's Socio-Economic Index for Occupations in Canada, it was established that four of the families fell within the first or highest socio-economic class, while the fifth family fell within the third class (Blishen, 1967, pp. 44-45). All five families were English speaking Caucasians. The one colored boy had been adopted by a Caucasian family as a baby.

Description of Selection Criteria

Objective Tests. The WISC-R was chosen as the measure for assessing intellectual potential since it assesses verbal and performance abilities independently. The test score used in computing the expectancy age was the higher of the two. This eliminates the danger of identifying only the children with verbal learning deficiencies. As described by Myklebust (1968, p. 4), "Nonverbal learning disabilities are at least as consequential and debilitating to behavior as are verbal deficits". In addition to selecting this test because of its dual IQ scores, the WISC-R is an excellent tool for assessing the intellectual capacities of children between the ages of six years zero months and sixteen years eleven months. Furthermore because of its construction whereby the standard deviations and the means of all age groups are identical, any changes observed in subsequent IQ testings can be ascribed to changes in the subject and not to the structure of the test nor its standardization (Wechsler, 1974). Split half reliability studies done across the entire age range of six to

sixteen years, yield average coefficients of .94, .90, and .96 for Verbal, Performance and Full Scale IQ's respectively. The correlational study between the WISC-R and the Stanford Binet suggests that they yield similar IQ's for normal children between the ages of six and sixteen years thus contributing to the validity of the WISC-R as a measure of general intelligence (Wechsler, 1974). The Mental Age was calculated by the formula

$$MA = \frac{IQ \times CA}{100}$$

Over the years the WRAT has proven itself as an effective measurement of the basic academic skills reading, written spelling, and arithmetic computation. Thus it was used in this study to assist in establishing each subject's present achievement level. This test, at any particular age level, consists of three subtests: Reading--basically a test of word recognition which tends to overrate the true reading ability of the individual while at the same time giving many valuable clues as to that individual's word attack skills. Written Spelling--a test which gives not only an achievement score but as well gives important clues about related skills such as letter reversals, sequencing problems, hand writing skills or lack of knowledge about basic rules. Arithmetic--a test of computational skills.

The normative population for the revised WRAT was selected from schools of known socioeconomic levels throughout several states in the United States. The authors report reliability coefficients as ranging from .92 to .98 for the reading and spelling tests; and from .85 to .92 for the arithmetic test (Jastak & Jastak, 1965). These are the cumulative results of population studies over a twenty year period. DeLong (1962)

studied the effects of test retest situations on a retarded population and found that the WRAT was the only one of five standardized tests that did not significantly change from one administration to the next. Woodward, Santa-Barbara, & Roberts (1975), using a population of Canadian clinic type children, found the test-retest reliability of the WRAT to be highly significant when administered at two week and twenty-two week intervals. Co-efficients for all three subtests reached the .001 level of significance under both situations. This confirms the stability of the WRAT and its usefulness in a research project such as the present one where the tests were administered at two month intervals.

The Gates-MacGinitie Reading tests were selected as a further indication of academic achievement level because they provide a more detailed analysis of the reading process taking into account power as well as speed and accuracy. They were useful in this particular project because the vocabulary subtest, a test of word understanding; and the comprehension subtest, the reading and understanding of passages together with the three subtests of the WRAT gave an excellent indication of overall academic achievement. At the younger grade levels (grades one through three) there are two forms of each test available and at the higher levels (grades four through nine) there are three forms of each test available. These different forms are very useful in a design such as the present one, which calls for repeated testings. Mean reliability score for the tests used in this project (Primary A, B, C, CS and Survey D) is .82. Split half reliability is naturally higher, all scores above .85 and ranging as high as .99 (Gates & MacGinitie, 1972). A validity study by Davis (1968) in which standardized achievement tests were correlated

with the various subphases of the Gates-MacGinitie found median co-efficients of .84 for Primary C vocabulary, .79 for Primary C comprehension, .78 for Survey D vocabulary and .80 for Survey D comprehension.

Each child's achievement grade was ascertained by taking the mean of the sum of the grade equivalents achieved on each of the six subtests of the WRAT plus the Gates-MacGinitie test results. The achievement grade was then transposed into an achievement age.

The Pupil Rating Scale (PRS) was developed to meet a widespread need in education namely, the screening of children with learning disabilities. It assesses Auditory Comprehension, Spoken Language, Motor Co-ordination, Orientation in Time and Space and Personal Social Behavior; all factors seen as pertinent prerequisites to academic achievement. Statistical analysis of this scale's worth as compared with a number of other screening tests, on the same population, shows it to be an economical and effective procedure for identifying children who are not achieving normally though they have the potential for doing so (Myklebust, 1971). This is a screening tool and is not intended for individual diagnosis of problem areas. It is intended to be followed by a detailed assessment where learning difficulties have been indicated. A discriminate analysis was made to explore the adequacy of the PRS as a tool to distinguish between the Learning Disabled and the Normal children. It ranked second in forty-nine variables (Myklebust, 1971). The differences between the two groups was significant at the .001 level for all five areas rated by the scale. This rating scale was used in the present research project because it covers areas not tapped by the usual achievement tests and it has been known to identify areas of disability despite a child's overall

adequate performance. Studies by Bryan and McGrady (1972); Proger (1973); and, Reaves & Perkins (1976) demonstrate the many uses of the test as a reliable instrument for screening of children with learning problems.

Tomatis Tests. The Tomatis Listening Test (TLT) is the most important of Tomatis' tests and determines the extent of the subject's listening potential both in relation to himself and to others. The TLT is divided into three parts: 1) threshold evaluation, 2) spatialization evaluation and 3) evaluation of selectivity.

The threshold evaluation is a modified form of the standard audiogram. It is administered fairly quickly and focuses on the adaptive perceptual dimension called "listening" in contrast to the passive sensory dimension called "hearing". Although a standard audiometer may be used for the threshold assessment, a specific instrument is available for this purpose. The threshold evaluation consists of an air conduction evaluation whereby the sounds are transmitted to the ear via well-fitted earphones, and a bone conduction evaluation whereby the sounds are transmitted through a vibrator placed on the mastoid bone.

For the air conduction evaluation pure tones are administered first to the right ear then to the left. Starting at 8,000 hertz sounds are administered in a single direction only and in increments of 5 decibels from the faintest -20 db to the loudest 100 db. The subject is asked to raise his hand when he hears the faintest sound. Once the subject clearly indicates that he perceives the sound this minimal threshold is recorded and the examiner proceeds to establish the minimal threshold for 6,000 hertz and so on through 4,000; 3,000; 2,000; 1,500; 1,000; 750; 500; 250 and 125. The procedures are essentially the same for the bone conduction

evaluation with some practical restrictions as to frequency range and intensity. Results of the evaluation are marked on an audiogram grid (Figure 3) where the air conduction threshold is indicated by the solid line and the bone conduction threshold by the dotted line. The results for the Right Ear are indicated on the left of the figure while the results for the Left Ear are on the right of the figure. The decibels are recorded on the horizontal dimension or in abscissa of the figure while the frequencies are recorded vertically or in ordinate. According to Tomatis ideal listening should yield a gradual ascending curve or threshold with a slope of six to eighteen decibels per octave starting around 500 hertz and peaking at 2,000 to 4,000 hertz. The bone conduction curve should rest below the air conduction curve by 5 or 10 decibels. This ideal curve is shown in Figure 3. This slope allows a person to assess and appreciate sounds with discrimination and also favors accurate easy vocal or musical expression. It further tends to focus on the higher harmonics which are of an energizing nature. However a dyslexic can adopt any of several non listening attitudes. One of these is the lowering of the listening threshold in whole or in part. In his practice Tomatis has found that up to thirty decibels is under the attitudinal control of the individual. For example, an individual can lower the listening threshold throughout the entire range taking a non accommodating stance by keeping all sounds at a distance (Figure 4a). Or, as is frequently found in dyslexics, there may be a dip in the middle ranges between 1,000 and 2,000 or 3,000 hertz causing him to tune out the range of human speech (Figure 4b). A high flat threshold is a third way of taking a non accommodating stance, as

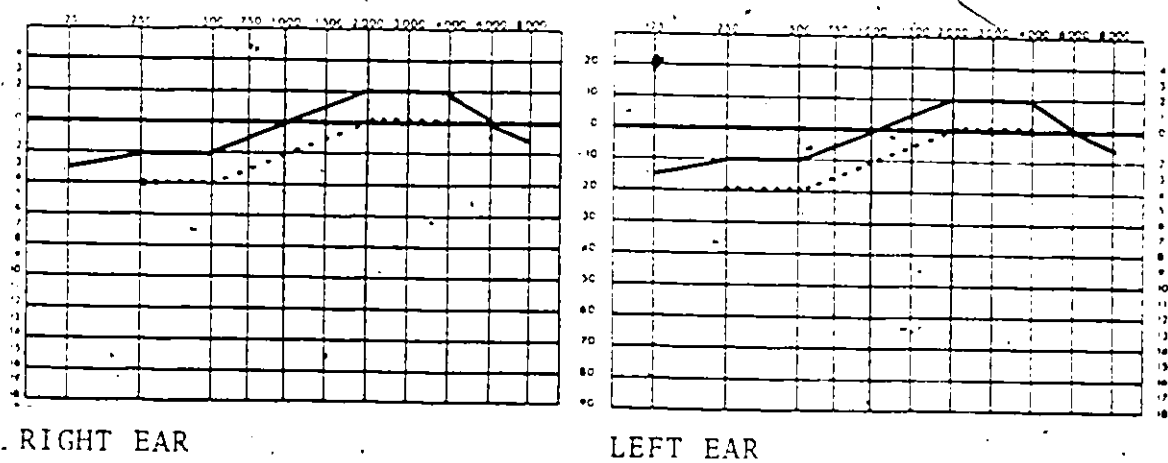


Figure 3. Ideal Listening Curve

the sensitivity to the lower frequencies masks the other sounds higher on the scale and also robs the individual of energy potential (Figure 4c).

In normal subjects the air and bone curves will be parallel and curved as described earlier but in the dyslexic both may be badly distorted in the same direction; they may follow a saw tooth pattern, or, be completely opposed.

Spatialization is assessed during the bone conduction evaluation. The subject is asked to lift his hand on the side where he first hears the sound; or, to lift both hands if he perceives the sound on both sides without clear localization. Inversions or confusions are indicated on the listening test at the frequencies where they occurred (Figure 5). This test, believed by Tomatis to be one of the most important, reveals the surprising degree of confusion on the part of dyslexics in localizing sounds.

Selectivity is assessed immediately following the threshold assessment. Via air conduction, and at a comfortable intensity of forty to sixty decibels, the subject is presented with paired pure tones in quick succession from 8,000 to 125 hertz. That is, nine sets of paired beeps: 8,000-6,000; 6,000-4,000; 4,000-3,000; 3,000-2,000; 2,000-1,500; 1,500-1,000; 1,000-500; 500-250; and 250-125. After each pair of beeps the subject is asked to state whether the second sound was higher or lower than the first sound. The order of presentation always remains the same. Here one needs to use himself/herself as the point of reference in perceiving the difference. According to Tomatis this quick test is a

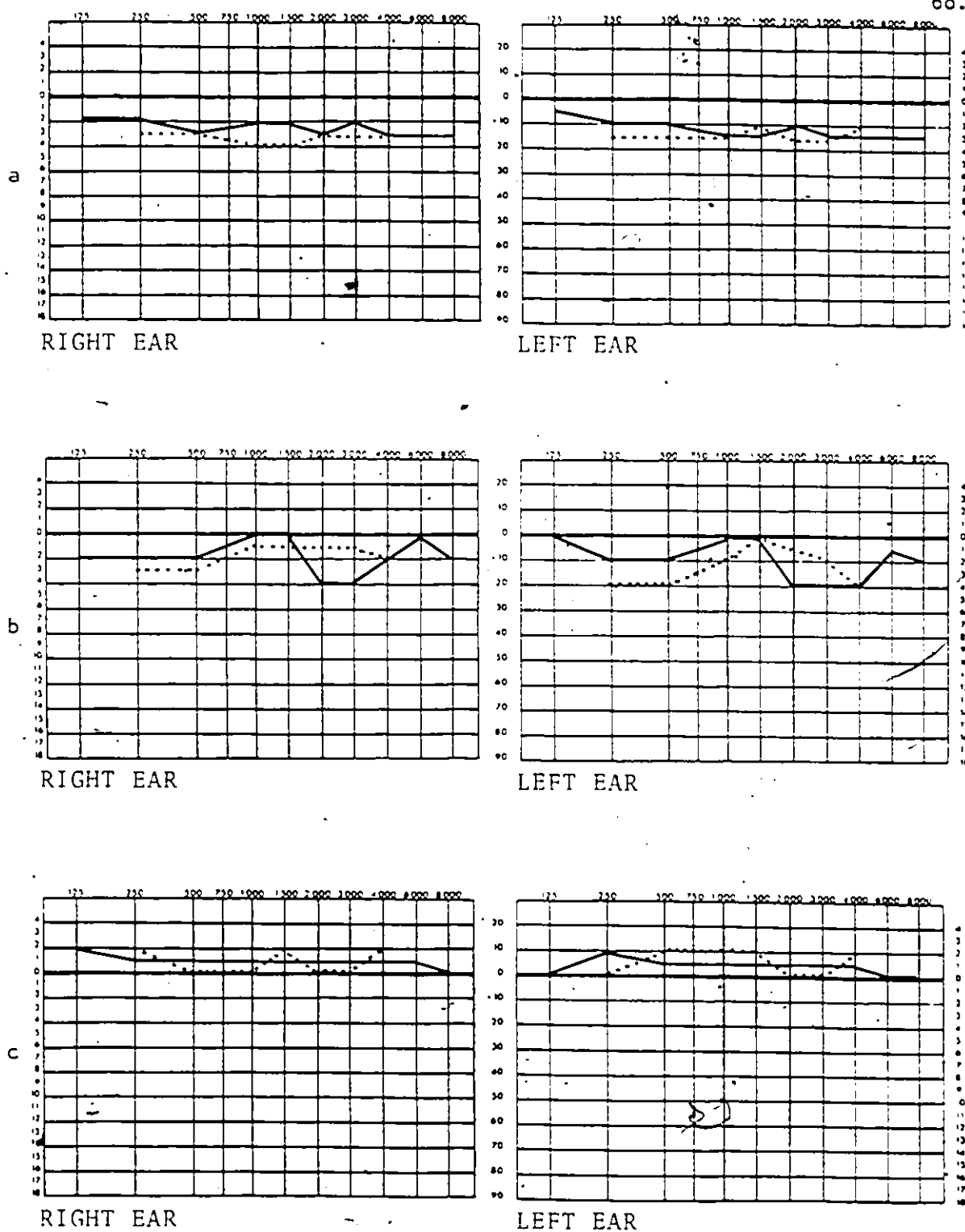


Figure 4. Various Non-Listening Attitudes
 a) Lowered threshold
 b) Dip within speech range
 c) High flat threshold

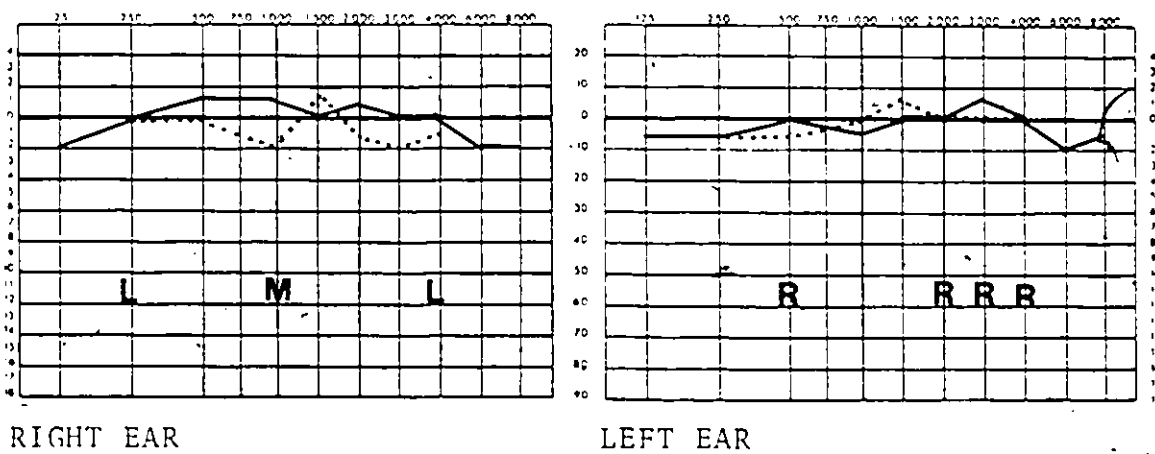


Figure 5. Spatialization Difficulties

powerful indication of auditory discrimination; of listening or non listening attitude; and a desire to become involved with sounds. Errors in Selectivity are indicated on the top of the listening test by check marks at the frequencies where errors occurred. Anything higher than the lowest check mark is considered closed as the lower frequencies tend to mask the higher ones (Figure 6). Selectivity is developmental in nature and by eight years of age, according to Tomatis, a child's selectivity should be completely opened. It is not uncommon to find dyslexics with completely closed selectivity. Such children or adults cannot distinguish differences in pitch nor the direction of the variations. These listening problems lead to difficulties in differentiating phonetically similar letters such as "m" and "n"; "f" and "v"; or "p" and "b"; and many others. Since the ear influences speech, dyslexics with completely closed selectivity frequently have voices that are low, lacking in timbre and monotonous. Their posture is poor and looks defeated. They are not deaf in the usual sense but they have difficulty attending to and analysing sounds. Some dyslexics have their selectivity only partly closed. They have problems analyzing or tuning into the richer energizing sounds and one can therefore expect to find problems with consonants in spelling, reading and talking.

The ILT has not been scientifically validated but has been used by Dr. Tomatis in the initial assessments and in monitoring the remedial progress of over twelve thousand dyslexic cases. It has been these cases that have allowed Tomatis to distinguish the dyslexic profile from the autistic, the schizophrenic, the deaf, the normal and many other listening profiles.

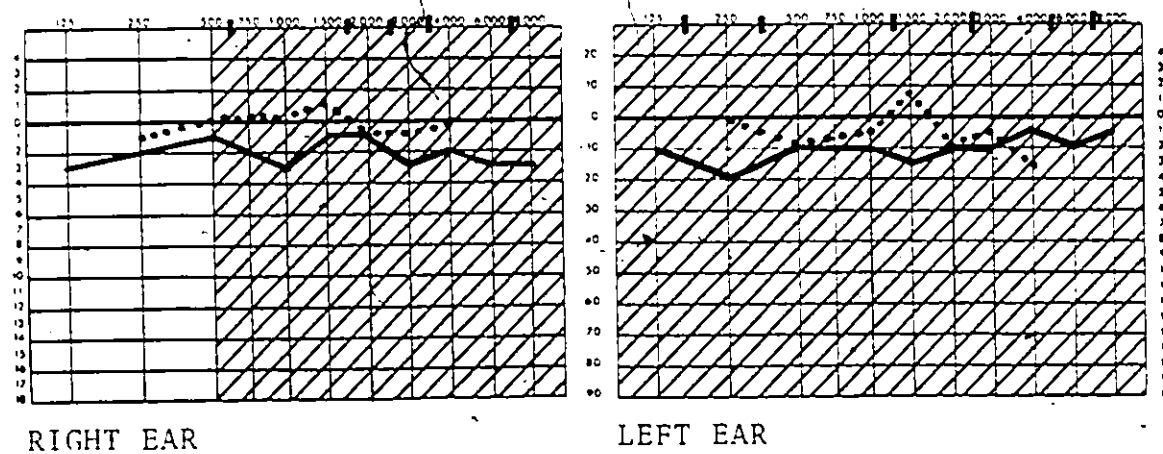


Figure 6. Closed Selectivity

However, it must be noted that the procedures used in the TLT evaluation differ markedly from those of a standard audiometric assessment. While the standard audiometric assessment attempts to establish an absolute threshold or the point at which an individual detects the auditory stimulation 50% of the time, the TLT tries to establish at which point the subject first perceives the faintest sound--that is, when he consciously takes note of the sound. Using this method, Tomatis claims to take into account the individual's attitude toward sound--a measure of when and at which frequencies he consciously "listens to" as opposed to when he "hears" as established by a standard audiometric assessment. It is recognized by this researcher that the assessments used for spatialization and selectivity, as outlined by Tomatis, are administered in a constant series at each testing leading to the possibility that the subject might learn the appropriate response sequence and thereby respond according to "test expectation" rather than "auditory perception". Hence there is a strong need for studies on the validity and reliability of the TLT. In the present research project the results of the TLT were used according to Tomatis' method which includes observational factors from teachers, program assistants and parents, to determine when a child was ready to move from one phase of the APP remedial training program to the next.

Besides the usual test of eye, hand, foot and ear dominance on which dyslexics usually show poor, mixed or unestablished preferences, Dr. Tomatis determines the dominant ear as it manifests itself through voice control. This can be done in observing the child speak or via an apparatus called the audiolaterometer. As discussed earlier, the right ear

is seen by Tomatis as the one best suited for self listening and voice control. It favors a smoother flow of speech, towards the front of the mouth, thus making for easier articulation. It allows for better timbre and intonation; body movements become more synchronized in the act of speech; the person seems more relaxed and often the face wears a smile. But, when the left ear takes over and controls speech, longer circuits and feedback loops come into play introducing a time delay. The rhythm and flow of speech becomes hesitant and choppy; speech tends to emanate from the back of the mouth with poor articulation; the voice becomes monotonous; and, facial expression is flat. The posture is notably poor and the individual exhibits marked movements and gestures when attempting to speak. He cannot organize his thoughts and has trouble both paying attention and in expressing himself. In the assessment of dyslexics therefore the audiolaterometer is used to estimate the degree of auditory laterality in the act of self listening. The instrument, and procedure for its use are explained in Appendix B. This test takes much observational skill and practice to administer correctly. The audiolaterometer is a tool developed by Tomatis for the specific purpose of assessing laterality in the use of one's own speech. Again it has proven itself in daily usage by Tomatis himself rather than in scientifically controlled situations.

The Personal Interview forms the third part of the Tomatis assessment. Tomatis starts the interview by observing the child as he interacts in a relationship; first with any other persons that might be present in the room, then in a one-to-one relationship with Dr. Tomatis

himself. In responding or initiating conversation the normal child uses his body so as to extract maximum efficiency with minimum effort. That is, the body remains stationary except for the area cortically involved in language production. The right side of the face is dominant and the right thumb and index finger move slightly. Verbal flow is rapid, fluid, timbred, lively, well controlled, confident, and adheres closely to the topic under discussion. The right ear is doing its job of listening and exerting control over both the output and input of language. Dyslexics vary depending on the degree of structural elaboration they have attained toward the goal of adequate listening posture. In general the dyslexic, when engaged in conversation, presents the left ear to his partner; the left side of the face becomes animated while the right is motionless; the face exhibits synkinesias and the body as a whole is often restless thereby losing enormous quantities of energy through the motor system. The dyslexic's voice is usually muffled, dull, unmodulated, lifeless and devoid of emotional thrust. The normal person uses his body like a well tuned instrument to express his thoughts succinctly while the dyslexic is caught in a web of bodily entanglements that rob him of energy.

In the final section of the Personal Interview Tomatis asks the child to identify parts of his own body as well as that of the examiner. While the normal child has no difficulty in pointing these out, the dyslexic has considerable difficulty. Finally the child is asked to

pretend that he is holding a microphone in his right hand. Into this microphone he is to give some pertinent information about himself.

Tomatis has found that when using the right hand the child's voice will be warm, animated, intense and timbred giving even the dyslexic a few moments of feeling in control of the expression of his own thoughts. The phenomenon disappears when the microphone is switched to the left hand thereby giving the normal child an experience of living in a dyslexified world. Tomatis believes that this phenomena is due to pressure on the left dominant parietal area (Tomatis, 1978).

The Personal Interview is Tomatis' unique assessment and has never been submitted to close scientific scrutiny but rather is based on his theory of developmental dyslexia. In his personal practice Tomatis has found this interview technique accurate and helpful in assessing cases of dyslexia.

This section has dealt with a discussion of the tools used to select the subjects for the research project. The following section discusses the tools used to assess the dependent variables of cognitive control functioning and spontaneous speech.

ASSESSMENT TOOLS

The five boys retained for this study were administered a group of cognitive control and spontaneous speech tests every two months throughout a fourteen month period as described earlier in the research design.

Cognitive Controls

The biodevelopmental framework of Santostefano consists of five interrelated cognitive control levels of development. At the time that this present research was organized, only four of these five levels (levels two through five) had evaluative procedures. These were used in the present study. Therefore the four cognitive control principles assessed in this study were: Focal Attention; Field Articulation; Leveling-Sharpening; and, Equivalence Range. The results of studies on validity and reliability plus personal conversation with the test author led this writer to select the following subtests for the measurement of the four levels of cognitive control functioning:

- | | |
|--------------------------------|------------------------------|
| Scattered Scanning Test | - Total Number |
| | - Total Distance |
| Fruit Distraction Test | - Time on Card II |
| | - Time on Card III - Card II |
| | - Time on Card IV - Card II |
| Leveling-Sharpening House Test | - 1st Stop Score |
| | - Number Correct |
| | - L-S Ratio |
| Object Sort Test | - Number of typical groups |
| | - Mean Concept Score |

The specific test materials and manuals were made available to the researcher by the test author himself as they are not yet available through the general testing companies. Studies of validity and reliability were also made available to the writer during the early stages of this research project. A detailed description of the tests with instructions for administration and scoring may be found in Santostefano's latest publication (1978, pp. 421-477). A summary description may be found in Appendix 2 of this thesis.

Test Descriptions

The Cognitive Control Construct of Focal Attention is presumed to be assessed by the test Scattered Scanning (SST). Here the child is requested to scan a stimulus field and to mark specific shapes within a definite time limit. The number and location of the shapes marked reveals the manner in which the individual scans. The child whose markings are numerous and spread widely over the page, is said to be characterized by active and extensive scanning; whereas the child whose markings are few and close together is characterized by passive narrow scanning.

Field Articulation is assessed by the Fruit Distraction Test (FDT). This test is believed to assess the manner in which the child deals with a stimulus field containing information defined as relevant and irrelevant. The child who responds quickly to those stimuli containing distracting information (geographical and contextual) is seen as being able to selectively withhold attention from irrelevant information and is not disrupted or inappropriately influenced by it. The child who takes longer to respond to the stimuli containing the distracting information is seen as directing his attention to both relevant and irrelevant information accordingly disrupting his performance on the central task.

The Leveling-Sharpening House Test (LSHT) is used to assess the cognitive control construct of Leveling-Sharpening. This test is believed to assess the manner in which the child perceives and makes adaptive use of information that remains stable and also changes over time. Children who detect changes early in a series, report many changes, and report the changes immediately or soon after they are presented are said to be Sharpeners. They tend to maintain discrete impressions and memories of

information over time and to differentiate present information from memory images of past information thus elements do not lose their individuality over time. Levelers are those who detect few changes and usually long after they have been introduced. They tend to assimilate new information with memories of earlier experiences thereby constructing relatively undifferentiated memory images of ongoing experiences.

The Object Sort Test used to assess the cognitive control principle of Equivalence Range, presents the child with an array of information which he must group or categorize in terms of some relationship or concept. The child who uses broad categories, abstract standards and is not overly concerned with subtle differences between information units is said to be functioning at the mature end of the Equivalence Range continuum. The child who uses few categories in grouping or relating the information, and concrete standards for judging similarity and belongingness, is said to be at the immature end of this continuum. The essential difference between the extremes is the degree to which the child is impelled to act on or ignore the differences revealed by the properties of the objects and the extent to which these differences are subordinated in the service of constructing the commonalities.

Test Validity

Three types of validity are considered: construct, content and criterion. Of these the test author considers construct validity to be the most important as it demonstrates the existence of cognitive controls as independent constructs which can be measured by observable cognitive behaviors.

Construct Validity. Four independent factor analytic studies were conducted on four separate populations of children. Cognitive Control tests plus cognitive measures and behavioral ratings were included in the factor space. In each of these factor analytic studies cognitive control tests dominated the meaning of each cluster of tests and each cluster was clearly interpretable in terms of one or another cognitive control principle. These four studies showed that cognitive control principles maintained their stability from population to population and from age group to age group.

Content Validity. Four analytic studies made with cognitive control and WISC test results from specific populations of children show that WISC subtest scores do not contribute in any significant way to the make up of cognitive control factors and cognitive control tests do not contribute in any major way to the make up of intelligence test factors (Santostefano, 1978). Therefore the author can conclude that the cognitive processes measured by Cognitive Control Tests are not the same as those measured by the WISC subtests. Several studies reporting on the relationship between academic achievement and cognitive control test results suggest that cognitive controls and academic skills represent two different domains of cognitive activity. When the cognitive control test results were factor analyzed with measures of academic skills, cognitive control principles maintained their individual identities and continued to define fundamental strategies in managing information. (Santostefano, 1978)

Criterion related Validity. - In a criterion related validity study relationships were drawn between cognitive control tests and teachers'

rating of classroom behavior. In a comparison between Scattered Scanning Test results and children rated as inattentive or attentive in classroom behavior results were significant at .001 level and the .05 level for the two subtests of the Scattered Scanning Test. However the same ratings correlated with the Fruit Distraction Test results were not found to be significant although they lend some support in that direction. (Santostefano, 1978, p. 204) A comparison of Leveling-Sharpener House Test scores of first graders rated as high or low in knowledge of classroom routine lends some support to the criterion validity of that test (Santostefano, 1978, p. 205).

Two studies comparing the cognitive control test performance of kindergarten learners designated by teachers as typical and suspect learners lend definite support to the criterion validity of the cognitive control tests (Santostefano, 1978, pp. 214-215).

This section has dealt with the construct, content, and criteria related validity of the Cognitive Control Tests. It has attempted to show that indeed children do use specific cognitive strategies or constructs which are measured by the tests developed by Santostefano. We turn now to the reliability of these test measures.

Test Reliability

Reliability is considered from two points of view: consistency, by establishing relationships with alternate form tests of cognitive controls; and stability, by readministering the test at two or more points in time.

With the exception of the Leveling-Sharpener House Test, alternate forms of the cognitive control tests are not yet available for children. However it would appear that alternate forms are feasible and the test

author is presently developing them for the principles of Focal Attention and Field Articulation. Meanwhile we will look at the statistics available for the alternate form of the House Test, namely the Hospital Test. Correlations were made between these two tests under three conditions: no stress; stress; no stress. Results show a significant degree of correlation for the subtest Number of Correct Changes: .55, .57, .51 for each of the three conditions; and for the subtest L-S Ratio: .55, .60, and .38. However correlation for the subtest 1st Stop Score was low: .08, .14, .29. (Shapiro, 1972) The content of the Leveling-Sharpening House Test therefore appears to provide reliable measures independent of environmental context and situation.

While the Fruit Distraction Test does not have an alternate form, two of its subtests (Card III and Card IV) have been viewed as alternate forms tapping similar cognitive processes (Santostefano, 1978). A series of reliability studies have been conducted on the relationship between these subtests. Correlations between these two subtest scores for a group of one hundred fifty kindergarten children judged as typical learners compared to thirty four kindergarten suspect learners yielded coefficients of .58 and .71 respectively. All were statistically significant. (Santostefano, 1978) A second study relating the correlation between these two subtests for a group of one hundred eight typical kindergarten learners and fifty six at risk learners yielded coefficients of .46 and .54 respectively for the typical and suspect learners. Again both results are significant. (Santostefano, 1978) Correlations between the two subtests for a group of sixty five third and fourth graders in a public school yielded a correlation of .44 which is significant at the

.05 level. These studies suggest that the Fruit Distraction Test is characterized by consistency and reliability.

Unfortunately at this time we have no way of assessing the reliability of the Scattered Scanning Test and The Object Sort Test.

Studies of stability of cognitive control tests were done with two longitudinal studies. In the first of these (Santostefano, 1978, p. 267) fifty one children were individually assessed at the kindergarten level and reassessed in grades one, two, four and five. Generally a fair degree of stability was noticeable in the tests from one year to the next. With the exception of SST-Total Distance subtest and FDT-Card III-II subtest, all correlations were significant at the .05 or .10 level.

The second longitudinal study (Santostefano, 1978, p. 269) tested two groups of children for the first time in kindergarten and then for a second time in either grade three or four. As found in the previous study, the closer in time the test retest occurs the higher the coefficient of correlation is likely to be. Given the three and four year separation the tests are remarkably stable. SST-Total Distance again appears to be the least stable. The inverse relationship observed in the Object Sort Test led the test author to question whether children, who at a young age manage information conceptually by using many narrow categories, tend to use broad categories at an older age and vice versa.

A test by Guthrie (1967) demonstrates that the Leveling-Sharpening House Test yields a highly stable measure over a short period of time in both stress and non stress conditions. On a test retest at a one week interval, given to an experimental group (stress) and a control group (non-stress), Guthrie obtained correlation coefficients of .70 and .67 respectively. Both were significant at the .01 level.

Although reliability studies are still being carried out by the test author there appears to be sufficient proof to justify the use of these tests in a research situation such as the present one. One hopefully can assume that they are obtaining fairly stable measures. As indicated by the test retest situations; the closer in time the testings are made, the more faith one can put in the stability of the results. This fact in combination with personal correspondence from the test author (Appendix A) led this researcher to believe that in administering the cognitive control tests every two months she would be obtaining a fairly accurate measurement.

Spontaneous Speech

Test Description

Samples of spontaneous speech were elicited every two months from each of the five boys in the project. Conversation was stimulated in three situations: the use of pictures as stimuli for composing a story; problem situations to stimulate the child to express his own ideas about the solution to the problem under discussion; and toys to stimulate speech in a totally free situation. The pictures about which the child was to compose a story were different for every session. Likewise there was a new set of problems and the play items were changed. The test items are described in detail in Appendix B. New but equivalent materials were presented each time so that the child had no opportunity to learn a "better story" between testing sessions; to compare problem solutions with other children; or to reenact play situations observed from his previous partner. In this way it was felt that each new testing session represented the child's current use of spontaneous speech. Each child's

conversation was recorded on tape, unknown to the subject, and was later transcribed by the researcher herself. The samples were analysed according to three different methods after the treatment and follow-up phases of the study had been completed.

Test Analysis

The spontaneous speech samples were first submitted to analysis by the Developmental Sentence Scoring (DSS) (Lee, 1974) technique which is a system to quantify syntactical growth within complete sentences. It enables an examiner to evaluate a child's ability to use generally accepted rules of grammar in formulating correct and complete sentences. It is an in depth analysis of fifty complete non echolalic sentences elicited from the child in conversation with the examiner and/or another child. In the present study these fifty sentences were gathered in consecutive sequence from the semi-structured problem solving situation and if fifty complete sentences were not available the balance were drawn from the free play sessions. It was felt that the problem solving situations would be the best reflection of the child's ability to formulate his ideas into syntactical constructions. In the DSS words or structures within each sentence are given a score of from one to eight depending upon the maturity of the structure. The summation of these scores is the sentence score. The scores for each of the fifty sentences are then summated and a Mean Score computed, which yields the DSS.

The second analysis of the spontaneous speech samples is based on the work of Walter Loban (1976). The two aspects of particular interest in this study are: Average Number of Words per Communication Unit and, Percentage of Maze Words to Total Words. Communication Units are defined

by Loban as "each independent clause with its modifiers" (Loban, 1976, p. 9). A Maze is defined as "a series of words (or initial parts of words) or unattached fragments which do not constitute a communication unit and are not necessary to the communication unit" (Loban, 1976, p. 10). For this particular analysis the present study used the most structured section of the spontaneous speech samples. Here the child was presented with five pictures in succession and asked to make up a story about what was happening in each picture. He was also instructed to start his story with what he thought was happening before the picture; followed by what was happening in the picture; and, to conclude the story with what he thought might happen in the end. In this way it was felt he could call upon his own experiences, put himself into the situation, use his imagination and consequently formulate his thoughts before attempting to express them verbally. Also, this situation was very similar to the situation set up by Loban for his selection of spontaneous speech samples. The interaction in the picture situation is between an adult (the researcher) and the child as was the case in Loban's situations. The child's responses were evaluated for the average number of words per communication unit and the percentage of maze words per total words. The results of these two measures were compared to the developmental norms worked out by Loban.

The third part of the spontaneous speech analysis used a Scale of Language Style formulated by the writer on the theoretical basis of the work of Tomatis. The scale, a copy of which can be found in Appendix B, attempts to capture some of the aspects of language development discussed by Dr. Tomatis but not accounted for in the previously discussed analyses. Two teachers, as well as the writer, listened to each of forty tapes (five

subjects over eight sessions), in random order, and scored each tape on a five point scale. There were eight dimensions to score: three dealing with the story content; two with interpersonal aspects; and three with voice quality. The dimensions included are seen, by Tomatis, as important aspects of good language development. Both teachers received two or more practice sessions. They also had the testing stimuli present so that they could judge the reality of the child's stories.

Validity and Reliability

Developmental Sentence Scoring. The statistical analysis of Laura Lee's work, as carried out by Roy Koenigsknecht (Lee, 1974, pp. 222-268), is one of the very few in depth analysis of a system used for quantifying child language development between the ages of two years, zero months and six years, eleven months.

A reciprocal averaging procedure was employed to rescale the original DSS grammatical categories described by Lee and Canter in 1971. Specific criteria utilized in this rescaling included: the typical age of emerging usage of a structure or item in relation to the emergence of other structures in the same or different grammatical categories; the consistency of structure usage with fifty utterance samples; the item total correlations; and, the discrimination of structure between successive age groups. The reweighted DSS measure displayed a quantitatively progressive increase in syntactic development throughout the age period under investigation. Comparisons between the age levels revealed significant differences in the usage of syntax at each successive one year level. This important finding supplied evidence for the clinical usage of the DSS at all intervals within the two to six year, eleven month age range as a technique

for evaluating the syntactic development of children. In summary then, with the reweighted scoring system, as age levels increased the scores which purported to measure spontaneous syntax and morphology usage increased systematically, indicating that grammatical development was being measured.

Validity of the DSS construct was verified by the confirmation of the grammatical hierarchies in the reciprocal averaging procedure. The stability and accuracy of the test was enhanced because of the reweighting of items within their grammatical categories.

Major support for the usefulness of this scoring system was supplied by the high reliability measures. The overall internal consistency of the instrument as measured by coefficient alpha was .71 (Lee, 1974). The within subject internal consistency of the DSS was assessed in a split half procedure in which odd items and even items were combined and correlated giving an overall estimate of reliability as .73 (Lee, 1974). This indicates good stability of the scoring procedure with subjects on a fifty utterance sample. Each of the individual grammatical categories was positively correlated with the overall DSS scores, indicating that each of the grammatical categories is measuring increases in oral language development and contributing to the total DSS score.

Although the age levels of the children used by Lee are unfortunately too young to use as norms for the present study, the sound statistical validity and reliability studies prove this test to be very useful in measuring the syntactical development of language, in particular spontaneous speech. Susan Vogel (1975) used the DSS system as one of the measures in the study of syntactic abilities in normal and dyslexic children and found that, in her age group of seven years four months to eight years

five months, the DSS distinguished between the normals and the dyslexics at the .01 level of significance. Vogel's study therefore gives the present researcher some indication of the level of syntactical functioning in both dyslexics and normals in the seven to eight and a half year range. The youngest three children in the present study are within that age range. The two older subjects would be expected to do better than Vogel's group of normals before they could be considered "normal" for their age.

Average Number of Words per Communication Unit. Loban (1976) did an in depth analysis of spontaneous speech samples and written composition samples of two hundred eleven children over a thirteen year period from kindergarten to grade twelve. All children were rated by teachers over the same period of time. At the end of the project these students were divided into High, Low and Random groups of thirty five children each. The High Group included subjects rated high by their teachers in terms of having control of ideas expressed, an overview or plan for their talk and/or writing that showed coherence and unity. They spoke not only freely, fluently and easily but also effectively, using a rich variety of vocabulary. They adjusted the pace of their words to their listeners and their inflection or "imparting tone" was adapted both to the meaning of their content and to the needs of their listeners. They were themselves attentive and creative listeners. (Loban, 1976, p. 70) The Low Group were seen as rambling on without apparent purpose seemingly unaware of the need of the listener. Their vocabulary was meager and as listeners they did not focus on relationships or note how main ideas control illustrations or subordinate ideas. They were painful "decipherers" rather than fluent readers. (Loban, 1976, p. 70-71)

Basically Loban's study is an in depth analysis of the nature of the communication units used by school age children. He thoroughly examined and compared the many strategies used to expand a communication unit beyond the simple one word subject and predicate. He concluded that the average number of words per communication unit is as adequate a measure to distinguish the verbal fluency of the High and the Low Groups as is any of the methods of elaborating language (Loban, 1976, p. 58). Therefore he recommends that anyone wishing to ascertain language growth can now use the easier to calculate "average number of words per communication unit" as an indication of language development because he has found it to be as accurate an estimate as any of his other measures and analyses of dependent clause elaboration. Accordingly the average number of words per communication unit appears to be a good measure of the complexity a child uses in attempting to express his ideas.

Percentage of Maze Words to Total Words. In Loban's findings the High Group consistently showed the smallest percentage of Maze Words with the Low Group considerably higher (Loban, 1976, p. 30). However Loban found that during the middle years of schooling there were erratic upward and downward fluctuations within each group. All groups ended in grade twelve with the same proportion of Maze Words as they had started with in grade one. That is all subjects maintained the same proportion of maze words to total words despite the fact that increasing chronological age produced an increasing complexity in their language. This led Loban to wonder if hesitations in language might be a part of one's personality structure rather than an external feature amenable to education and development (Loban, 1976). For the present study it might be of interest

to observe the pattern of maze behavior at the various phases of the APP Remedial Training Program.

Scale of Language Style. Interjudge comparisons were made of scores on the Scale of Language Style using an intraclass correlation technique (Guilford, 1956). Table I indicates how each of the three raters scored with each of the other raters. The last column expresses the reliability when all three raters are taken into account.

These results indicate that the two teachers were in stronger agreement with each other than either of them was individually with the writer. This in part could be due to the fact that the writer was more versed in the subtleties of the psychological organization and interrelationships to good story telling. On the other hand the teachers were well versed in the everyday language used by children at this age level. Their professional experiential backgrounds would also have been similar leading to a stronger agreement. The overall high interrater reliabilities would seem to justify using the ratings as an indication of these aspects of spontaneous speech.

PROCEDURES

Setting

All five boys were full time pupils at the Child Study Centre. Classrooms are organized in small groups so as to facilitate individual attention and progress. The academic year is spread over a twelve month period interspersed with several four day week-ends and short holidays. From September to June the school program is held in the specific school area of The Child Study Centre. During July and August the children live in a camp setting receiving academic instruction for half the day. All

Table 1

Interrater Reliability for Scale of Language Style

Language Trait	Raters			
	I*III	II*III	I*II	I*II*III
Descriptive - Dynamic	.73	.64	.95	.86
Disorganized - Organized	.55	.43	.75	.71
Unrealistic - Realistic	.70	.63	.76	.77
Ego Centric - Social	.66	.70	.85	.77
Other Directed - Self Directed	.76	.59	.74	.68
Halting - Fluent	.70	.69	.84	.82
Monotone - Expressive	.88	.80	.95	.90
Mumbled - Distinct	.69	.65	.83	.80

I - teacher
 II - teacher
 III - the writer

children attend camp on a residential basis and parents are encouraged to visit their children weekly.

Three of the boys selected for the project lived at home with their families and attended The Child Study Centre for school; the other two boys lived in residence at the Centre because their problems were such that it was felt that the structured residential program would help them to learn and develop their personalities more effectively.

The remedial training was carried out in individual treatment rooms containing a table along one wall. This held the Electronic Ear apparatus and left room for the child to do pencil and paper work. The room was large enough for the child to lie down if he so desired. Each room was equipped with a one-way mirror permitting the Program Assistant to observe the child's posture, facial expression etc. when left to his own devices.

Testing of the cognitive control tests and the academic tests was carried out in the testing rooms of The Child Study Centre. These are plain rooms equipped solely with table, chairs and one-way mirror. Language tests were carried out in a sound proof room so as to maximize correct recording of the voices. The children were unaware that they were being recorded.

APP Remedial Training Program

The APP remedial training program is a developmental therapeutic program whereby the individual in training is perceived as progressing at his own pace through the natural hierarchy of language experiences until he has the desire to communicate both auditorially and via the written word. The APP remedial training program is therefore programmed

to follow the natural sequence of language development but geared to meet the specific needs of the individual dyslexic. The remedial training must be monitored by a specifically trained Program Assistant who is constantly at the call of the dyslexic. The child's program is designed by a Program Consultant who has personal individual contact with the child at specific intervals as well as guiding the Program Assistant with the monitoring of the program.

The Electronic Ear is an apparatus, built by Dr. Tomatis, which facilitates listening and the development of laterality. The machine itself consists of two channels joined by an electronic relay and a set of electronic gates used for opening up and stimulating the right ear (See Appendix C). The left ear is also always employed but it is not permitted an equal listening function. There are microphone, earphones and amplifiers that work on both channels. The sound source for the machine is a set of tapes recorded and played on a high quality tape recorder.

During the Passive Phase of the training program the child wears the earphones and can receive the input while reclining in a relaxed position or, as is most common with children, while playing with clay, drawing or doodling on paper. These simple activities are designed to allow the child to relax and permit the material from the tape to penetrate his body via the auditory channel. In this phase we are attempting to decondition the body's reaction to negative auditory input and to allow the child once again to experience the initial desire to communicate. The Listening Test is administered weekly and gives important indications, along with behavioral observations, about the subject's progress. When

this test indicates open Selectivity and an upward curve at least on the Right Ear, together with behavioral changes that indicate an openness to others and a higher energy level, the child is ready to proceed to the Active Phase of the program. The subphase of Sonic Birth is usually accomplished within a few sessions. Here a tape, starting with the Mother's Voice filtered at 8,000 hertz and gradually introducing all the lower frequencies within a half hour period, is played to the child. If he recognizes his mother's voice he is ready to proceed with the Active Phase of the program. If he does not recognize his mother's voice then he does not proceed to the next phase until he completes the subphase of Sonic Birth successfully. The individual case studies will demonstrate how this is accomplished.

During the Active Phase of the program the child is required to sit in an upright posture, to hold the microphone with his right hand and to actively project his voice through the machine in response to the material from the tape. In this way he is tuning his body to communicate linguistically. The brain is energized by the high frequencies and takes control, as it were, of the body. It becomes the dispatching center collecting, analyzing and rearranging information and controlling the co-ordination of vast numbers of hierarchically arranged nervous cells. This synthetic analytic power enables the human machine to pass smoothly from subjectivity to objectivity and vice versa. (Tomatis, 1978)

During the Performance, or first subphase of this Active Phase, the child listens to and repeats sounds, words and phrases, rich in sibilant sounds, from several series of tapes. Each series gradually filters out the lower sounds thereby forcing the child to attend more and more closely

in order to grasp what is being said. When the child can complete the tapes with eighty percent accuracy he is ready to move on to the final phase of the program. Tomatis sees this Performance phase as the important training of the child in communicating with his environment. The self-monitoring of speech begins to occur during this phase as the training of the Right Ear gradually introduces a listening awareness of, and attention to, what is being heard.

In the fourth and final phase, called Training, the child is led to practise his newly developed auditory attitudes by talking, reading and singing to himself via the Electronic Ear. These active sessions are interspersed with short periods of filtered music to assist the child in relaxing. During this final phase the remedial training sessions are reduced from five to three times a week. The program is now complete and the child is seen as ready to learn to read. That is, he now has the auditory attitude to learn or relearn the skills which he could not grasp before.

The Electronic Ear is completely automatic but it must be operated by a Program Assistant who has been specifically trained to program the machine in accordance with the phases of APP growth as they occur during the remedial training program. The Program Assistant needs to guide, counsel, and console the child when necessary, through this growth process. He/she also needs to be in regular consultation with the child's parents and/or home participants; as well as teachers or other pertinent people in the child's environment.

The remedial training programs for the five dyslexic boys were designed by Dr. Tomatis at the conclusion of his initial assessment. The

progress of these programs was then guided by Dr. Sidlauskas who acted as Program Consultant to the three Program Assistants working individually with the boys. These Program Assistants included the writer and two male researchers interested in different aspects of developmental prerequisites to reading. All three were candidates for the doctoral degree in Child Clinical Psychology and therefore were well versed in normal and deviant child development. They also had instruction from Dr. Tomatis himself on normal and deviant APP development.

The subjects received daily sessions of one hour duration with weekends and holidays free. The remedial training intervention lasted for a period of ten months.

The purpose of the APP remedial training program is to establish proper APP development and therefore readiness for reading. When language is well established reading becomes a pleasure. While the APP remedial training attempts to establish proper language control, it does not teach reading. It prepares the child so that he is then ready to learn the skills that will permit him to gain meaning from the printed word. Reading skills must then be taught, or retaught, by a qualified reading teacher. Upon completion of successful APP remedial training the dyslexic is seen as being no longer dyslexic although he may not yet be able to read. He has acquired the prerequisites for reading and is now ready to learn and use the reading skills that made no sense to him earlier.

Time Series Assessments

The choice of a two month baseline, ten month treatment and two month follow-up design was to some extent arbitrary. However, guided by the length of therapeutic intervention suggested at the time by Tomatis as

well as realistic time constraints for the completion of a doctoral dissertation, a ten month treatment period was chosen. The pros and cons of this particular time frame will be discussed in a later chapter.

Tests of cognitive controls (with the exception of Object Sort) and Spontaneous Speech were administered before and after baseline; every two months during training; and at the end of the two month follow-up period. The academic achievement tests were administered at the same intervals. The Object Sort Test used to assess the cognitive control principle of Equivalence Range was not administered at the beginning of the baseline period. This was due to a misunderstanding between the writer and the test author as to the correct administration of the child's form, based on the original adult form, of the Object Sort Test. This was rectified in time for the second testing session and will be taken into consideration in discussing the results.

The cognitive control and spontaneous speech tests were administered by the researcher but were not scored until all of the data for the total project had been collected. The researcher decided to do her own testing because of several factors: learning disabled children are easily disturbed by novel situations, such as strange examiners; the testing schedule was arduous; the cognitive control tests were known to the researcher alone; and, spontaneous speech samples needed to be transcribed by the examiner.

Achievement tests were administered in part by a remedial teacher and in part by one of the Program Assistants. Two of the Tomatis tests, the Listening Test and the Audiometerometry, were administered by two of the Program Assistants who had been especially trained in the administration of these tests by Dr. Tomatis himself.

The results of the present study are presented in the form of graphs and figures. No statistical analysis was performed. Jack Michael (1974) and Srinika Jayaratne (1978) note that statistical proof of progress is not always necessary. A graphic depiction of the results should clearly demonstrate the possible effectiveness of the treatment. Statistical significance, while helpful to the statistician, frequently does not answer detailed questions about the effectiveness of an individualized program. Very little improvement may be necessary to obtain a significant difference between pre and post therapy behavior; yet the subject may be a long way from cured.

The cognitive control tests will be charted in comparison to the average score (plus and minus one standard deviation) of the "typical" child at the subject's present grade level. The syntactic development scores will be charted in comparison to the results achieved by the "Normal" and "Dyslexic" groups (plus and minus one standard deviation) of Vogel's study. The Number of Words per Communication Unit and the Percentage of Maze words will be compared to the average score obtained by the High Group and the Low Group, in Loban's longitudinal study, at the subject's present grade placement.

Each subject's results will be presented and discussed individually. First their pattern of change will be presented as it is manifested throughout the time series assessments. Second, these results will be compared with the four phases of the Remedial Training Program. Finally the results of the five individual case studies will be compared in exploration of any commonalities of change at specific periods of the APP remedial training program.

The next chapter will discuss the Diagnosis and Remedial Training of each of the five boys used in this research project.

CHAPTER III

Diagnosis and Remedial Training Program

This third chapter presents the diagnostic findings and an in depth analysis of the APP Remedial Training Program for each of the five boys in this research project. Each child has been given a fictitious name; and, will be dealt with in a separate subsection of this chapter. Background information, presenting problems, and diagnostic indications will first be presented for the child under discussion. His individualized APP remedial training will next be described along with the Tomatis Listening Test (TLT) results and behavioral observations that were used to monitor and modify the program in terms of its phases and subphases.

The diagnostic information was gathered in November and December 1975. The remedial training program commenced at the beginning of February 1976 and terminated at the end of November 1976. During the training period, behavioral reports were accumulated on a daily basis, and the TLT was given after every twenty half-hour training sessions.

SUBJECT 1 - ANDREW

Diagnosis

Background Information

Andrew is a blonde freckle faced sturdy boy with many babyish characteristics for his chronological age of seven years eight months. He was awkward in his movements, shifting his body from side to side as he walked. Despite his age, he still descended stairs two feet at a time. He was a restless but good natured child who preferred the company of adults to

that of his peers. He was talkative, appearing to have a good vocabulary, but most of his conversations were repetitions of what he had heard adults say. He never expressed an original opinion of his own.

Presenting Problems. These parents admitted that their son had some academic problems as well as physical co-ordination difficulties. However, they found him angelic and very easy to live with.

The teachers noted that this boy made little social contact with his peers and quickly reverted to tears if in conflict with them. He preferred doing things for adult approval. He was never assertive or aggressive. In the classroom he was physically fidgety although not deliberately disturbing. Teachers saw this boy as needing much help with both his academic and social life.

Family Constellation. Andrew is the second of four children. Both parents are professionals. The father works full-time as a teacher of Business Management at the university level. The mother works part-time as a nurse. The oldest child presented such severe behavioral problems in the home that he was in a residential treatment program. There is no mention of learning problems in the family history but three males on the paternal side of the family are either left-handed or ambidextrous.

Developmental Characteristics. Andrew was of average weight born at full term. He is described by his parents as having been a docile baby content to play by himself for long periods of time in a playpen. Parents could not recall specific milestones but stated that the boy walked at fifteen months, spoke his first words at ten months and spoke in clear sentences by two years of age.

Educational Experiences. Andrew entered Kindergarten at five and a half years of age. He was described as "unready to learn" and spent most of his time in gross motor play. After one year in the Public School System Andrew came to the Child Study Centre at the age of six years. He had been at the Centre for one year and three months when he was recommended for the present research project. At seven years he was still working at the preschool level and experienced great difficulty in mastering the earliest skills of reading and mathematics.

Diagnostic Test Results

WISC-R. The intelligence test yielded a Verbal IQ of 104 and a Performance IQ of 123. Intellectual potential, as measured by the higher of the two, is certainly above average.

Learning Quotient. Achievement Age, computed from the combined results of the WRAT and Gates MacGinitie tests, was 7 years, 4 months. Expectancy Age, calculated according to the Myklebust formula, was 8 years, 4 months. Together these scores yield a learning quotient of 86 which is below the cut-off of 90 described by Myklebust.

Pupil Rating Scale. This particular evaluation yielded a score of 68 which again was below the cut off of 70.

In addition to the discrepancy criteria reported here, Andrew also met the exclusion and special education criteria from the composite definition described earlier.

APP Assessment

Tomatis Listening Test. The TLT indicated: 1) completely closed selectivity showing that the boy refused to "listen to" his environment; 2) a generally well shaped curve; and 3) spatialization errors. However

neither spatialization errors nor a generally well shaped curve are seen to be of significance when selectivity is completely closed.

Audiolaterometry. The ALM test indicated a preference to use the Left ear (-1.5) for the monitoring of speech.

Personal Interview. Andrew became quickly fidgety and fatigued when trying to follow a conversation or to participate in one. He could identify his own body parts but used two hands to touch them showing much hesitation in choosing left or right. Motorically he presented as disorganized. Voice timbre was generally good but a great deal of energy was being lost in the constantly present synkinesias whenever he spoke. When asked to pretend he was talking into a microphone held in his right hand, his voice became slightly higher, clearer and the flow was easier. When using the left hand it became low and flat with many hesitations.

Dr. Tomatis described this boy as a severe dyslexic on the basis of deficient listening as well as poor language and motor skills. He added that a psychological interpretation of the TLT suggested a fearful dependent child who refused to relate to his mother. Dr. Tomatis recommended approximately nine months of APP remedial training with a strong emphasis on the initial phase of prenatal sounds using the mother's filtered voice.

Andrew met all the criteria for a diagnosis of dyslexia according to both the composite definition and the APP evaluation methods.

Remedial Training Program

This section describes in detail Andrew's individual progress through the four subphases of the APP remedial training program. It also describes the changes in the TLT as well as the observations of the Program Assistant, Teachers and Parents all used to monitor progress in training.

Passive Phase - Filtered Sounds

The phase of Filtered Sounds was unusually long for this boy, lasting two and a half months or 110 sessions, indicating that his resistance to the acceptance of high frequency sounds was very strong. The initial sessions of filtered mother's voice (VMF) produced no noticeable change in TLT results or Andrew's behavior. Since the mother's natural voice was low, it was rerecorded through the Electronic Ear to obtain a richer cluster of high frequencies after filtering. Training sessions with the new VMF achieved the opening of selectivity to 3,000 Hz as assessed by the TLT. At this point, an attempt was made to move onto the Sonic Birth subphase but this failed as Andrew did not recognize his mother's voice and selectivity began to close again. The first subphase was reinstated using a different woman's voice, again filtered at 8,000 Hz, but one richer in tone, vibration and timbre than was the natural mother's voice. Bathed auditorally with this richer voice, the lad gradually permitted himself to perceive the vibrations and by mid-May positive results were obtained. That is, the frequencies essential for language learning were now available to this boy.

Tomatis Listening Test. By mid May selectivity had remained fully open for twenty sessions and the air conduction curves had taken on an ascending slope. However, the bone conduction curve remained high and flat and spatialization had become reversed on the left ear.

Program Assistant's Observations. During this initial phase of the program the Program Assistant found the boy to be very hyper both physically and verbally. The introduction of the richer voice seemed to have a calming effect on him. He gradually became more calm and less

negatively attention seeking during his training sessions. He also sought more and more physical closeness during this period. His posture, during the sessions, began to straighten up.

Teachers' Observations. The classroom teacher noted that the boy would, for the first time, get into conversations with his classroom peers but then "could not put the brakes on" that is, he did not seem to know when to stop. Also, he very gradually became more physically settled in the classroom.

Parents' Observations. The parents observed that during the second month of the program their "good little boy" for the first time showed his temper physically at home and actually hit out at his mother. At this stage they were counselled by the Program Assistant on how to handle such situations while at the same time allowing and, in a sense encouraging the boy to express his feelings.

Passive Phase - Sonic Birth

In late May, the Sonic Birth was gradually introduced over fifteen sessions alternating the natural mother's voice with the filtered music in the prescribed fashion. Andrew came to recognize and accept his mother's voice with mild enthusiasm.

Tomatis Listening Test. Selectivity remained open during this subphase and the air conduction thresholds remained gently ascending. The bone conduction thresholds rose slightly indicating an increase in tension. Spatialization became reversed in both ears mainly in the frequencies related to speech.

Program Assistant's Observations. During the Sonic Birth subphase the verbal attention seeking behavior had diminished and Andrew gradually

enjoyed more and more physical closeness. He also started to express some of his own feelings in terms of his own interests, rather than reiterating the statements of his parents and/or teachers.

Teachers' Observations. At this time Andrew's teacher noted a marked improvement both towards interest in reading as well as in reading ability itself. The lad was particularly eager to read to the class and to interpret what he read for them.

Parents' Observations. The parents did not observe any noticeable changes in home behavior during this period. Andrew was again into the accommodating role within the family setting. They had however also noticed a marked increase in an interest in reading particularly to his younger brother.

Subphase Summary. The continued opening of selectivity on the TLT and the positive behavioral reports as well as the interest in reading indicated that Andrew was ready for the Active Phase of the program.

Active Phase - Performing

This is usually the longest of the subphases. For this boy it lasted a total of 140 sessions, from the beginning of June until the end of October. During this particular subphase the muscles of the ear are being conditioned to lateralize the child to the right. The subphase is continued so as to condition the body to habitually attune itself effectively during language listening or expression. Continued and regular practice is necessary to establish this habit.

Tomatis Listening Test. By late October spatialization errors had disappeared while selectivity remained open. The air conduction curves took on a more pronounced ascending slope. Bone conduction thresholds

started to fall below the air conduction curves, at least in the middle and high frequency ranges, suggesting that Andrew was beginning to be more relaxed in the use of his language.

Program Assistant's Observations. Andrew very willingly participated in this part of the training program. He was co-operative and conformed almost rigidly to the postures suggested by the Program Assistant. Gradually over a four and a half month period his posture became more relaxed and his verbal communications more realistic. He endeavoured to explain his likes and dislikes of his family and his peer group as well as to express opinions about his reactions to events in his daily life. During the final two weeks of this subphase he began to take definite chances about making errors in his academics and/or projects and could accept his errors gracefully. He was enthusiastic about his life in general and expressed definite interest in his APP progress. His facial and body expressions were now alive, in tune with his enthusiasm and one definitely got the feeling that you were faced with a person, and not a programmed child.

Teachers' Observations. During this subphase the teachers also noticed a gradual growth toward social maturity as Andrew began to interact more effectively with his peers. At times he even became bold in class, which the teachers noted as a positive step for this one time "angelic child". His enthusiasm for class projects increased greatly and he would contribute some of his own ideas. Teachers also noted that the boy seemed to come alive from within.

Parents' Observations. The lad's father became sincerely interested in his son's progress during this phase of the remedial training program.

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He took an active participation in listening to and trying to understand the boy as he communicated about his daily experiences. The father also assisted the lateralization process by encouraging and presenting opportunities for the boy to practice right sided activities. Both parents noted with enthusiasm, this lad's steps toward independence in family relationships, and his positive attitude toward independence in his school work. It was during the second half of this subphase that Andrew's older brother moved back home on a permanent basis from the residential setting. This introduced a significant change in our subject's life situation and we feared a relapse. The two boys quite quickly found their own niches and apparently Andrew was sufficiently mature and secure within himself to handle the situation by fighting for his rights and he did not slip back into his old role of accommodation. He expressed his feelings about his brother both at home and in the training sessions and came up with his own solutions for handling difficult situations.

Subphase Summary. More positive results on the TLT, improvements in self expression and academic performance were noted during this subphase. However Andrew still had difficulty with some of the more difficult APP exercises and this subphase could have been prolonged. The final subphase was introduced because the overall training program was scheduled to terminate in one month.

Active Phase - Training

This final subphase consisted of thirty five sessions for Andrew. During this phase self listening is enhanced to reinforce proper auditory-vocal skills. This is accomplished by reading to one's self via the Electronic Ear. This more actively involved subphase is said to increase awareness of and confidence in one's own communicative ability.

Tomatis Listening Test. During this final subphase the air conduction curve took on a more pronounced ascending slope.

Program Assistant's Observations. These show that the boy grew in self assurance and enthusiasm for life during this period. He also began, at this time, to look forward and to anticipate events as well as to reminisce on past activities. He seemed genuinely happy although occasionally he would slip back into the role of "trying to please" particularly in the presence of adults. During the final week of training, for the first time, this boy could take on roles in his reading, changing characters effectively as the story unfolded. He was also insistent on finishing what he was reading. Indeed reading had now become a pleasure!

Teachers' Observations. In general the teachers had not noticed any particular growth spurt during the final subphase of the training program. The biggest progress in social interaction had occurred during the third phase. At the termination of this remedial training program teachers, in a Teachers' Conference, noted many improvements in this boy over the remedial training period. These included: better motor control in walking, carrying and playing; smiley; speaks his ideas clearly; much independence in the class and can lead his peers; much happier and involved with peers on the playground; uses right hand consistently for activities both in class and on the playground. At this point the classroom teacher noted that while the boy's verbal expression of ideas was very clear and well organized his written work was not yet at the same level.

Parents' Observations. At this point in the training program the parents continued to comment on how well Andrew had adjusted to his older brother's reentry into the family and his ability to make his feelings

known as well as to stand up to his older brother. They commented that he was more independent in carrying out his homework assignments and was not as fearful of making errors.

Subphase Summary. During this brief period of training the air conduction curve on the right had improved according to the TLT. Behavior wise, Andrew showed progress in self reliance and self confidence. Reading skills improved markedly but spelling ability remained weak.

Summary of Andrew's APP Training Program

According to APP criteria, Andrew had made significant gains in listening and language skills. Figure 7 compares the TLT and ALM results obtained before and after remedial training. In December 1976, immediately after the close of the program, auditory selectivity was open and spatialization errors were absent. The air conduction curves showed an ascending slope, especially on the right ear. The bone conduction thresholds were lower, especially on the left ear. The ALM indicated a right ear preference of 1.5 for the control of speech as opposed to the left ear preference at the onset of training.

Andrew had attained a better upright posture. His speech was clearer and his bodily movements were better controlled as he spoke. He related more comfortably to others and could express his thoughts in a more organized manner. His concentration and energy level had improved from the start of the training program, and reading skills began to improve towards the close of the program.

According to APP criteria, this program was successful although a more extended period of training might have brought the bone conduction thresholds fully below the air conduction curves. It might also have strengthened the right ear to an ALM advantage of 2.5 or 3.



TOMATIS LISTENING TEST TEST D'ÉCOUTE TOMATIS

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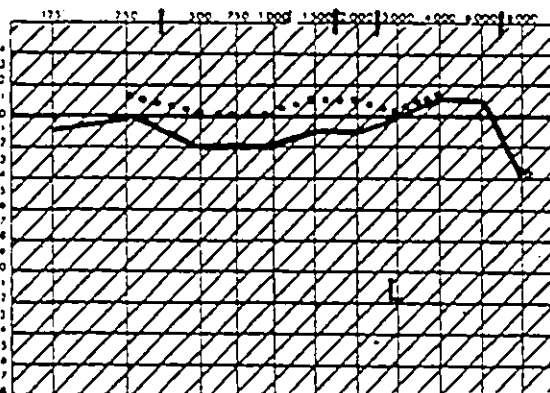
111.

FAMILY NAME SUBJECT 1 GIVEN NAME ANDREW AGE 7 yrs 8 mons
NOM de FAMILLE SUBJECT 1 PRÉNOM ANDREW

N°

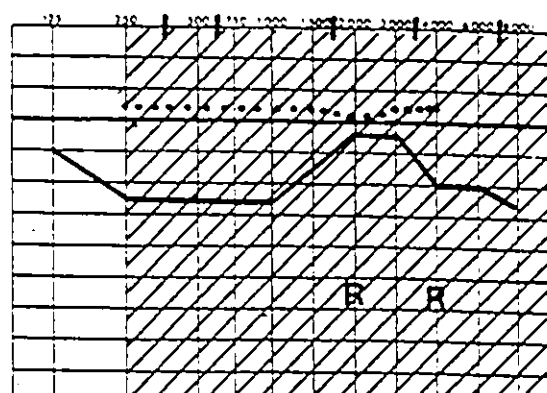
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3.5



By J. R. The 14/11/75

After 0 Sessions
Après 0 Séances



Time Heure

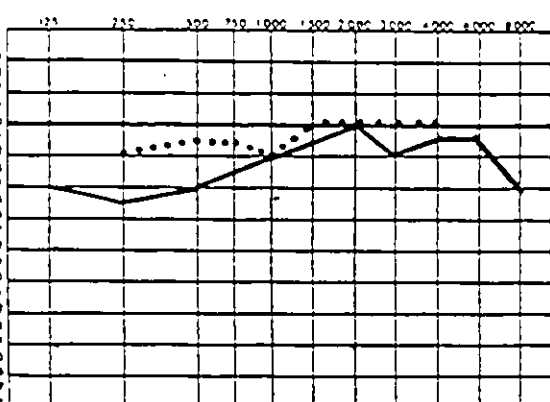
Observations
Over/au verso

AT THE START OF APP TRAINING

N°

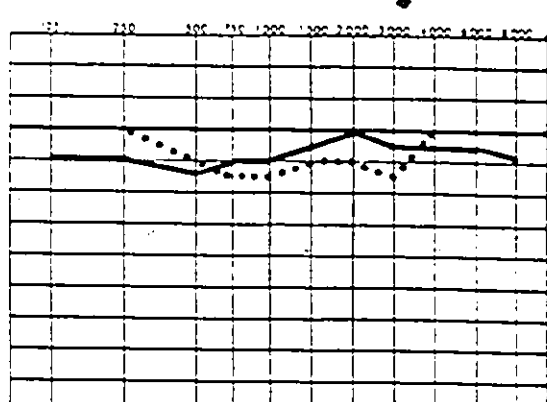
16

6.5



By J. R. The 16/12/76

After 301 Sessions
Après 301 Séances



Time Heure

Observations
Over/au verso

AFTER TERMINATION OF APP TRAINING

Figure 7.

Pre and Post APP Remedial Training Results on the
Tomatis Listening Test and Audiometer for Andrew

Andrew could no longer be considered dyslexic according to the diagnostic test criteria either. At the close of the training program this boy's achievement grade level was 3.5 yielding a Learning Quotient of 94, considerably above the "90" cut-off. On the Behavior Rating Scale his score was 73, again above the cut-off of 70 for an indication of learning disabilities.

SUBJECT 2 - BRIAN

Diagnosis

Background Information

Brian was seven years eleven months at the start of the project. He is a dark curly haired fellow of average height with a square sturdy build. He was very active on the playground but seldom interacted on a verbal level. Even with peers he expressed brief remarks rather than exchanging ideas. When he tried to express himself his conversations were full of false starts and hesitations.

Presenting Problems. Brian's parents saw their middle child as the happiest of all their children, quite capable of entertaining himself for long periods of time and usually managing to solve his own problems. They began to realize, rather late, that Brian could be a very clever manipulator of both peers and adults with his cute ways. They realized early that this boy was having serious problems in reading, as did their oldest son, and definitely agreed that he required special assistance.

The teachers saw this boy as a very likeable lad, a favorite with both teachers and peers. He preferred to be a non participant in academic activities and had considerable trouble organizing himself and/or his ideas particularly in the Language Arts class. He tried to fake "looking good"

in reading so as to be acceptable in the eyes of his peers. He had many reversals in letters and numbers. He was popular with his peers on the playground but he was passive, quiet and too accepting.

Family Constellation. Brian is the middle child and second boy in a family of five children. In the family unit he is odd man out; that is, the two youngest siblings make a team as do the two older ones, leaving this lad on his own. The father is a physician whose long working hours and quiet disposition leaves little room for interacting with his children. The mother, herself professionally trained, is presently a full time homemaker handling the discipline and everyday living problems:

The father had a history of reading difficulties as a youngster but felt he had been able to overcome his problems on his own. All of the boys in this family (four of the five children) either have, or give indications of having, academic difficulties. The oldest boy's problems were discovered late and had a negative effect on his personality. The father realizes that there may be an hereditary factor here and has sought early assistance for the other boys.

Developmental Characteristics. Brian's birth was described as uneventful. The boy sat at six months and walked only at seventeen months. While he spoke his first words at twelve months, he did not speak in sentences until he was three years of age. He did however communicate non verbally. As a baby he did very little spontaneous exploring and would remain seated for hours on the floor wherever he had been placed, playing with one toy. The busy mother, with two older toddlers, considered him to be a "very good baby". The child has always had trouble adjusting to family moves which were quite frequent in his early years.

Educational Experiences. At the age of four Brian entered kindergarten but the school felt that he was not ready for grade one by the end of that year. He was immediately enrolled, at the age of five, in the Child Study Centre where he could have a specialized program within a small group learning situation. He had been in the program for two years and three months when recommended for the present research project.

Diagnostic Test Results

WISC-R. These results indicated a Verbal IQ of 101 and a Performance IQ of 131. Using the higher of the two, this boy is above average intellectual potential.

Learning Quotient. Achievement Grade at this time was Grade 1.8 yielding an Achievement Age of 6 years, 11 months. Based on Myklebust's Discrepancy method the boy's Expectancy Age should be 8 years, 7 months. This yields a Learning Quotient of 80, well below the 90 cut off.

Behavior Rating Scale. Brian's global score was 66, again below the cut off of 70 used to designate dyslexia.

In addition to the discrepancy criteria reported here, Brian also met the exclusion and special education criteria from the composite definition proposed earlier.

APP Assessment

Tomatis Listening Test. The TLT showed that while general hearing acuity was excellent, the boy had many ways of not listening: 1) selectivity was closed in all but the lowest frequencies; 2) the hearing curve was flat with a dip in the language area; and, 3) there was an inability to localize sounds. The bone conduction thresholds were above the air conduction thresholds for both ears.

Audiolaterometry. The ALM indicated Left ear advantage (-1.5) in the control of speech.

Personal Interview. Dr. Tomatis noticed Brian's slumped posture, marked synkinesias when talking, very low voice, very passive and concrete self expression. The child could not consistently identify left from right on himself or others which Tomatis described as "being lost in his own body".

Tomatis felt that this second lad was very definitely dyslexic and that he would require long and intensive training on an APP program.

Remedial Training Program

Passive Phase - Filtered Sounds and Sonic Birth

Both subphases of the Passive Phase will be discussed as one unit since they cannot be distinctly separated as was possible in the previous case. The initial thirty sessions of mother's filtered voice (VMF) were sufficient to reduce the resistance shown in closed selectivity and theoretically permit Brian to proceed to the second subphase of Sonic Birth. This was accomplished very smoothly in five sessions with the child recognizing and accepting his mother's voice with delight. Brian seemed ready to proceed with the Active Phase of training but despite cooperation and effort he experienced considerable difficulty in understanding the voice on the tape and became physically tired by the end of the session. While the selectivity was opened at this point, there was still the noticeable drop within the language area on both the left and right listening curves. The Program Consultant decided to return to the Filtered Sounds subphase for a further twenty sessions of VMF. After a total of sixty four training sessions, the Sonic Birth was again briefly reintroduced in mid April in preparation for the Active Phase of the program.

Tomatis Listening Test. By mid April, selectivity had opened completely and all spatialization errors had disappeared. However on both ears the air and bone conduction thresholds showed a pronounced dip in the frequency range related to speech, that is, between 1500 and 4000 Hz. In APP theory this is believed to indicate that the subject has "given up hope" of overcoming his communication problems.

Program Assistant's Observations. In the initial training sessions Brian appeared quiet and relaxed but after two weeks his physical activity began to increase in the therapy room, the classroom, the playground and at home. This was immediately followed by aggressive outbursts in all of the same settings. The Program Assistant offered suggestions to both teachers and parents on how to handle these short lived episodes in a positive manner. At this point Brian began to show a definite curiosity about the APP program so the Program Assistant had to reexplain the program and his involvement in it.

Following the initial Sonic Birth Brian made his first original creation; began to seek attention in a positive manner; and began to enjoy physical touch for the first time.

Towards the end of the Passive Phase, Brian was more open and at ease in relating. He wanted to share his experiences with the Program Assistant. He returned from his short Easter Vacation absolutely elated because his dad had made a specific effort to spend half of each day with the family.

Teachers' Observations. The teacher first noticed a general quieting of physical activity, after the initial training sessions, followed by a short period of almost "detachment" which gave way to better gross motor

activity and a much keener interest in the physical education program. Brian was now depending less on the group for ideas but still remained in the background when plans were made on a verbal level. About the close of the Passive Phase the classroom teacher enthusiastically reported that, for the first time, this child drew a picture then volunteered to write a story about it on the blackboard for the whole class to view. He was organized in his thoughts and systematically looked up the spelling of difficult words. He was therefore showing a desire to socialize within the classroom situation.

Parents' Observations. At home Brian's behavior grew from a desire to be completely by himself and open physical expression of aggression to some socializing with the family, an ability to focus his aggression and to stand up to his siblings. While the parents found this behavior very difficult to accept in a large family where a "quiet child" had been a welcome relief, they did accept the consultation of the Program Assistant and encouraged the boy in his social development at home.

Passive Phase Summary. The opening of selectivity on the TLT along with slight ascendance of air conduction curves and a slight lowering of the bone conduction thresholds suggested readiness to proceed to the Active Phase. The dip in the speech range could be dealt with more effectively in the Active Phase of training. Brian's general mood was now more relaxed, he showed signs of wanting to relate on a personal level, and he had begun to assert himself.

Active Phase - Performing

This third stage proved to be the longest and most difficult part of the training program for Brian. It lasted a total of six and a half

months (220 sessions) from mid April to early November. The auditory-vocal exercises were very difficult for Brian who had experienced difficulty in auditory discrimination and verbal expression since early childhood. He now had to listen to words and phrases presented on a tape without the assistance of visual aids. Visual learning, especially through observation of pictorial situations, has always been quick and easy for this lad. It has tended to take over for the auditory attention which lags far behind.

Brian's mood and involvement in the exercises fluctuated throughout this phase. He required considerable support and encouragement to continue to overcome his difficulties.

Tomatis Listening Test. By early November the selectivity had remained open but the bone conduction thresholds had risen especially in the lower frequency range denoting tension and easy exhaustion. More positively, the air conduction thresholds had taken an ascending curve, and the dip in the speech zone for each ear was much less pronounced.

Program Assistant's Observations. At the beginning of this subphase Brian needed constant encouragement from the Program Assistant as he demonstrated easy discouragement and very little energy for sustained auditory attention or physical posture. As the boy was extremely distractible with any visual stimulus even in a darkened room, he was asked to close his eyes when working on the auditory-vocal exercises. At first Brian found this almost frightening then, with time, he came to enjoy it.

In June, after two and a half months on this subphase, Brian began to discern differences in the words he was perceiving from the tapes. At times he even became argumentative claiming that the voice on the tape

was mispronouncing the word as he had always heard it differently. An example was his insistence that "describe" ought to be "descrive". It was impossible for Brian, at the beginning of this subphase to repeat more than the initial word or words of a phrase and if single words were lengthy, he often only got the initial sound.

By mid July Brian had mastered the easier single word exercises and he spontaneously maintained correct posture during the training sessions. He noticeably shifted from left mouth to right mouth as he spoke, something which Brian himself also observed. During sessions of filtered music the boy began to add words to his drawings. His spelling had become at least phonetically correct.

Brian's progress was slow. If pushed too quickly he reverted to wild guessing and poor participation. A marked improvement was usually followed by either a plateau or a short period of regression.

Teachers' Observations. The teachers had noticed the first impact of the child's self awareness of his difficulties not only because he verbalized them, as mentioned earlier, but because the "awareness of himself" seemed to temporarily throw him into a rather depressive mood. At the same time he seemed much more human; having a need for people, and obviously more sociable with both peers and adults. As we had noted in the training sessions, the boy also had exhibited periods of progression interspersed with regression, in his school activities. His social involvement appeared to be gradual but consistent. By midway in the training program this boy was considered to be a leader with his peers, usually in a positive manner but occasionally negatively, making choices and implementing his own decisions rather than standing on the periphery

waiting for others to organize the activities. After three months on this third subphase, the boy showed a decided improvement in concentration and application of his school work. He was having a lot of difficulty, particularly in the language arts, but he was co-operative and eager to participate in class discussions and to share his projects with the group. Toward the end of this phase the teachers felt that the boy gradually slipped into a slump. This lasted about a month before he began to pick up again.

Parents' Observations. In May Brian's mother enthusiastically reported that her son now strongly desired to be with the other family members even if having difficulties with them. She also noted his improved tolerance for accepting correction in his speech as well as his ability to catch his own errors. The third marked change was that, for the first time in his life, he was able to accept mother's departure for a week-end without demanding a detailed itinerary of her planned activities. An interview, later in this phase of APP training, showed that behavior at home continued in a positive manner with this boy taking more and more part in the family life; using more language to express himself; accepting the blame for his own misdeeds; and being able to correct many of his language errors spontaneously. The parents expressed their son's development as one of improvement followed by a short plateau; followed again by even greater improvement.

Subphase Summary. The main gains obtained during this lengthy subphase include: improvements on the TLT; increased social participation; greater effort towards accuracy in speech and language. However Brian's overall mood tone and motivation had been variable. He still experienced

difficulty with some of the more demanding auditory-vocal exercises. More time could have been spent on this subphase but since the overall program was coming to a close, the final subphase was introduced.

Active Phase - Training

Training in this subphase consisted of reading simple first grade books over the last three weeks of the program. Reading sessions were alternated with sessions of filtered classical music (MF).

Tomatis Listening Test. Although the air conduction thresholds took on a more ascending slope as desired, the bone conduction thresholds rose again in the lower frequencies, suggesting increased tension. In addition the dip in the speech area of both curves became more pronounced.

Program Assistant's Observations. During this final phase Brian would still become tired and fidgety with concentrated work although he had improved a great deal in this respect. As he tired he would begin to wildly guess at words, rather than sounding them out.

Teachers' Observations. Brian's teachers had not noticed any specific behavioral or academic changes during this final phase of training. Rather they felt that he had progressed noticeably during the total APP intervention even though academically he still was not up to par. They stated that he would now defend himself verbally even with adults, as opposed to his former "clam up" attitude. They also noted a remarkable change in his self confidence. He was now a leader in his group in the gym class and accepted by his peers as a leader on the playground. Academically he was not stable. He had good days and bad days although there had been a gradual overall improvement especially in his enjoyment of reading.

Parents' Observations. The parents noted a definite change in this boy's self confidence and happiness during the last month of training. They also noted that for the first time, he was beginning to reflect on past events demonstrating excellent recall, and planning for the future. They expressed their feeling that Brian was going through a very verbal stage insisting on getting his word in and trying to express his ideas clearly even correcting himself when necessary. In the family setting, if given responsibility for his own activities he did well; but, if an older sibling was put in charge Brian became babyish and careless.

Subphase Summary. The training in this subphase was too short and perhaps immature. Although Brian gained in self assurance the TLT results show that he regressed slightly.

Summary of Brian's APP Training Program

Brian's training program can be considered only partially successful. This is seen in Figure 8 where the boy's TLT and ALM results are reported for before and after the training program. Although selectivity remained open and spatialization errors had disappeared, the air conduction curve had attained only a slight ascendancy, mainly in the lower frequencies. The bone conduction thresholds remained too high in the low frequencies indicating underlying tension. The dip in the middle range remained in evidence after it had been partially corrected earlier in the program. The ALM test indicated that the left ear still had the advantage (-1.5) in the control of speech. Despite the lengthy auditory-vocal training this boy was not yet lateralized.

Those results together with Brian's tendency to fatigue and synkinesias during demanding exercises suggest that a prolonged Performance

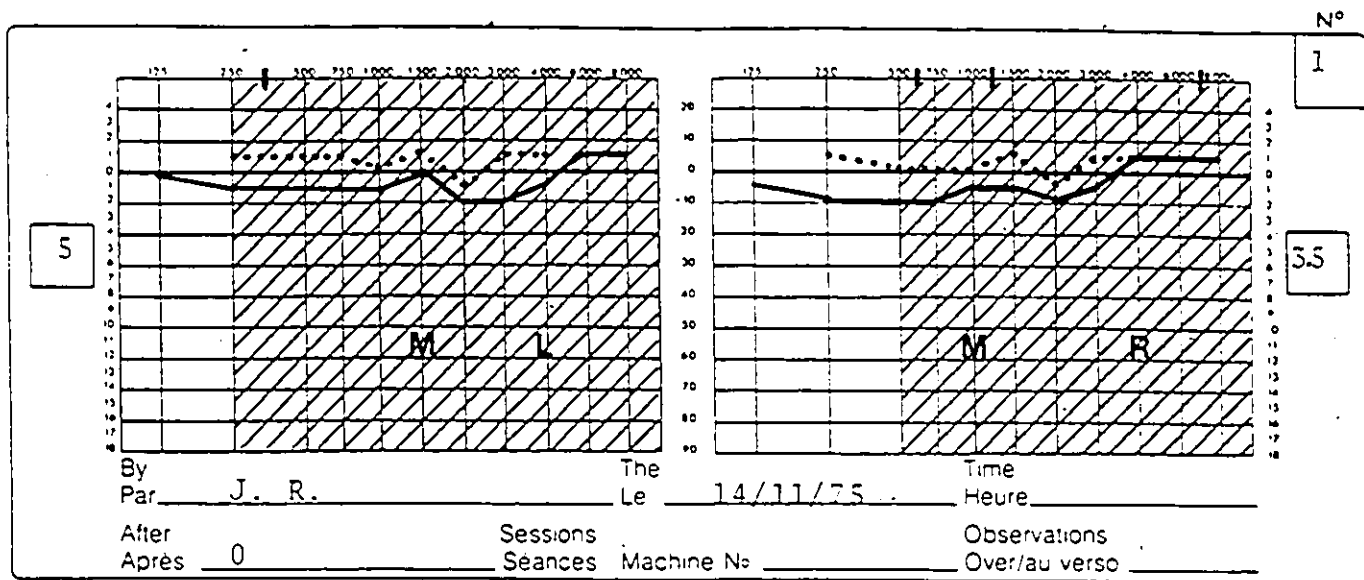


TOMATIS LISTENING TEST TEST D'ÉCOUTE TOMATIS

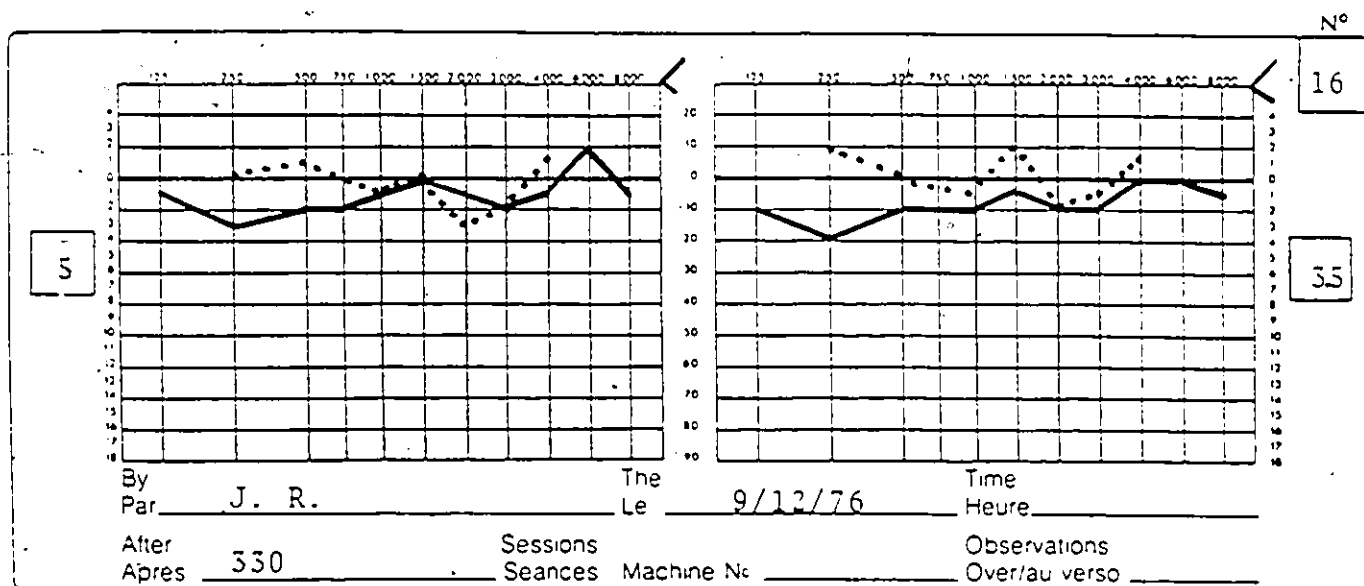
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123.

FAMILY NAME SUBJECT 2 GIVEN NAME BRIAN
NOM de FAMILLE SUBJECT 2 PRÉNOM BRIAN AGE 7 yrs 11 mons.



AT THE START OF APP TRAINING



AFTER TERMINATION OF APP TRAINING

Figure 8.

Pre and Post APP Remedial Training Results on the
Tomatis Listening Test and Audiolaterometry for Brian

subphase might have been advisable. However the reports of increased self-confidence, better social interaction and improved verbal expression suggest that some gains had been attained.

The diagnostic tests readministered at the termination of the APP remedial training program indicate that Brian would still be considered as dyslexic according to their parameters. His achievement level was Grade 2.3 which was an improvement of half a year over a one year period. His expectancy age was nine years nine months yielding a Learning Quotient of 81. At this point his Behavior Rating Scale score was 70, which was the cut-off point established for dyslexia.

SUBJECT 3 - CHARLES

Diagnosis

Background Information

The third of our dyslexic boys was a blonde haired blue eyed, frail looking youngster, eight years of age, whom one could size up immediately as being socially awkward with peers and adults. He is an only child from a rural environment which had prevented him from interacting with other children. He had great difficulty making friends in school so could usually be found playing by himself, most frequently with small cars on the floor, typical of a much younger child.

Presenting Problems. As the parents themselves tended to be loners, they did not see this or their more peculiar life style as problematic for their son. They did however remark on his babyish behavior particularly under the mildest of physical discomfort. Other behaviors, normally acceptable as average behavior for an eight year old, were viewed as immature by these parents who expected their child to respond and act like

an adult. They were concerned about Charlie's poor academic performance as well as his babyish behavior.

The teachers noted that Charles had many problems in sequencing and reversals. His social skills were inadequate as most of his encounters with his peers were either boastful or completely unrealistic. He preferred to either play by himself or to daydream. He was also quick to respond with sobs if things did not go his way or if he was even slightly hurt physically.

Family Constellation. Both parents are artists and employed. The father is an Industrial Designer teaching part time in a college setting. This child was unplanned and as such interfered with the mother's completion of a Bachelor Degree. The family lives a rather secluded life and in a style commensurate with their artistic personalities. Of the two parents the mother is the more sociable. She is likewise the main organizer in the family and has not facilitated or encouraged the boy to reach out to his father as a model for socialization.

Although loners by nature, the parents are employed in situations demanding daily contact with other employees. The father was diagnosed as Learning Disabled when he was fifteen years of age.

Developmental Characteristics. Mother reported an uncomplicated pregnancy and birth. Charles' early developmental milestones were all within the normally expected ranges. Allergic reactions to milk and wheat are controlled effectively by a corrective diet.

Educational Experiences. Academic life started for this young lad at the age of two and a half with enrollment in a Montessori program. From the start the boy did not like school and, when more formal work was

introduced, he found all reading and number concepts difficult. After four years in the Montessori program Charles was enrolled in the Child Study Center at the age of six. Despite his bright potential and the small group learning situation, the boy had progressed only six months during his fifteen months stay at the Centre prior to inclusion in the present research project.

Diagnostic Test Results

WISC-R. In November of 1975 the boy's WISC-R Verbal IQ was 112 and Performance IQ 114. This indicates that Charles is of high average intellectual potential.

Learning Quotient. Charlie's achievement grade level was 1.7 yielding an Achievement Age of 6.9. Expectancy Age as calculated by the Myklebust Discrepancy Formula was 8.1 giving a Learning Quotient of 85 which is below the "90" cut off discussed by Myklebust.

Behavior Rating Scale. This lad obtained a score of 67 on the BRS which was below the cut off of 70.

In addition, Charles met the requirements for classification as dyslexic according to the exclusion and special education criteria spelled out in the operational definition.

APP Assessment

Tomatis Listening Test. The TLT indicated: 1) open selectivity, 2) only one spatialization error on the Right ear graph 3) a good listening curve showing that the boy was ripe for lateralization.

Audiolaterometry. This ALM test indicated that Charles used his Left ear in the monitoring of his own speech (-2.0).

Personal Interview. Tomatis found that Charles had a very good voice and that his posture was good when he spoke. Tomatis diagnosed him as mildly dyslexic and should respond to an APP remedial training program within three to four months. He apparently had the basic security but now needed the socialization experiences and acceptances to produce lateralization through communication.

Remedial Training Program

Passive Phase - Filtered Sounds and Sonic Birth

The two subphases are described together because they are both of short duration.

After thirty sessions of passive listening to filtered sounds (VMF) the Sonic Birth subphase was successfully completed over a period of five sessions. Charles was delighted to recognize his mother's voice. By mid March he was ready for the Active Phase of the program.

Tomatis Listening Test. The TLT results remained essentially unchanged and favorable.

Program Assistant's Observations. Early in the training program Charles was restless, talkative and attention seeking. He was dependent on the Program Assistant to complete his projects such as drawings and plasticine sculptures. Charles made frequent references to his mother who at this point, was his sole point of comfort. By the tenth training session the boy's bodily tension increased noticeably and he became more restless, disruptive and provocative. By the twentieth session he became somewhat dazed, distant, forgetful and disorganized in his behavior. However by the thirtieth session he was more relaxed and in tune with his environment. At this point he began to enjoy physical play with the

Program Assistant. He also began to complete his own projects thus showing more independence. Following Sonic Birth he again became more talkative but in a personal way.

Teachers' Observations. After an initial period of hyperactivity Charles sank into a state of self absorption almost losing touch with his surroundings. By the fifth week of therapy the teachers noticed that Charles was becoming more involved in playground activities and was beginning to talk like the other kids in his group. There was much more physical activity and contact in his play, and he began to enjoy roughing with his chums.

Parents' Observations. During the initial treatment phase the mother reported changes in the child's bodily experiences. He complained of frequent stomach aches, some dizziness; and a short period of accident proneness. She also noted the initial self absorbent forgetful gaze. The parents were encouraged to use more physical and less verbal contact with their son. The mother readily admitted treating the boy as an adult and was initially enthusiastic to learn more appropriate and less frustrating methods of handling his behavior. The father, on the other hand, had to be encouraged to participate. At the end of the Passive Phase this boy began to show definite self assertiveness. This upset the mother who felt very threatened and afraid of losing control of the situation. Her immediate reaction was to withdraw the child from the program. With guidance from the Program Consultant and the Program Assistant she decided to keep her son in training and began to realize her own opportunity for growth. While Charles' growth toward self assertion caused a great deal of physical tension, the final sessions of this first Phase helped the boy to physically relax and to be ready for the Active Phase.

Summary of Passive Phase. The favorable TLT results, and behavioral reports of social outgoingness and self assertion indicated a readiness for the Active Phase.

Active Phase - Performing

This third phase proved to be the happiest and most fulfilling for Charles. . He progressed positively and rapidly through the auditory-vocal exercises in seventy sessions from mid March until the end of May. His posture was upright but relaxed, he discriminated sounds and articulated clearly.

Tomatis Listening Test. Air and bone conduction thresholds gradually took on a more sharply ascending curve and the bone conduction thresholds began to fall below the air conduction thresholds.

Program Assistant's Observations. Charles' busy work with plasticine, drawing etc. began to reflect peer experiences. He was serious and worked diligently in the training sessions which required his effort. His thoughts became noticeably better organized and more realistic. He also began to show an interest in words, their spelling and uses, particularly to describe his creations. By the end of May Charles was demonstrating a definite interest in reading to obtain information. However, his choice of material was way beyond his reading skill level.

Teachers' Observations. The teachers saw Charles as progressing slowly but positively both academically and socially.

Parents' Observations. At this point in the program both parents were pleased with their son's efforts to relate warmly to them and to share his experiences with them. They also took time to read to the boy without expecting him to reciprocate. He was also encouraged to invite

classmates to his home over the week-ends. Charles' parents were pleasantly surprised when at the end of this phase of the training, the boy spontaneously picked up a book and read to them. This warm growth producing home environment was reflected in the boy's daily attitude toward school and friends.

Subphase Summary. The positive TLT results, quick success on the auditory-vocal exercises, improved socialization, better self expression and improved academic performance all indicated that Charles was ready to proceed to the final phase of training.

Active Phase - Training

The boy began this final phase of the program with marked enthusiasm. He was eager to read and felt lifted by his successes. He had a tendency however to gloss over word endings and to use reversals. His reading ability continued to improve slowly but surely over the next four months. Despite the lateralization and the improved reading this lad's bone conduction curve was high in comparison to the air curve suggesting a considerable amount of physical tension. Tomatis feels that this is frequently the result of a poor model for language communication in the person of the father or father substitute. This boy's father had a history of severe learning problems and had himself been diagnosed as dyslexic. His own audiogram demonstrated a dip in the language area. When Charles had been on the fourth phase for three and a half months, and still demonstrating the signs of tension, the father decided to start APP training as well, in the hopes of reeducating his own language communication and at the same time supplying a better model for the boy. However after about ten sessions he was reluctant to continue when he began to experience outbursts of anger.

Tomatis Listening Test. The TLT results remained generally positive throughout this subphase. The bone conduction thresholds did rise noticeably indicating an increase in underlying tension.

Program Assistant's Observations. During July, although Charles spoke with greater clarity and more facial expression, he began to show decided regression in his enthusiasm for work in the training sessions as well as in the classroom. The Program Assistant learned that the parents were making family holiday plans contrary to their commitment to this research project. The child was aware of this but had been sworn to secrecy. This was brought out into the open and the child, somewhat relieved, again picked up in enthusiasm and interpersonal relationships. This however had slowed down his APP progress as well as his academic learning. After this Charles did continue to improve in self assertion and independence but at a very unpredictable rate. The parents continuously found excuses, during the final three months of training, to withdraw the boy from therapy sessions and classroom programs again preventing him from the consistent and continuous APP training and the social activities important to peer interaction. The parental interference was even more noticeable at the end of the program when they had related to the child that he would be changing schools the following year and by their behavior indicated that he need not be too concerned with any demands put on him by the Child Study Centre.

Teachers' Observations. During July the teachers noted that Charles completely closed off communication with them and other staff members. He needed to be physically brought to attention. He was also very restless. At the same time he withdrew from participation with his peers. After

the source of his problem had been settled Charles once again became more settled and attentive. However the final two months of the training program were marked with fluctuating behavior.

Parents' Observations. At the beginning of this subphase Charles' mother commented upon the boy's increased attention span particularly for projects around the home. In November, at the close of the program, both parents described their son as more self reliant, less babyish, able to stand up to others and conscious of other's needs. They were enthusiastic about the boy's improved interest in reading as well as his ability to express himself better. They noted however that he still experienced some difficulty with spelling.

Subphase Summary. The TLT results and Charles' behavior indicated increased tension which interfered with his performance in both the training program and school progress. Training during this subphase was not as productive as had been hoped.

Summary of Charles' APP Training Program

Charles showed many positive changes during the first half of the remedial training program. He became more relaxed, more outgoing and had some success in relating to his peers. His general behavior became more age appropriate. His concentration improved, he gained an interest in reading and his academic achievement level improved. His progress however was slower during the second half of training. He did gain in the areas of greater self reliance and consideration of others but his progress did not live up to expectation. The increase in tension and frequent periods of absenteeism made the boy's motivation and performance quite variable.

Figure 9 compares the TLT and ALM results before and after APP training. Shortly after the program, December 1976, the air conduction thresholds had taken on a more distinct ascending curve. However the bone conduction thresholds were high again after they had fallen to a more appropriate level earlier in the program. One spatialization error appeared. The most positive gain was registered in auditory-vocal laterality: whereas Charles commenced training with a Left ear advantage of 2.0 in the control of speech, he terminated training with a strong Right ear advantage of 2.5.

Overall, this training program could be qualified as moderately successful.

At the termination of the training program Charles could no longer be considered dyslexic according to the criteria used for diagnostic assessment. At this time his Achievement Age was 8.3 and Expectancy Age 9.2 yielding a Learning Quotient of 90. On the Behavior Rating Scale he received a score of 73.

SUBJECT 4 - DARRYL

Diagnosis

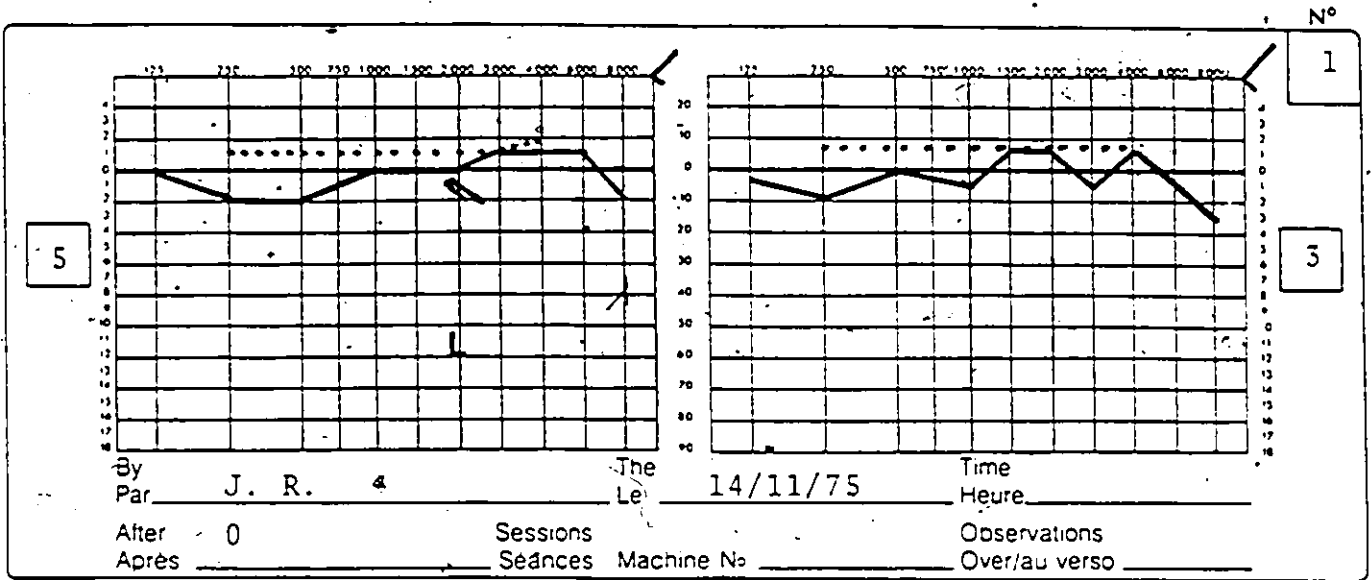
Background Information

The fourth of the subjects is an adopted boy, living in Residence at the Child Study Centre. Physically Darryl is a tall thin curly haired good looking negro boy. For this project the Residence is considered as his basic home environment although it was important to maintain contact and counselling with the adoptive parents as the boy spent several long week-ends with his family during the fourteen months of the present study. He was in residence partly because his home was too far to allow for

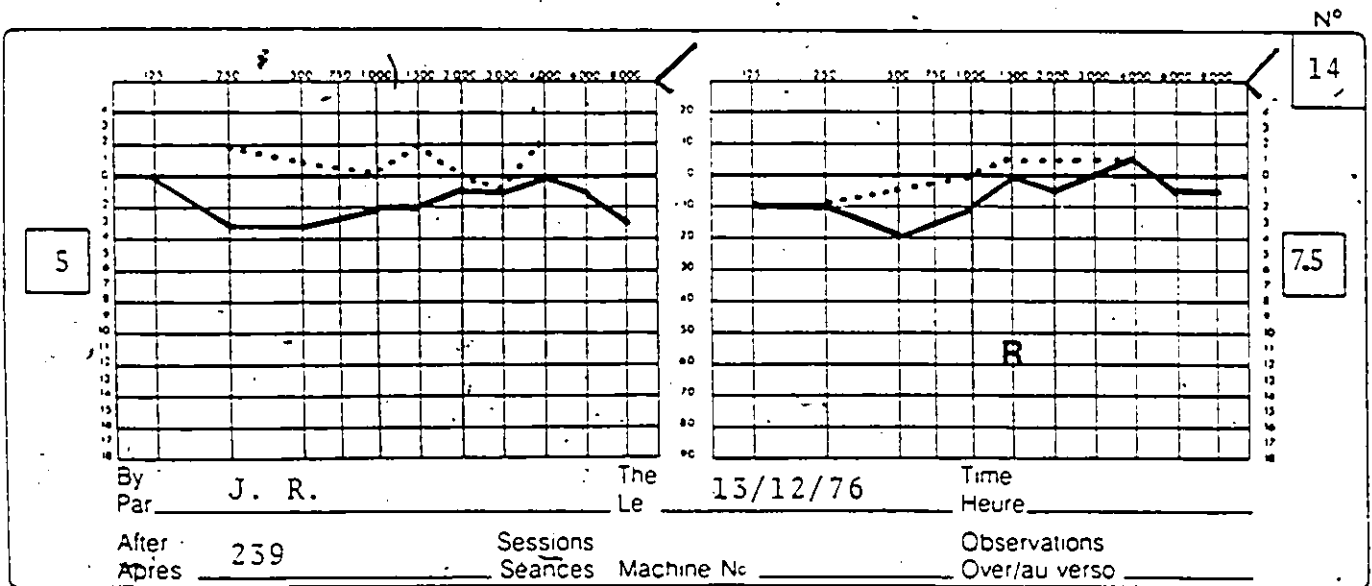


TOMATIS LISTENING TEST TEST D'ÉCOUTE TOMATIS

FAMILY NAME SUBJECT 3 GIVEN NAME CHARLES AGE 8 yrs 0 mons
NOM de FAMILLE SUBJECT 3 PRÉNOM CHARLES



AT THE START OF APP TRAINING



AFTER TERMINATION OF APP TRAINING

Figure 9.

Pre and Post APP Remedial Training Results on the
Tomatis Listening Test and Audiolaterometry for Charles

daily commuting and partly because he required the specialized program offered by the Centre for his severe learning problems. At the commencement of the study, Darryl was nine years, four months of age.

Presenting Problems. In the residential setting Darryl was happy and cheerful as long as no demands were made of him. When faced with the least responsibility or task he turned into a profound complainer. He went around with a chip on his shoulder expecting the worst both from himself and from others. The adoptive parents described his behavior as negativistic and disruptive on his visits home.

The classroom teacher felt that Darryl was achieving at a grade one level although he was in a grade three group at the time. Posture was very poor and he was described as being constantly on the move. He did not voluntarily or enthusiastically pursue any academic work and usually had a defeatist attitude before starting any project or assignment.

Family Constellation. Darryl's biological mother was a graduate nurse and white; his father, negro. The natural mother kept her child for thirteen months before giving him up for adoption due to family pressures. He was adopted by his present family at fifteen months of age.

Darryl's adoptive parents are both well educated: the father a professor in Business School; the mother, a teacher. Their three natural children, all girls, range in age from thirteen to eighteen years.

Developmental Characteristics. Pre and early post natal information is not available on this boy. At the time of adoption the boy was a bouncy, well co-ordinated, active but cautious little fellow. He demonstrated immediate affection for the adoptive father and sisters but took a long time to become trustful of the adoptive mother. Language was slow

to develop but the boy appeared to understand verbal instructions long before he spoke spontaneously. He has always been a sociable, curious fellow.

Educational Experiences. In nursery school, at three and four years of age, Darryl was described as aggressive and lacking in frustration tolerance. By kindergarten he was considered the bully of the class. At ages six and seven he was having obvious difficulties in both reading and mathematics. He started the pattern of "acting out" when asked to do something. It was during this period that his behavior at home began to deteriorate. By the time he was enrolled at the Child Study Centre at nine years of age, Darryl was already two years behind academically and demonstrating very negativistic behavior both at home and in school. At the commencement of this study he used many reversals when reading and writing, was slow to auditorize words and lost the flow of meaning in a sentence because of his many hesitations. When faced with new words he had considerable difficulty blending the sounds. He seemed to have no memory for words which he himself had previously sounded out.

Diagnostic Test Results

WISC-R. The intelligence test administered at this time, showed Darryl to be of average intellectual ability with a Verbal IQ of 108 and a Performance IQ of 111.

Learning Quotient. The achievement tests indicated this lad was working at the grade 1.9 level, which yields an achievement age of 7.2 years. His expectancy age was assessed as 9.4 years, yielding a Learning Quotient of 77. This is well below the 90 cut-off explained by Myklebust.

Behavior Rating Scale. Darryl's score on the BRS was 65 which is again below the cut-off, 70 for this test.

In addition to the discrepancy criteria just reported, Darryl met the requirements of the exclusion and special education criteria from the operational definition.

APP Assessment

Tomatis Listening Test. The results of this test indicated that:
1) selectivity was open; 2) the shape of the listening curve on the Left ear was not too bad, however the curve on the Right ear indicated that Darryl lacked an analytical approach to incoming auditory information; 3) there were several spatialization errors.

Audiolaterometry. The ALM indicated a preference of the Left ear in the monitoring of speech (-2.0).

Personal Interview. Darryl was fidgety and restless when trying to follow ongoing conversation. The boy not only had a poor posture but he tended to throw his head back much like an infant. When his head and back were supported his strained flat voice rose noticeably.

Dr. Tomatis assessed Darryl as dyslexic and noted that several months of training would be required to overcome this condition. Tomatis indicated that the boy's posture would improve as he learned to perceive the higher frequencies.

In summary, Darryl could be considered as dyslexic according to the composite definition and APP criteria.

Remedial Training Program

Passive Phase - Filtered Sounds

Since Darryl had been adopted, it was impossible to obtain the biological mother's voice. Because the adoptive mother's voice was low and since Darryl had been reluctant to relate to her in infancy, Dr. Tomatis

recommended that the program commence with twenty sessions of filtered music followed by twenty sessions of a substitute female voice that would supply the orientation of a human voice. A carefully selected substitute voice is said to be better than music alone.

While the initial assessment showed open selectivity the child dealt with his world through a selective listening attitude and a confused spatialization. With the first twenty sessions of filtered music body tension gradually relaxed. After forty sessions the Sonic Birth was attempted with encouraging results but when Darryl's behavior deteriorated shortly thereafter he was reinstated to the Filtered Sounds subphase. In April the Sonic Birth was again attempted with success but Darryl regressed in the face of the auditory-vocal exercises. The Filtered Sounds subphase was once again reinstated until the boy's mood and motivation stabilized. By the end of June, after 140 sessions, he was ready for the Active Phase.

Tomatis Listening Test. TLT results fluctuated during this subphase. Selectivity remained open and spatialization errors were overcome early in the program. The air conduction curves gradually took on an ascending curve. The bone conduction thresholds fluctuated considerably showing a more desirable ascending curve toward the end of the Passive Phase. They remained slightly above the air conduction curves.

Program Assistant's Observations. In the early sessions Darryl complained constantly about having to work in school, to obey rules, to participate in the activities of the residence, and about the hours of his remedial training sessions. This had produced constant verbiage and it took structuring to get him to listen to the tapes and to stop talking. During specifically allotted conversation periods, he rambled on flitting

from one subject to another, often in a confused manner. After thirty sessions the boy became less talkative, was showing more aggression in his drawings and at the same time began to talk about one or two things that were important to him in his everyday life situations. The fantasy exhibited in his earlier work in plasticine and drawing began to take on more realistic proportions. As he became less tense in his body, he became very giddy, almost uncontrollably so. After one and a half months of training the boy organized and expressed realistically his dislike for structure and adult demands made both at home and in the academic setting. He experienced a short period of depression at this time.

At the time of the initial Sonic Birth session Darryl's mother had walked out of the home. Although the boy actually lived in residence, he was informed of the family situation which heightened his insecurity as he already felt some rejection at being sent away to school. During the next two weeks of filtered sounds this boy talked a great deal about his negative feelings toward his adoptive family and his feeling of rejection.

During the third month of training, the Program Consultant and the Program Assistant worked intensively with the adoptive mother on her attitude toward the program at the Child Study Centre. She had been "going along" with the program because it was handling her child at a time when she was experiencing great difficulty controlling him. However she apparently felt guilty that he was away from home and therefore frequently presented the Centre and its program in a negative light so she herself could "look good" to the child, who was negative to anyone who tried to structure his life. Following these interviews, Darryl's mother

made a decided effort to co-operate with the program thus presenting the child with a firm and unified approach from all sides.

Teachers' Observations. Initially Darryl was overtalkative and disruptive in the class. Then he fell into a slump. From March until mid June he was difficult to handle but more realistic in his complaints. Toward the end of the subphase he began to show some motivation for learning.

Parents' Observations. At the time of the initial session of Sonic Birth Darryl became more involved in the residential program and for the first time was beginning to rise enthusiastically in the morning, looking forward to his day; rather than pulling himself out of bed and dragging himself through the preschool routine. The child's adoptive mother felt that he had become more content and genuine in his feelings during his visit at home which occurred at the close of this phase.

Subphase Summary. After six weeks of training the TLT and behavioral results suggested that the boy was ready for the Sonic Birth subphase. However the adoptive mother's interference complicated Darryl's progress and the Filtered Sounds subphase was reinstated. At the end of the fifth month of training again the TLT results and behavioral reports suggested that Darryl was ready for the Sonic Birth subphase.

Passive Phase - Sonic Birth

During the first two weeks of July a very slow version of the Sonic Birth was introduced combining both the music and substitute voice versions of the sonic birthing process.

Tomatis Listening Test. The results of the TLT remained positive and the bone conduction thresholds had started to become lower than the ascending air conduction thresholds.

Behavioral Observations. The program assistant, the teachers and the camp staff all noted that Darryl was gloomy early in the week following the regular week-end visit by his family. By mid week his attitude and motivation would improve.

Subphase Summary. Positive TLT results plus general improvement toward a positive attitude suggested readiness for the Active Phase.

Active Phase - Performing

Darryl worked diligently on the auditory-vocal exercises of this subphase. He required ninety sessions to complete the subphase. These lasted from mid July to early October.

Tomatis Listening Test. TLT results remained positive but the bone conduction curves rose above the air conduction thresholds.

Program Assistant's Observations. After his initial resistance to structure in July, Darryl became co-operative in August. He could then attend to the exercises without tiring and advanced more rapidly than had been expected. Also during August, the boy's improved articulation and facial expressions suggested that the Right ear was taking over the monitoring of speech. In September he began to show interest in reading.

Teachers' Observations. In August Darryl came to camp with an entirely different and positive attitude. The teachers noted that his spirits were bouyant and he was eager to do things. His concentration had improved and he wanted to work in class. He now began to recognize words rather than sounding them out each time as if they were entirely new words.

Parents' Observations. During the second half of summer camp Darryl began to prefer the residential setting to the family setting. With this

more settled attitude the crying behavior ceased and the boy put much more effort into his work and play.

Subphase Summary. The boy's moods and general attitude became positive and stable during this subphase. Darryl also became more self assured.

Active Phase - Training

Darryl had sixty sessions of the final subphase during the last two months of the remedial training program. Active reading sessions were alternated with sessions of listening passively to filtered music. The reading was taken slowly as the boy was just beginning to master basic skills. If he attempted material beyond a grade two level, he tired quickly, synkinesias appeared and Darryl would skip word endings.

Tomatis Listening Test. TLT results remained generally positive.

Program Assistant's Observations. Darryl enjoyed his new found ability to obtain meaning from words. By the end of November he read some sentences fluently. His attitude and motivation were positive during this subphase.

Teachers' Observations. Reading fluency and comprehension began to improve during this subphase. Oral expression improved to the point where Darryl could express his thoughts and feeling in a clear systematic fashion.

Parents' Observations. Residence staff noted particularly the boy's increased self awareness. The lad became more independent in the completion of house chores and homework. Both residence staff and adoptive parents noted Darryl's increased self confidence.

Subphase Summary. The first indications of a desire to read for information or meaning occurred during this subphase. Mild synkinesias and signs of fatigue in more difficult reading material suggest that further training, in this particular subphase, might have been beneficial. Self awareness, self confidence and self sufficiency all showed improvement during this subphase.

Summary of Darryl's APP Training Program

Darryl required five months of training in the Passive Phase before he settled into the more positive and co-operative disposition required for the Active Phase. From that point on, his concentration, work attitude, self expression, self confidence and academic performance improved slowly but surely. His program involved 295 training sessions.

Figure 10 presents the TLT and ALM results before and after the APP training program. At the termination of training selectivity had remained open and all spatialization difficulties had been overcome. The air conduction thresholds had taken on a more ascending slope, indicating a more differentiated form of listening. Bone conduction thresholds were slightly higher than at the start of training, with spikes at 250 and 1500 Hz. This indicates the presence of tension. According to Tomatis, this pattern is often associated with an allergic condition. The ALM results show a shift from Left ear advantage of 2.0 in the control of speech, to a Right ear advantage of 1.0. The latter does not represent a strong advantage but it does point to a step in the hoped for direction.

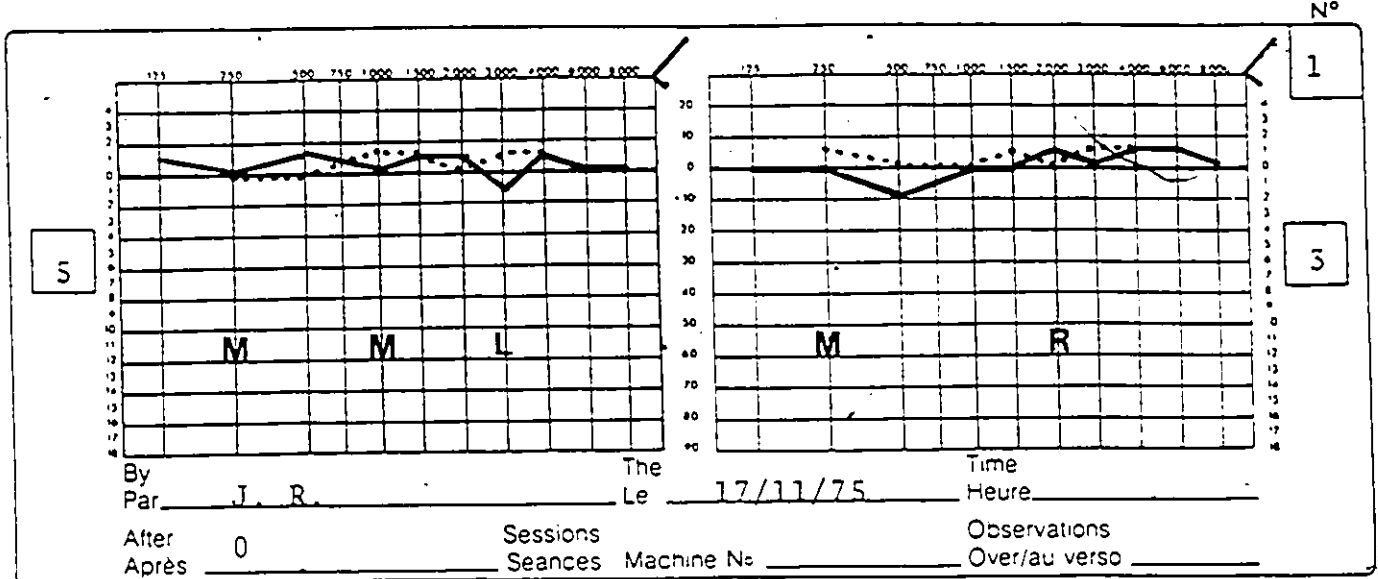
Darryl's remedial training program could be called moderately successful according to APP criteria. A stronger reinforcement of Right ear self listening and the attainment of more appropriate bone conduction



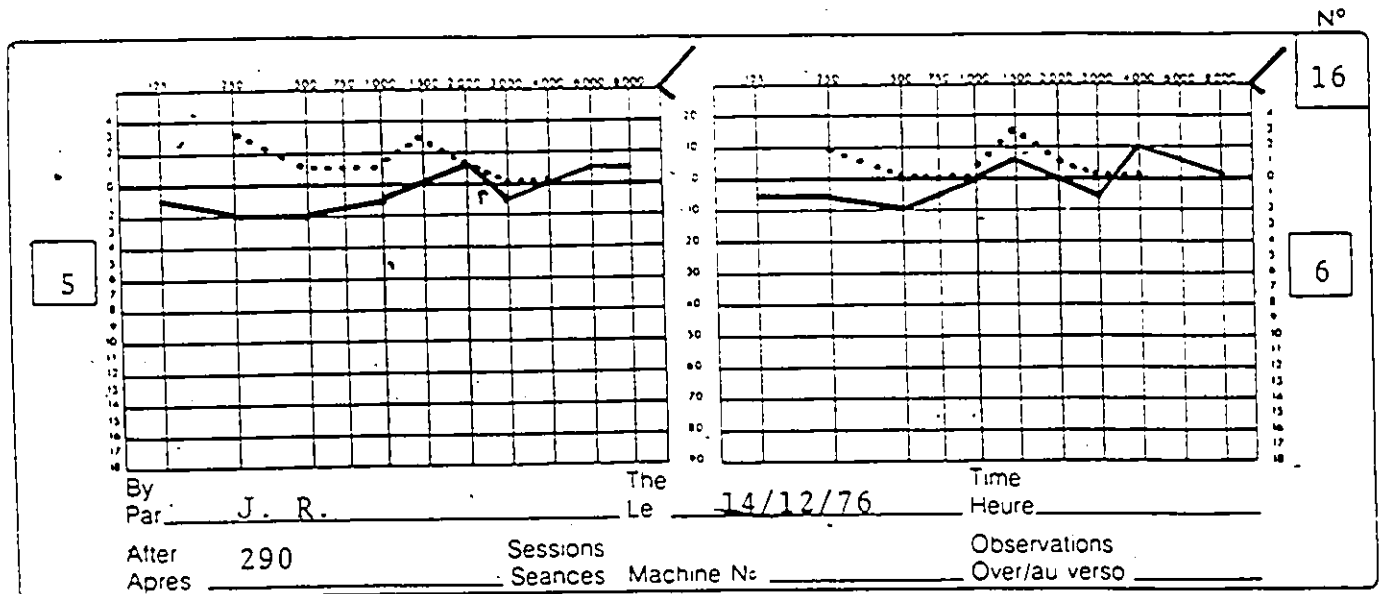
TOMATIS LISTENING TEST TEST D'ÉCOUTE TOMATIS

Page No ☐
Feuille N° ☐

FAMILY NAME SUBJECT 4 GIVEN NAME DARRYL AGE 9 ^{144.} yrs 0 mons
NOM de FAMILLE SUBJECT 4 PRÉNOM DARRYL



AT THE START OF APP TRAINING



AFTER TERMINATION OF APP TRAINING

Figure 10.

Pre and Post APP Remedial Training Results on the
Tomatis Listening Test and Audiometer for Darryl

thresholds would have been desirable. A longer period in the Active Phase would have been preferable.

At the close of the remedial training program Darryl would be considered as borderline dyslexic according to the criterion used for the diagnostic assessment. At the close of the remedial training program his Achievement Age was 8.8 while his Expectancy Age was 10.5. These yield a Learning Quotient of 83 which is still considerably below the cut-off of 90. However he scored 71 on the Behavior Rating Scale at this time. This score is above the 70 cut-off for dyslexia.

SUBJECT 5 - ERNEST

Diagnosis

Background Information

The eldest of the boys was nine years five months at the beginning of the APP remedial training program. Physically he can be described as short and plump with babyish facial features. He was a whiny child who looked scared and discouraged.

Presenting Problems. Ernest's parents saw their son as unhappy because he could not live up to his own self imposed expectations. They themselves value academic achievement but have not pressured the boy in this respect. They realized early that their son had serious learning difficulties and have always tried to help him by providing good remedial assistance. They also recognized that Ernie cried easily if things did not go his way; and, that he related easier to younger children or adults than to his peers.

Ernie's teachers stated that he had not yet mastered the basic reading and spelling skills. They found him to be easily frustrated in his

work, becoming more negative toward school and himself. They too noted that he played with the younger children, overreacted to little situations and was easily reduced to tears. He was very demanding of the attention of adults while his peers tended to call him "dummy" or "sissy".

Family Constellation. This boy is the elder of two children in an intellectually oriented family. The sibling, a sister, is two years his junior experiencing no problems academically, socially or within the family setting. Parents are both M.A. graduates. The mother, although professionally trained, prefers to spend her time at home with her family. The father is an economist and influential civil servant. Both parents enjoy sports in their leisure time and include the children in many of their activities. There is no history of learning problems in the family background.

Developmental Characteristics. Other than breach presentation all factors of this lad's pre and post natal life were within the normal range. Motor milestones such as sitting, crawling, walking and toilet training were average or earlier. Language development, however, was slow. Ernest had his own words for everything; between two and three years of age only the parents could understand him. He seemed to have trouble blending syllables into words although he could pronounce each syllable individually. At the age of five enunciation was still poor. He was ^{always} an inquisitive active child and socially independent in these early years despite his lack of clear speech.

Educational Experiences. Ernie started school at the age of four, in New Brunswick at which time school problems were first reported--he was described as a behavior problem. At age five he moved to Halifax

where he attended an open concept class with one hundred children. Here he was described as pleasant but attention seeking. He did not learn anything that year. The next year he entered grade one in a suburban Ottawa school. At the end of the year he was still behind his peers despite having received remedial assistance after school hours. He was also becoming aware of his own problems. At this time he began to continuously seek assistance from an adult rather than attempt any solutions of his own. Finally in the spring of 1974 he was referred to the Child Study Centre because of slow school progress, poor self image, and general academic attitude. He was enrolled in the combined Residence-Academic program in September 1974 at eight years of age having completed four years in the regular school system. He had spent one year and three months at the Child Study Centre when he was recommended for the present project.

Diagnostic Test Results

WISC-R. On the battery of formal tests administered, this boy had a WISC-R Verbal IQ of 102 and a Performance IQ of 131 indicating that he was of above average intellectual potential.

Learning Quotient. The achievement test results indicated that Ernie was functioning at the Grade 2.9 level yielding an achievement age of 8.2. The actual Expectancy Age, as calculated by Myklebust's formula was 10.2 yielding a Learning Quotient of 80 which is well below the cut-off of 90.

Behavior Rating Scale. Here Ernie received a score of 63 which is below the 70 point cut-off.

In addition to these discrepancy criteria Ernest met the requirements of the exclusion and special education criteria of the operational definition.

APP Assessment

Tomatis Listening Test. The initial Listening Test showed: 1) completely closed selectivity on the Right with the language areas closed on the Left; 2) the air conduction curve was high and flat with a severe drop off in the higher frequencies indicating good hearing, lack of analysis of sound and a loss of energy due to the blocking out of the high frequencies which are the energizers; 3) one spatialization error. The bone conduction curve was quite distorted.

Audiolaterometry. The ALM indicated that Ernie had a small Left ear preference for the monitoring of speech (-1.0).

Personal Interview. Ernie became restless and fatigued when attempting to follow on going conversation. In self-expression his voice was halting and monotonous and synkinesias was apparent. When speaking into a make-believe microphone, held in the right hand, Ernie's voice rose and he spoke more fluently. This was a hopeful sign! According to Tomatis, a psychological interpretation of the TLT suggested that this boy had a poor and guilt laden relationship with his mother. Tomatis stated that the boy was dyslexic according to APP criteria, and would require intensive training on the Passive Phase using filtered mother's voice.

Ernie was accordingly classified as dyslexic by both the operational definition and APP criteria.

Remedial Training Program

Passive Phase - Filtered Sounds

As predicted by Dr. Tomatis, the Passive Phase of this boy's program was a long one lasting 120 sessions from early February to mid May. The

first month and a half of this subphase was marked by alternating periods of calm attention and absolute boredom.

Tomatis Listening Test. Selectivity opened slowly until late March. By mid May both the air and bone conduction thresholds had taken on a definite ascending curve with the bone slightly higher than the air. The one spatialization error had disappeared by mid March.

Program Assistant's Observations. Gradually, during this subphase, Ernie was more willing to approach a problem and try to solve it rather than running away from it or giving up immediately. He also began to take pride in some of his achievements. As the selectivity opened Ernie became more talkative. He became conscious of the fact that he had no friends and was able to discuss this with the Program Assistant as well as his father. This was a marked improvement in self awareness for a boy who rarely reflected upon his actions ahead of time or on his relationships with others. This new self awareness threw the boy into a temporary state of depression, seemingly as he faced the reality of his social situation. In April and May Ernie's outlook on things became more hopeful and positive.

Teachers' Observations. Ernie's teachers found him to be gradually more buoyant with a better willingness to work and a greater ability to stick to a task for a longer period of time. He became more active and reactive.

Parents' Observations. Residence house parents noted that Ernie no longer needed to be pushed to do his homework. He also started to sleep more soundly awakening fresh and cheerful in the morning. On a visit home in mid March, Ernie showed a strong need to be physically close to

his mother. She found this surprising and annoying but was counselled on how to handle the situation in a healthy positive way. The same week-end Ernie spontaneously called up some of his old friends and invited them over to play.

Subphase Summary. Open selectivity and ascending listening thresholds on the TLT, plus reports of improved work attitude and positive social interactions indicated a readiness for the Sonic Birth subphase.

Passive Phase - Sonic Birth

The Sonic Birth process was successfully completed in a single session. Ernie was delighted to recognize his mother's voice. After four sessions of listening to the mother's natural voice Ernie's TLT results and behavior remained positive. The Active Phase was then introduced.

Active Phase - Performing

Ernie advanced quickly through the auditory-vocal exercises taking a total of seventy sessions from mid May to mid July. His posture was well maintained and he articulated the words and phrases accurately.

Tomatis Listening Test. TLT results improved slightly. That is, bone conduction curves fell slightly below the air conduction curves.

Program Assistant's Observations. Ernie learned to articulate and enunciate more quickly than expected. His facial expressions suggested right ear control of language. Synkinesias disappeared except when repeating difficult phrases. In July he seemed to suddenly "pull himself together" and began to express his thoughts clearly and succinctly.

Teachers' Observations. Ernie now very much wanted to be considered a part of the group and was frequently seen taking the initiative in getting things organized even if things were not going the way he

originally wanted them to. In class his phonetic, word recognition, and spelling skills improved.

Parents' Observations. The residence staff noted that during this phase of training Ernie was able to co-operate in projects; had a happier disposition towards his peers and was frequently found organizing activities. The boy's parents noted that he was capable of sitting down and carrying on a conversation that made sense as opposed to his habitual verbal rambling.

Subphase Summary. Ernie performed positively during this subphase and TLT results were favorable. He discovered a need to be with others and to give of himself. His body co-ordination and expression of ideas improved. Academic skills showed improvement as well.

Active Phase - Training

During this subphase Ernie had 115 sessions. Reading sessions were alternated with sessions of passive listening to filtered music. By early September the boy had read several grade 1 and grade 2 level texts with little evidence of fatigue or synkinesias. Voice quality and speech control were very much improved. In October and November training sessions were reduced from five to three hours a week.

Tomatis Listening Test. TLT results remained positive although the bone conduction thresholds rose slightly suggesting increased tension.

Program Assistant's Observations. Ernie was enthusiastic and co-operative in performing the reading tasks demanded by this phase of the training program. Initially he had a tendency to read too quickly using a monotonous, dull and staccato type voice. By September he could read fluently showing enjoyment in interjecting appropriate rhythm and intonation.

Teachers' Observations. Ernie began to show a strong desire to communicate with others and to have his say in every discussion. He also began to listen to what others said. His reading ability was improving but spelling remained weak.

Parents' Observations. Because of his marked improvement in overall behavior and academic performance Ernie no longer required the residential living environment. He moved back into the family home in September. While the shift to living at home introduced an unexpected change in the boy's life style, and the research design, it points out the realities of a successful remedial program.

The boy's move back home did not interfere with his recent development. The parents noted with pleasure that he now talked at length and could organize his ideas. He could verbalize that he missed the organized activities of the residential setting yet he made efforts to organize his own time at home and make his own fun in the neighborhood. During these final months of training, the boy began to exchange ideas with his father which the father in turn came to appreciate. He also now felt accepted as an interested and participating family member.

Subphase Summary. TLT results remained positive. The boy's social skills and sensitization to others continued to improve. He communicated more readily and effectively with others. His reading ability improved but spelling remained weak.

Summary of Ernest's APP Training Program

During the Passive Phase of the remedial training program, early improvements in mood tone, energy level, sleep pattern and concentration were followed by greater and more positive involvement in social and

academic activities. During the Active Phase successful social interactions were the most apparent changes. Ernie could discuss with others on a give and take level; was more sensitive to the needs of others; and, organized social type activities. Academically his verbal self expression improved as did his reading skills.

Figure 11 presents the TLT and ALM results taken before and after the APP training program. The final listening test, December 1976, shows that Ernie had made considerable progress since the start of the program. Selectivity was open and no spatialization errors occurred. The air conduction thresholds revealed a more differentiated ascending curve with greater sensitivity in the higher frequency range. The bone conduction thresholds were not as distorted as at the beginning of the program but they were still above the air conduction curves. The slight peaks in bone conduction at 250 and 1500 Hz are said to be related to food allergies. Ernie has a history of milk allergy. The final ALM test indicated a strong Right ear preference for the monitoring of speech (2.5) as opposed to the slight Left ear advantage shown in February 1976.

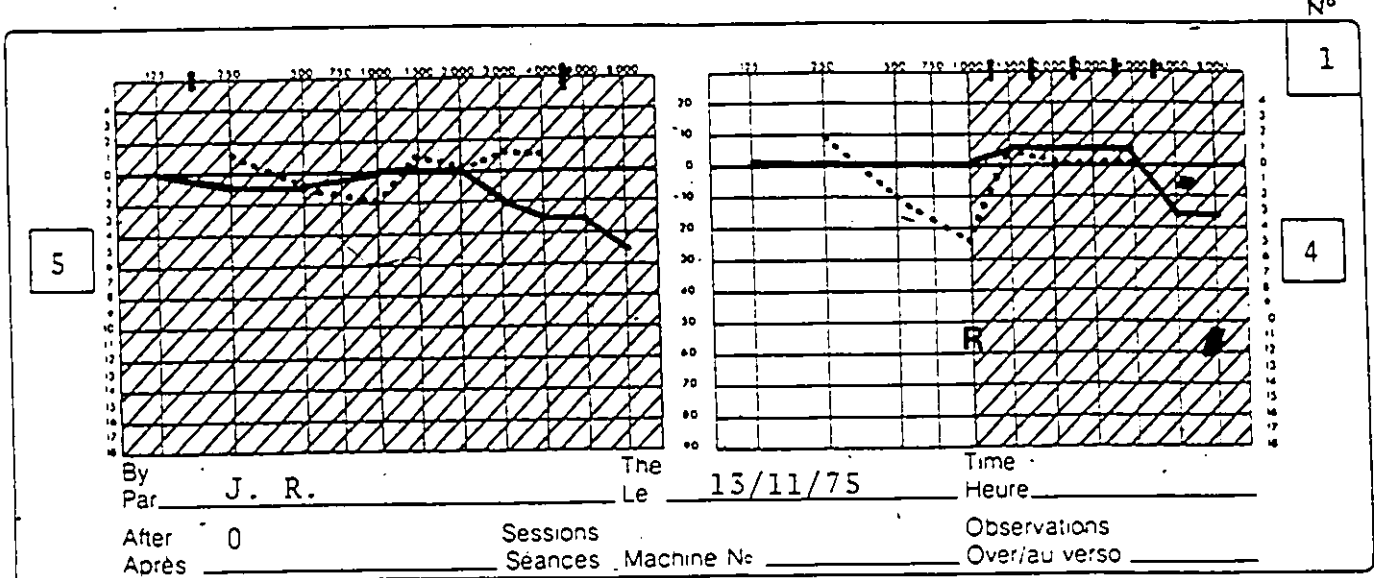
Ernie could no longer be considered dyslexic according to the measures of Dr. Tomatis. On the more formal diagnostic tests the boy was now achieving at the grade 4.5 level which yields an Achievement Age of 9.8. This together with his Expectancy Age of 11.3 yields a Learning Quotient of 87. While this remains below the 90 cut-off for dyslexia, the boy had improved 1.4 years in the ten months of remedial training. This is a reversal of his former trend in which he advanced only one month in six months. The lad received a score of 72 on the Behavior Rating Scale which is above the cut-off used for dyslexia.



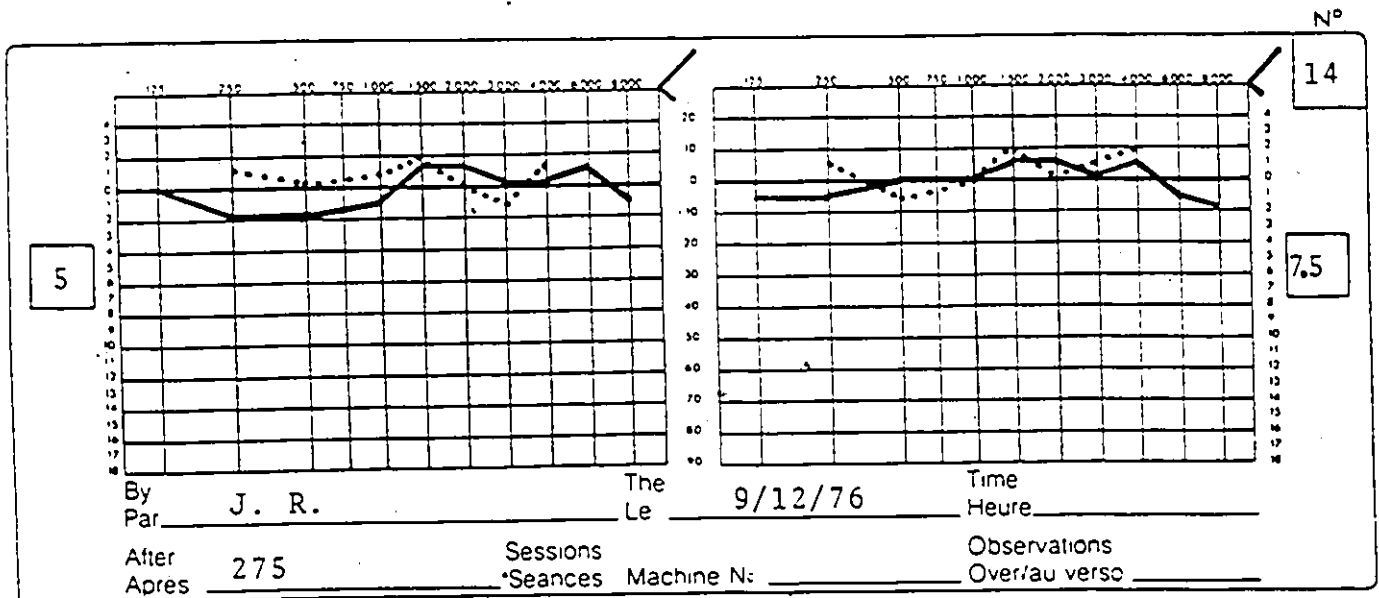
TOMATIS LISTENING TEST TEST D'ÉCOUTE TOMATIS

Page N° ☐
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FAMILY NAME SUBJECT 5 GIVEN NAME ERNEST AGE 9 yrs 3 mons
NOM de FAMILLE SUBJECT 5 PRÉNOM ERNEST



AT THE START OF APP TRAINING



AFTER TERMINATION OF APP TRAINING

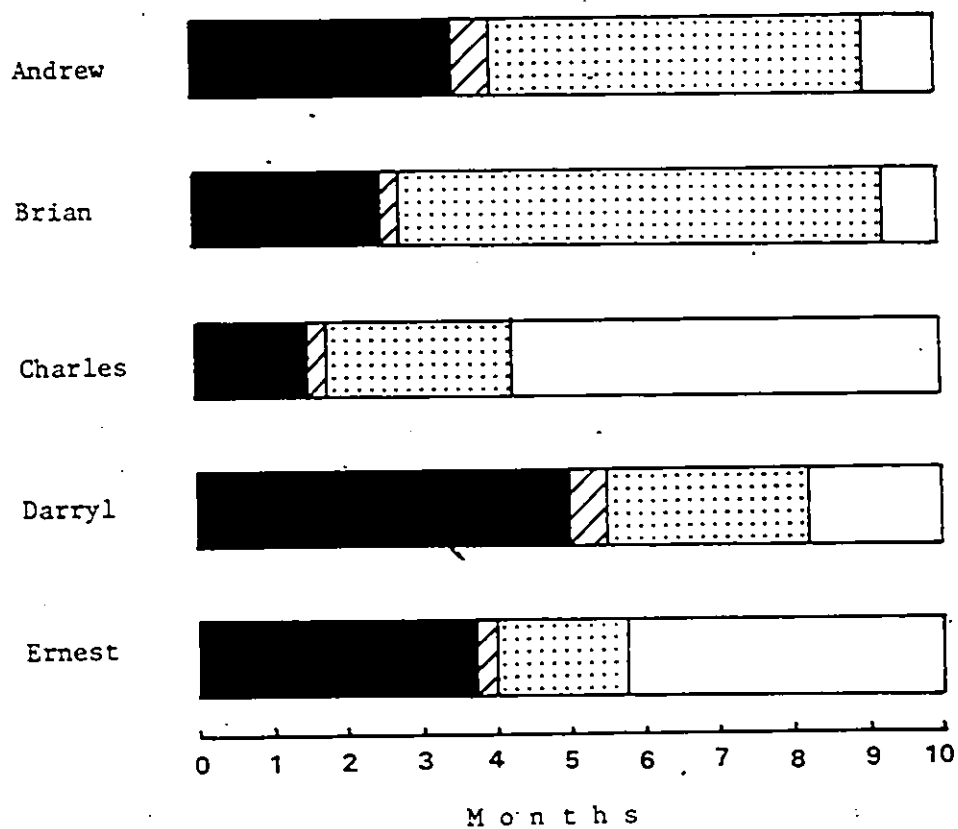
Figure 11.

Pre and Post APP Remedial Training Results on the
Tomatis Listening Test and Audiolaterometry for Ernest

Overall, Ernie's APP Remedial Training Program could be considered very successful.

Comparison of Programs

One of the driving forces behind the undertaking of this particular research project was the knowledge that the dyslexic child suffers from his problem in an individualized manner and that a therapy program must respect this individuality. This factor would seem to have been born out in the present research. That is, the children spent varying lengths of time on each of the four subphases of the APP remedial training program. The following figure demonstrates how these programs differed.



- Passive Phase: Filtered Sounds subphase
- /// Passive Phase: Sonic Birth subphase
- Active Phase: Performing subphase.
- Active Phase: Training subphase

Figure 12. Indication of Time Spent by Individual Children on each of the APP Remedial Program Subphases

CHAPTER IV

Presentation of Results

This chapter will present the results of the tests used to assess cognitive control functioning and spontaneous speech during the research project. Because of the remedial nature of this project each subject's results will be considered from two points of view. First they are examined in accordance with the two month interval testing schedule set up in accordance with the research design which includes a pre and post training phase as well as the remedial training phase itself. Secondly the results are considered in the light of the various phases of the APP remedial training program which, as demonstrated in the previous chapter, differed for each of the five boys.

The test results are presented in a series of graphs drawn on .5 cm interval graphic paper. In presenting the graphs the writer uses a number of terms and defines them as follows:

- slight: a change in slope, positive or negative, of .5 cm or less on the vertical axis.
- small: a change in slope, positive or negative, of more than .5 cm but less than 1.0 cm on the vertical axis.
- marked: a change in slope, positive or negative, of from 1.0 to 2.5 cm on the vertical axis.
- dramatic: a striking change in slope, positive or negative, of more than 2.5 cm on the vertical axis.
- spurt: a small, marked or dramatic increase and decrease in slope within three subsequent assessments during the remedial training phase.
- stable: test scores that remain relatively consistent, including slight changes, from one testing session to the next.

variable: small, marked, or dramatic changes on the vertical axis accompanied by alternating of positive and negative directions over the duration of the horizontal axis.

Subject 1 - Andrew

Cognitive Controls

Table 2 gives the numerical results of Andrew's performance on the Cognitive Control tests throughout the fourteen months of the research project. These results are depicted graphically in Figures 13, 14, 15, and 16 which appear on pages 163 to 166. They are contrasted to the average score, plus and minus one standard deviation, of the "typical" grade two student, according to the norms of Santostefano. Testing Sessions (TS) 1 and 2 represent the baseline phase; TS 2 through 7, the remedial training phase; and TS 7 and 8, the follow-up phase.

Scattered Scanning Test (SST). On the first subtest (Figure 13) Number Correct, believed to assess the activity of scanning, Andrew's performance in the baseline phase was relatively stable. Both scores were below that which would be expected for his chronological age and grade placement. Results during the remedial training phase indicate a small positive change at the beginning and a marked positive change at the end of this phase with stable performance during most of the phase. The follow-up phase indicates a marked negative change leaving Andrew once again performing at a level just slightly better than that expected for his chronological age.

The second part of Figure 13, Total Distance used to assess breadth of scanning, shows a lack of stability in baseline with both measures indicating that Andrew was functioning at a level below that considered

Table 2
Results of Tests used to Assess Cognitive Control Functioning - Andrew

Test	Date of Assessment - Andrew								Typical Grade 2	
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77	Mean	SD
Scattered Scanning Test:										
Number Correct	15	18	24	24	24	24	34	23	20.3	1.08
Total Distance	93.0	115.0	121.0	161.0	113.0	133.9	176.8	169.9	127.8	5.23
Fruit Distraction Test:										
Time on Card II	64	44	33	40	42	49	33	36	54.7	2.03
Card III - II	-5	4	6	-6	-2	2	3	-3	0.8	1.32
Card IV - II	36	35	38	18	21	15	28	21	35.3	4.70
Leveling-Sharpening House Test:										
1st Stop Score	12	13	10	7	7	7	7	7	10.7	.80
Correct Changes	12	11	14	14	15	16	16	16	12.1	.28
L-S Ratio	14.6	14.6	11.5	11.1	8.7	7.1	7.0	6.8	14.0	.55
Object Sort Test:										
Typical Groups	5	4	4	4	8	9	5	5	9.4	.69
Mean Concept Score	5.4	5.0	5.0	6.5	5.9	5.6	6.2	5.6	5.1	.13

"typical" for his age and grade. During the early part of the remedial training phase there is a marked positive change so that by the fourth testing session Andrew performs at a level higher than average for his chronological age. This is followed by an initial marked negative change then a gradual marked positive change until, at the end of this phase, the lad performs well beyond the "Typical" score. He maintains this level of functioning throughout the follow-up phase.

Fruit Distraction Test (FDT). The first subtest (II) on Figure 14 reflects the measure of the length of time it takes the subject to respond to the base card, a card supposedly free from distractions. The baseline scores are not stable and by the end of this phase Andrew completed the task at a rate much quicker than that considered "typical" for his age and grade. The curve, during the remedial training phase, shows considerable variability yet all scores are better than average and in the final testing session of this phase Andrew's performance is markedly better than expectancy. Performance during the follow-up phase is relatively stable.

The curve for the second subtest (III-II), believed to assess degree of interference to performance in the face of geographical distractions, again indicates a lack of stability during the baseline phase. The early part of the remedial training phase is characterized by a small positive change while the major part of this phase is marked by gradual slight negative changes, at a level considered "typical" for Andrew's age and grade placement. There is a small positive change during the follow-up phase.

The curve for the final subtest (IV-II), believed to assess performance in the face of contextual distractions, is stable during baseline.

At this time Andrew's performance is at a level considered "typical" for his age. The curve during the remedial training phase is characterized by variable performance but is consistently better than the "typical" performance. There is a small positive change during follow-up.

Leveling-Sharpening House Test (LSHT). Results on the First Stop Score (Figure 15), depicting the card on which a change is first perceived, are stable during the baseline phase. The early part of the remedial training phase is characterized by a marked positive change. The graph indicates stability of performance throughout the balance of this phase. Performance remains stable during the follow-up phase.

The graph showing performance on the Number of Correct Changes perceived, can be considered stable during the baseline phase. A marked positive change is noted during the early part of the remedial training phase. This was followed by small positive changes leading to a high level of consistent performance at the end of this phase. This level of performance remains stable during follow-up.

L-S Ratio, which measures the lapse in time between the first exposure of a change and the subject's actual perception of that change, shows stability in the baseline phase followed by consistent small positive changes throughout the remedial training phase. The high level of performance reached at that time remained stable during the follow-up phase.

All three graphs in this figure show that, during the baseline phase, Andrew was functioning slightly below that expected for his age and grade. Two months after the introduction of the remedial training phase he was performing above his grade level and continued to show positive change.

Object Sort Test. The curve for Number of Typical Groups (Figure 16), believed to assess an individual's ability to group objects, shows low stable performance during the first half of the remedial training phase, followed by a marked positive change lasting over two testing sessions. At the close of the remedial training phase there is a marked negative change. This later level of functioning is maintained in the follow-up phase. The Concept Score, a measure of the subject's ability to label his groups abstractly, is consistent, except for a small positive spurt, and above that expected for Andrew's age and grade placement.

Summary of Cognitive Control Test Results. Most of the cognitive control tests show a lack of stability in the baseline measures. SST and LSHT results indicate that Andrew was functioning below expectancy on the cognitive control levels of Focal Attention and Leveling-Sharpener during the baseling phase of this research project. Two months after the introduction of the remedial training phase, he performed at a level, which could be considered typical for his chronological age and grade placement on the first three levels of cognitive control functioning. These are Focal Attention, Field Articulation and Leveling-Sharpener. Equivalence Range, as assessed by the Object Sort Test demonstrated positive change during the second half of training. Despite some variability these higher levels were maintained or surpassed by the end of the remedial training phase.

Spontaneous Speech

Developmental Sentence Scoring (DSS). Andrew received the following scores over the eight testing sessions:

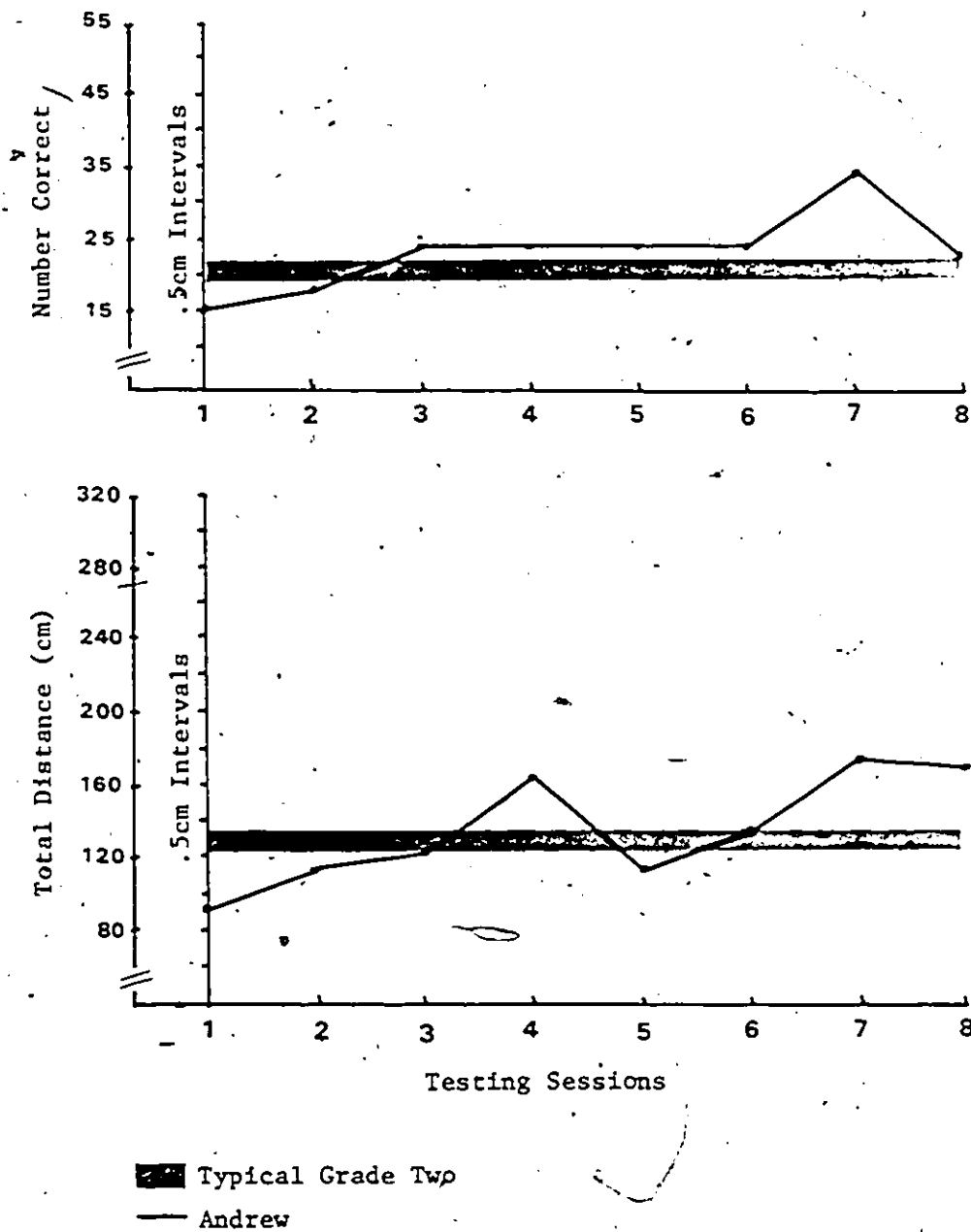


Figure 13. Scattered Scanning Test - Andrew

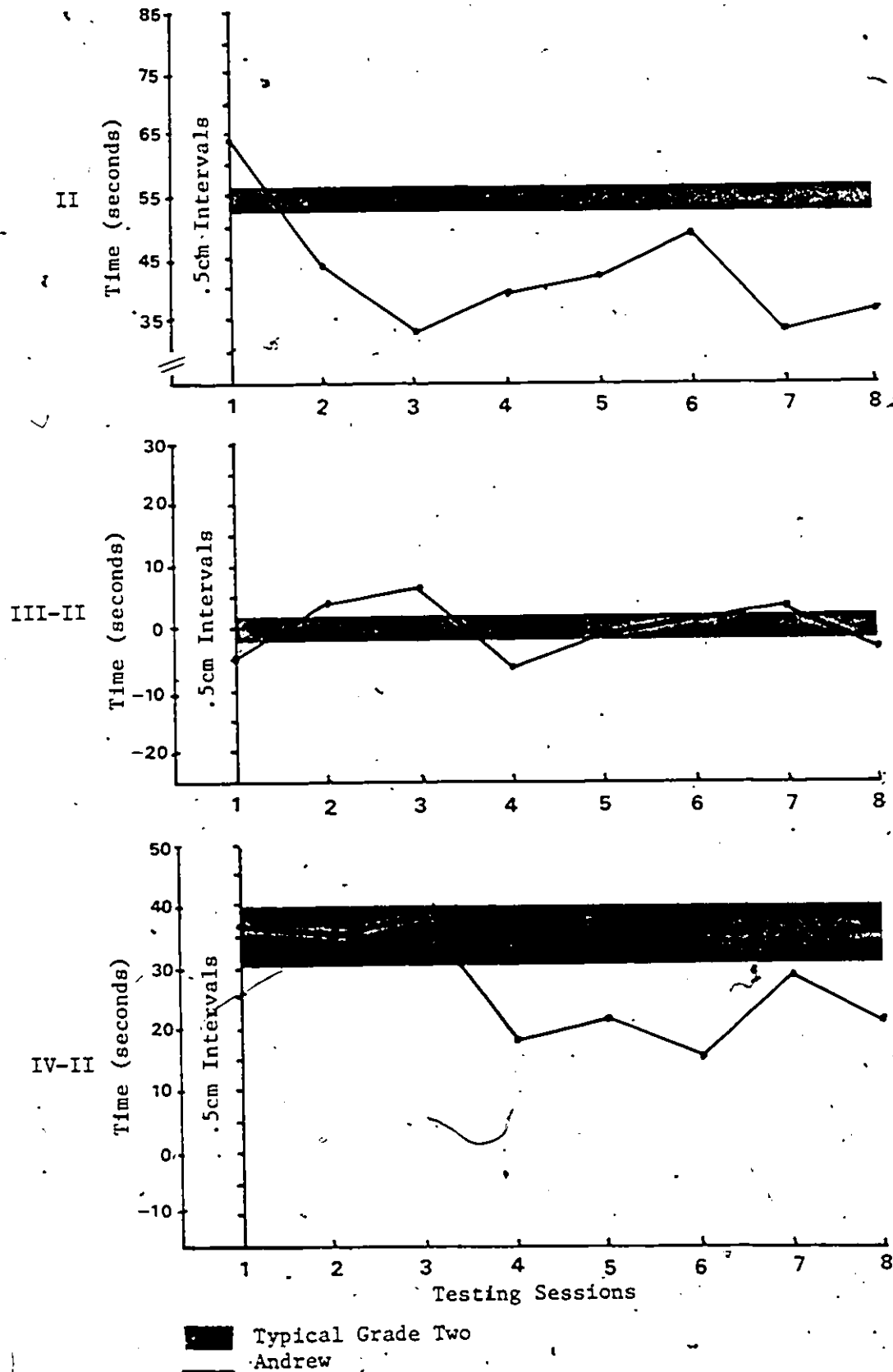


Figure 14. Fruit Distraction Test - Andrew

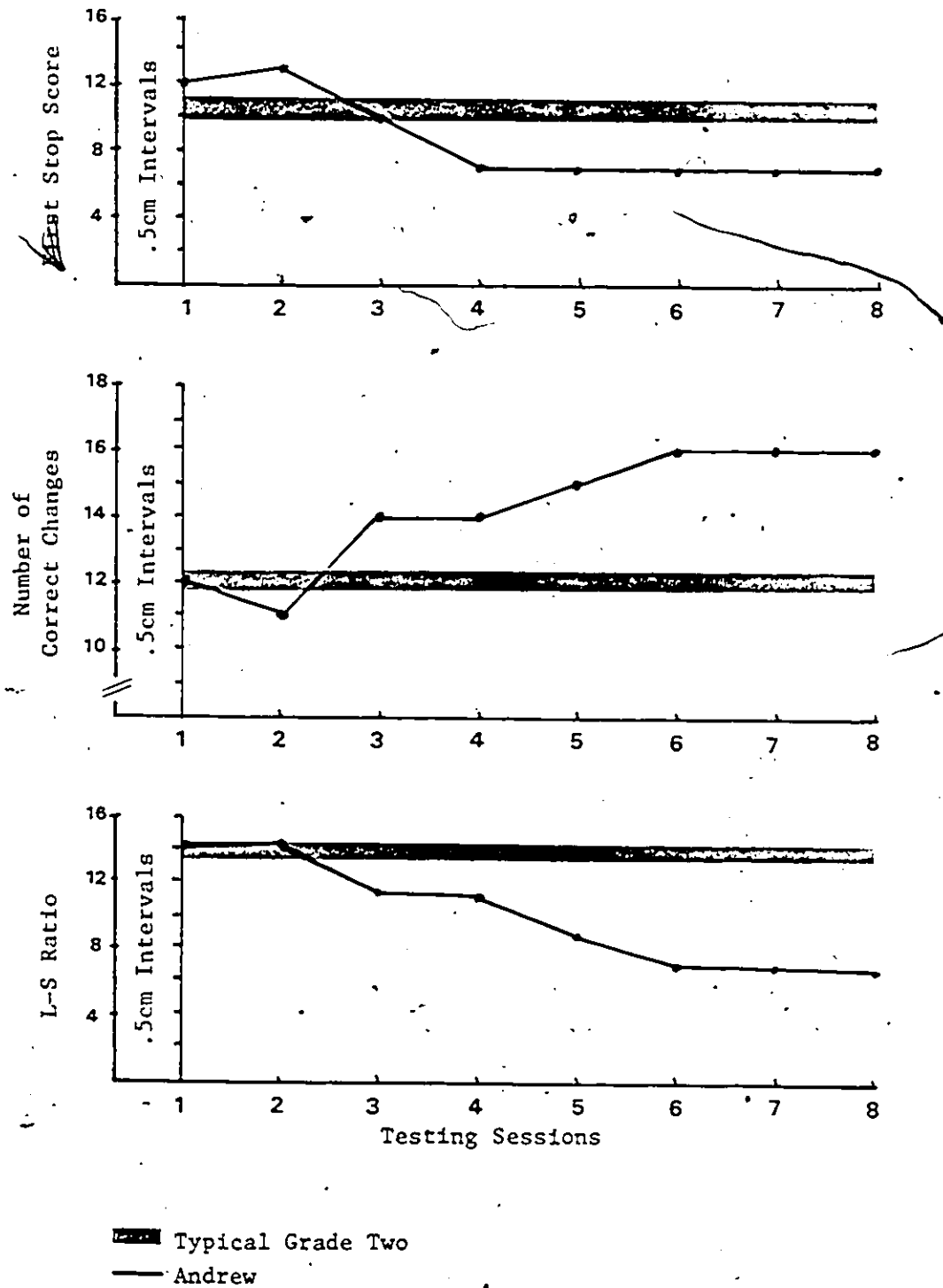


Figure 15. Leveling-Sharpener House Test - Andrew

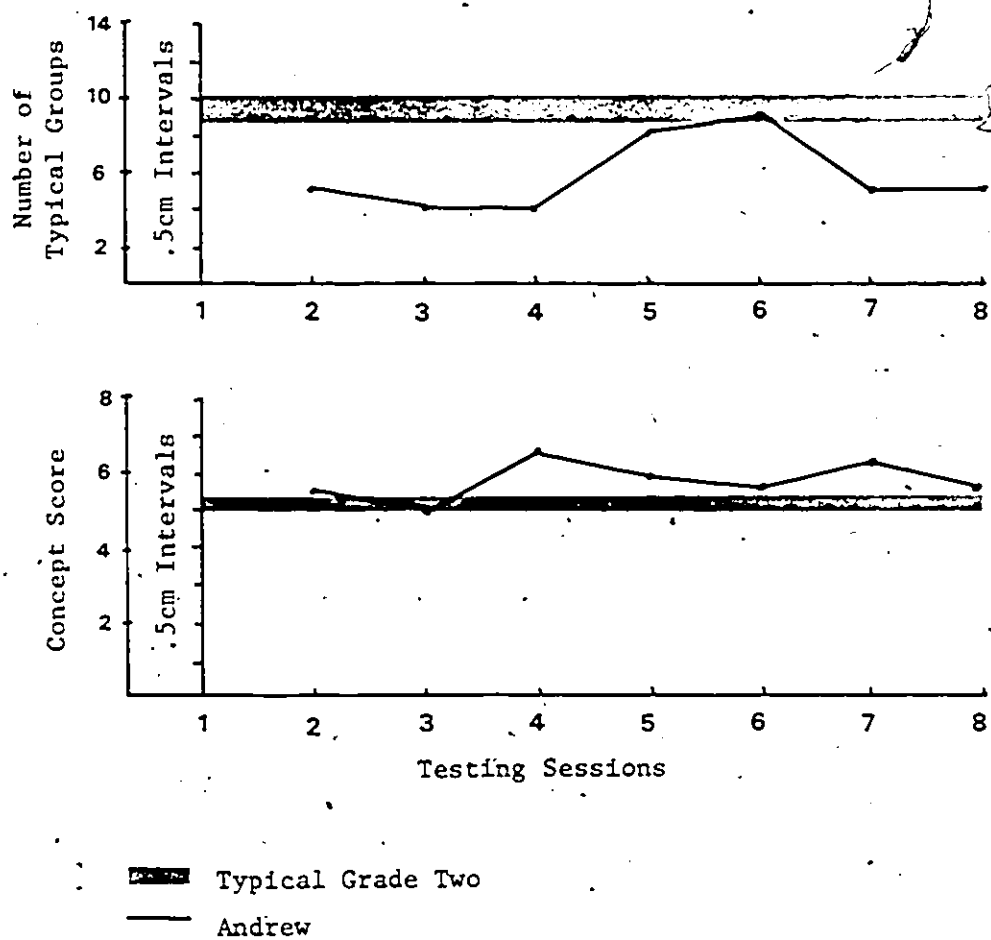


Figure 16: Object Sort Test - Andrew

December 1975	13.44
February 1976	12.20
April 1976	12.16
June 1976	12.14
August 1976	13.98
October 1976	16.28
December 1976	14.24
February 1977	15.22

These scores, depicted in Figure 17, compare Andrew's test results with scores received by a group of "Normals" and a group of "Dyslexics", plus and minus one standard deviation, in a study of a similar age range, carried out by Vogel (1975). This, to the writer's knowledge, is the only study that has been done using the DSS with older children.

Figure 17 shows a lack of stability in performance during the baseline phase. Andrew's performance during the first four months of the remedial training phase is stable. The second half of this phase shows a dramatic positive change followed by a marked negative change. There is a small positive change during the two month follow-up phase. Despite the changes in the curve, this boy's performance was consistently equal to or better than that achieved by the Normal Group in Vogel's study.

Table 3 shows the results of the analysis of Andrew's spontaneous speech responses to the problem of formulating stories, for a series of pictures, in the manner described in Chapter II. This analysis includes the average number of words in a unit of communication and the percentage of maze words used in each of the spontaneous speech samples. Figures 18 and 19 show Andrew's results in relation to the average scores obtained by the High and Low Groups of Logan's Normative Study.

Words per Communication Unit (WPU). As depicted in Figure 18, baseline measures are not stable and Andrew's performance two months after

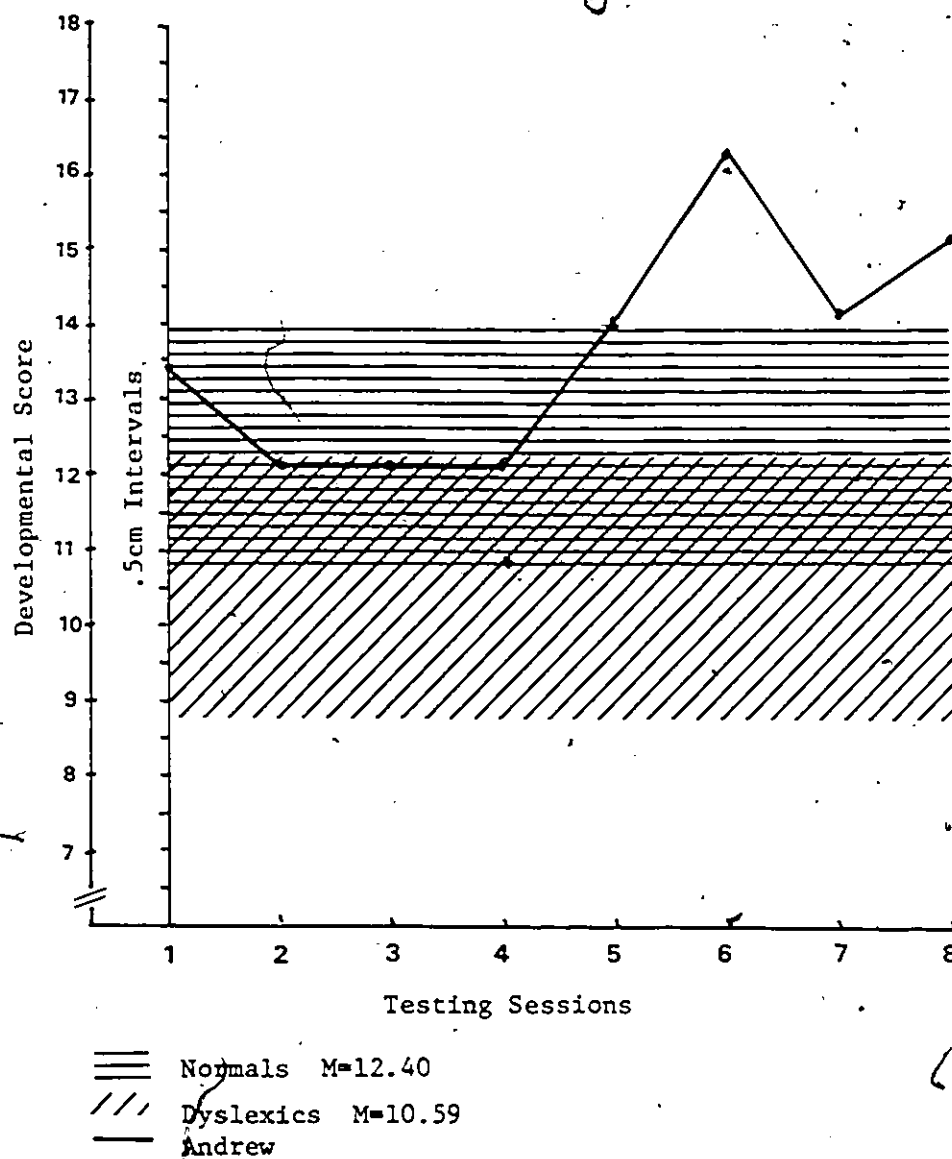


Figure 17. Developmental Sentence Scoring - Andrew

Table 3
Analysis of Communication and Maze Units in Spontaneous Story Telling - Andrew

Test	Date of Assessment - Andrew							Loban's ^a Groups	
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77	Low High
W P U ^b	8.5	6.6	8.9	9.3	10.4	10.0	9.3	10.1	6.7 8.1
Total Words ^c	589	400	452	913	493	1048	1578	670	
Percentage of Maze Words ^d	7.6	6.5	4.0	10.3	11.6	12.1	14.8	10.7	8.3 6.2

^aGroups at the Grade 2 level.

^bAverage number of words per Communication Unit.

^cCommunication words plus Maze words.

^dPercentage of Maze words to total words.

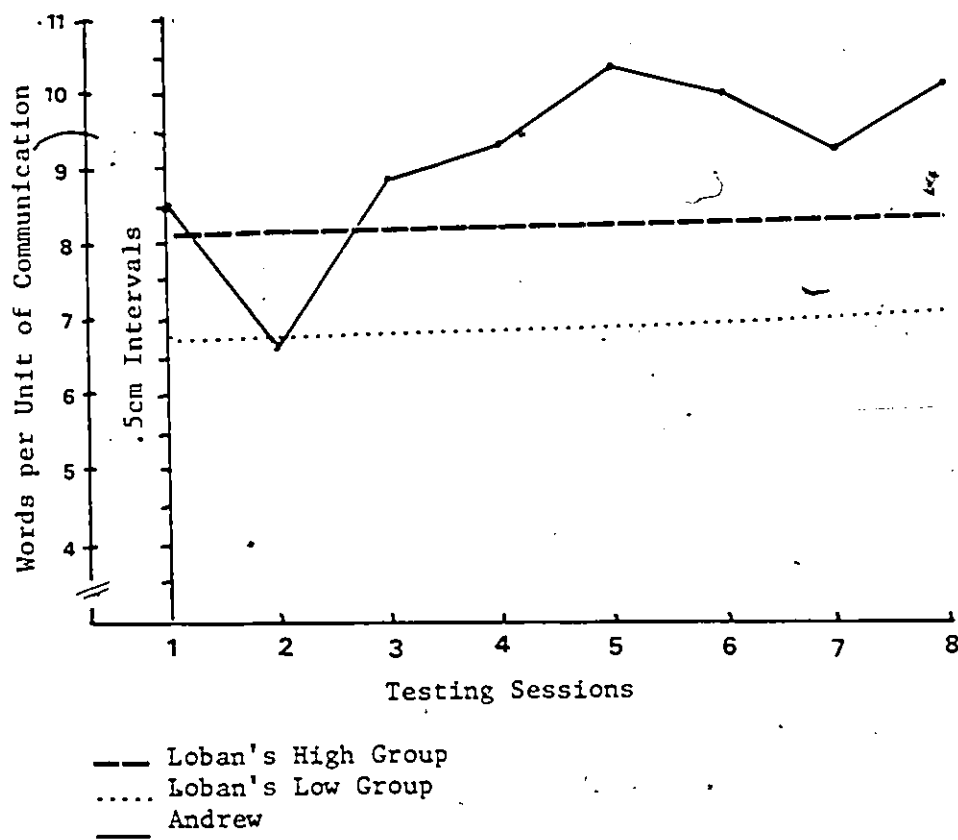


Figure 18. Number of Words per Communication Unit - Andrew

the onset of the remedial training phase is very similar to his initial performance. During the remedial training phase the graphic curve is characterized by early positive changes followed later by negative changes. At the close of this phase the boy was performing only slightly better than at the beginning. There is a small positive change during the follow-up phase. With the exception of the second baseline measure, Andrew consistently used a larger number of words in his communication units than did the High Group of Loban's Normative study.

Percentage of Maze Words. Figure 19 indicates that the baseline measures are not stable. During the early part of the remedial training phase the curve shows a marked positive change followed by a dramatic negative change. There is another dramatic, but more gradual, negative change over the balance of this phase. A dramatic positive change occurs during the follow-up period but at the termination of this research project Andrew uses a much larger percentage of Maze Words than was used by the Low Group in Loban's study.

Language Style. Table 4 lists the scores obtained by Andrew on a rating from one to five, in the Language Style assessment described in Chapter II. Figures 20, 21 and 22, presented on pages 176 to 178, graphically depict these scores.

Figure 20 represents the first three factors or those dealing with the individual's ability to organize the material and to tell an adequately realistic story. Baseline measures are stable and suggest that Andrew was unusually descriptive in his story telling. That is, he did not formulate a dynamic story interrelating the various parts of the picture. However, his thoughts were adequately organized and his themes very

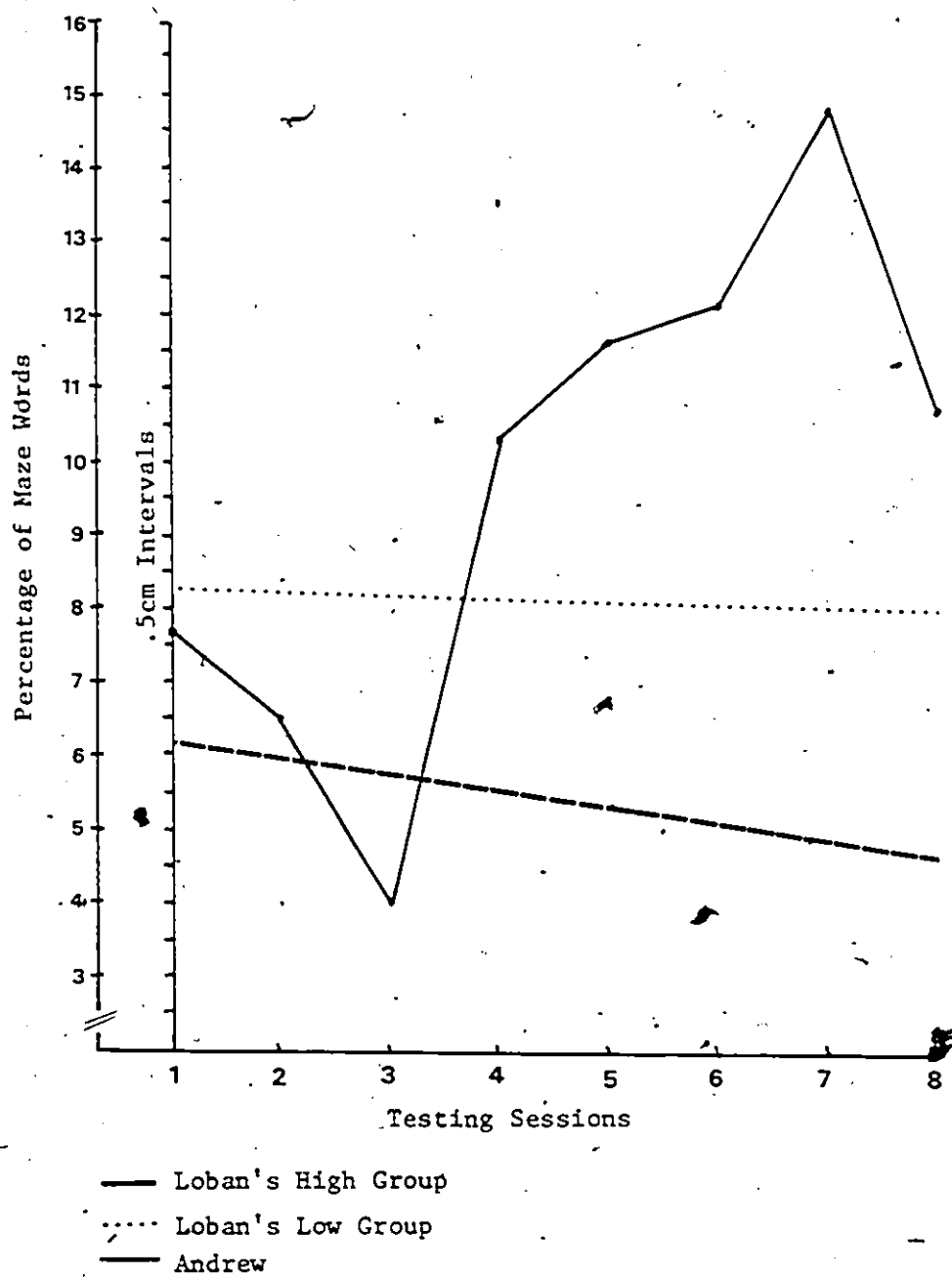


Figure 19. Percentage of Maze Words to Total Words - Andrew

Table 4
Measures of Language Style on a Five Point Rating Scale - Andrew

Trait	Date of Assessment						
	12/75	2/76	4/76	6/76	8/76	10/76	12/76 2/77
Story Content:							
Descriptive - Dynamic	1.7	1.3	2.7	2.3	4.7	5.0	5.0
Disorganized - Organized	3.3	2.7	3.7	3.0	5.0	4.3	4.7
Unrealistic - Realistic	4.3	4.0	4.7	3.3	4.7	2.3	3.7
Interpersonal Aspects:							
Ego-Centric - Social	3.3	2.3	4.7	3.3	5.0	5.0	5.0
Other Directed - Self Directed	2.0	1.3	2.3	2.7	4.3	4.0	4.3
Voice Qualities:							
Halting - Fluent	3.3	1.3	4.0	3.7	4.3	5.0	4.3
Monotone - Expressive	2.7	1.7	4.3	4.0	4.0	4.7	4.3
Mumbled - Distinct	2.7	1.7	4.3	3.7	4.3	4.0	4.7

realistic. Over a six month period in the remedial training phase there is a gradual but marked positive change in the first graph; a small positive change in the second graph; and variable performance in the third. By the 5th testing session Andrew formulates good dynamic stories for his age; his thoughts are very well organized and his story themes realistic. Over the last part of this remedial training phase Andrew shows stable performance on the first two graphs but a marked negative change in the realism of his story themes. During the follow-up phase there is a stable performance on the first two measures and a small positive change on the third.

The first graph in Figure 21 indicates that Andrew was moderately capable of interrelating with the examiner and the realities of the picture content while formulating his stories. Baseline measures were not stable. During the early part of the remedial training phase there was a marked positive change. With the exception of the small negative spurt at session 4, Andrew continued to act on this dimension, as would be considered excellent for his age, throughout the balance of the remedial training phase. Follow-up measures are stable.

The second graph in Figure 21 shows that Andrew originally required many structuring questions from the examiner in order to complete the story telling task. Baseline measures can be considered stable. The first half of the remedial training phase is marked by a series of small positive changes until the boy needs very little structure to complete the task. This level of performance is maintained throughout the balance of the remedial training phase. Follow-up measures remain stable.

The three graphs in Figure 22 show definite similarity in their form. Initially Andrew's voice was mediocre in all three dimensions. Baseline measures were unstable and at the close of the baseline phase the boy's voice was halting, monotonous and mumbled. Two months after the introduction of the remedial training phase a marked positive change is noted in all three measures and Andrew's voice is considered fluent, expressive and distinct. This level is maintained for the balance of the remedial training phase and remains stable during the follow-up phase.

Summary of Spontaneous Speech Analyses. Baseline measures demonstrate a lack of stability in performance. All measures with the exception of the Descriptive-Dynamic dimension in Figure 20 suggest that Andrew was low average to slightly better-than-average in his use of spontaneous speech in everyday activities. During the remedial training phase of this research project earliest positive gains were seen in voice quality and the average number of words in a unit of communication which is seen as assessing fluency in speech. Significant increases in the more mature use of syntactical structures; structuring of the story telling process; dynamic interrelation of the parts of a picture were obvious during the second half of the training phase. Percentage of Maze Words (used to assess speech tangles) also increased dramatically later in the training phase.

Test Results Compared to Individualized APP program

The Passive Phase of remedial training lasted a total of four months for this lad. Hence testing sessions (TS) 3 and 4 were completed during this phase of the training. The test results indicate a definite positive change in the cognitive control levels of Focal Attention, Field Articulation,

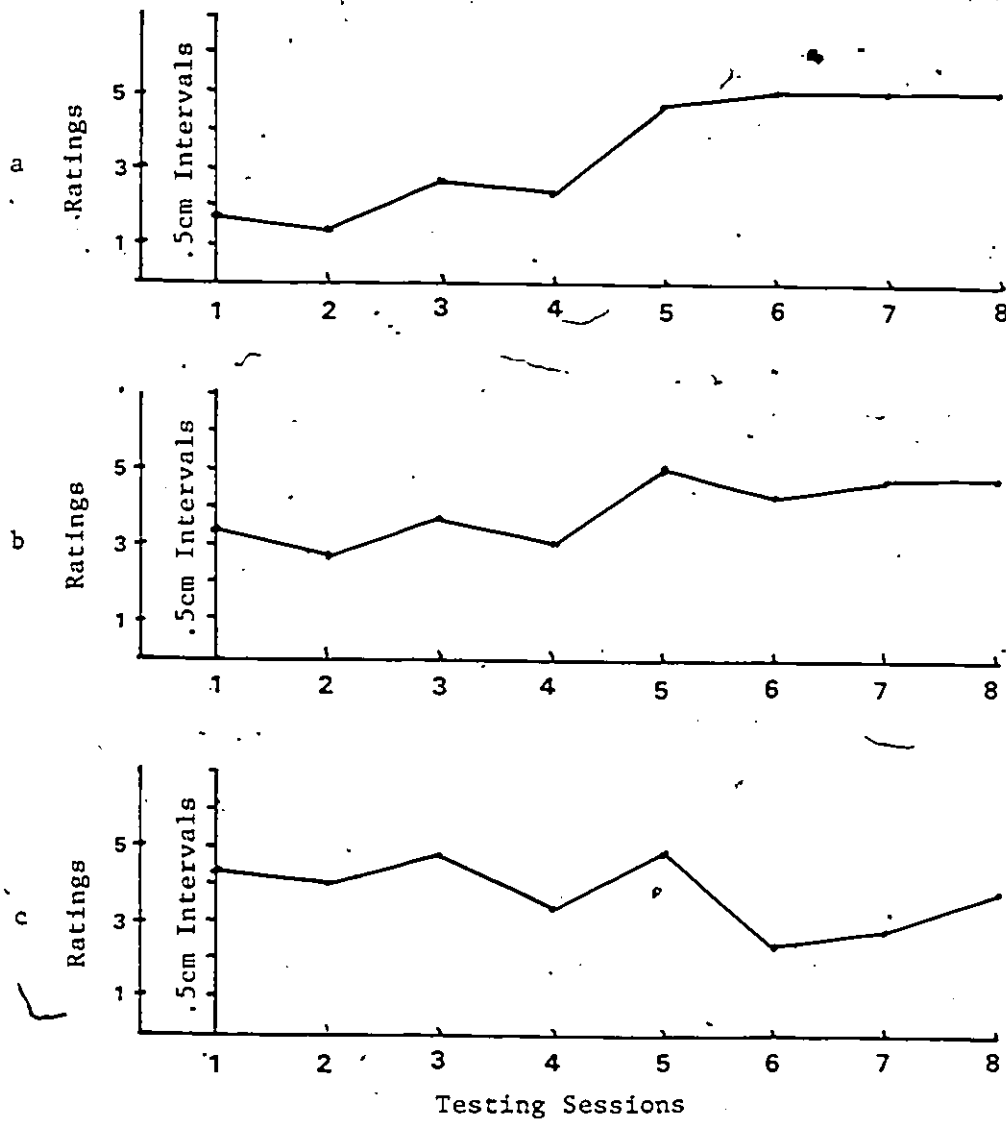


Figure 20. Analysis of Story Content - Andrew
a) Descriptive to Dynamic
b) Disorganized to Organized
c) Unrealistic to Realistic

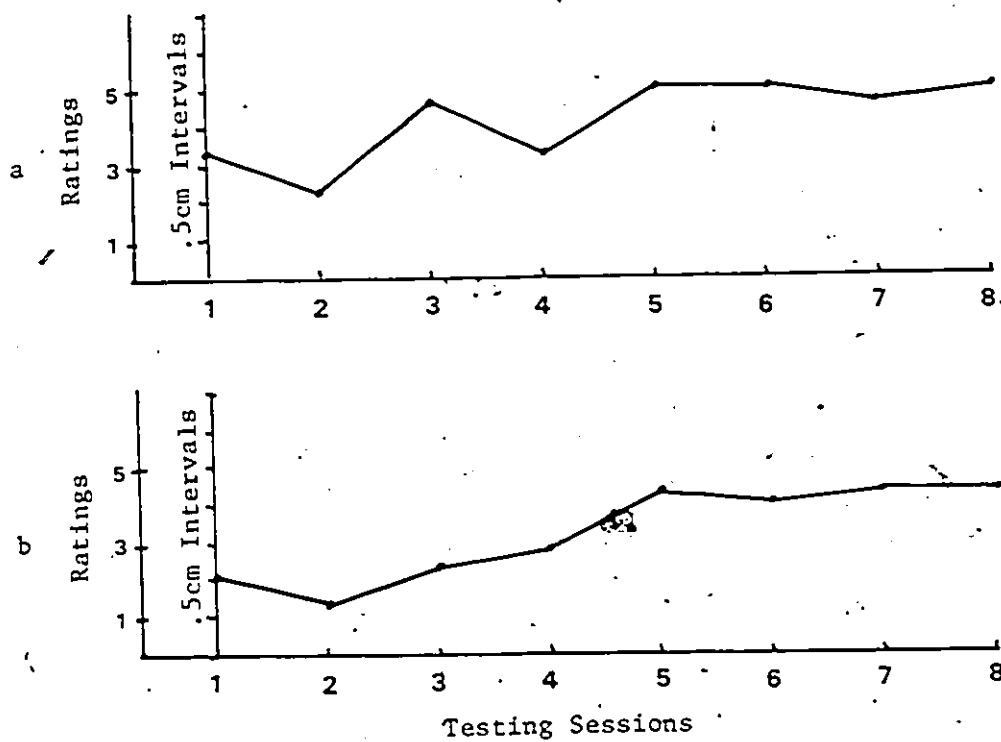


Figure 21. Analysis of Interpersonal Aspects - Andrew
a) Ego Centric to Social
b) Other Directed to Self Directed

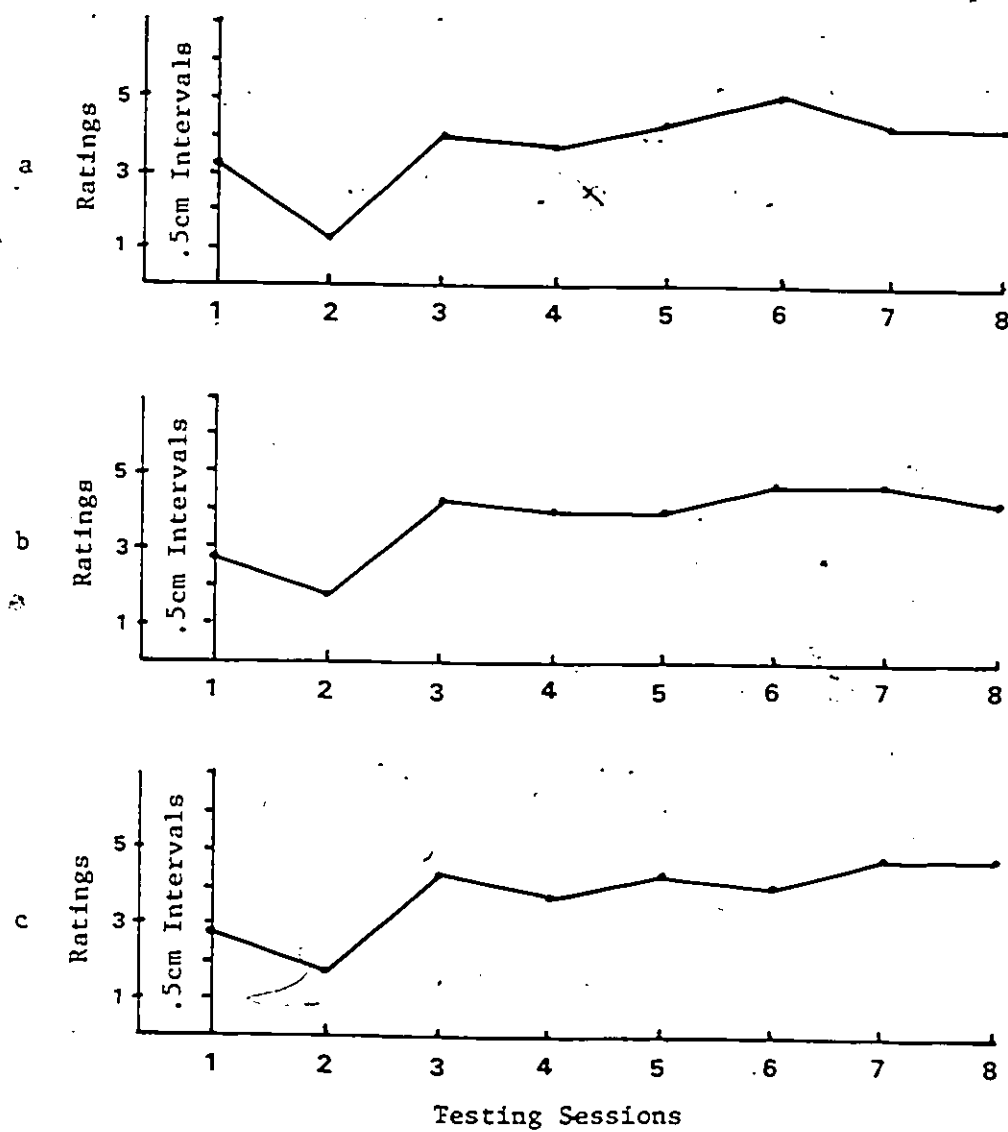


Figure 22. Analysis of Voice Qualities - Andrew

- a) Halting to Fluent
- b) Monotone to Expressive
- c) Mumbled to Distinct

and Leveling-Sharpening. These were assessed by SST, FDT and LSHT respectively. While Field Articulation was adequate for Andrew's age and grade placement, levels of Focal Attention and Leveling-Sharpening moved from below to above expectancy. All levels of cognitive control functioning continued to function above expectancy throughout the Active Phase of the Remedial Training Program. The three measures of voice quality also changed positively during the Passive Phase of remedial training and maintained this improvement throughout the Active Phase.

With the introduction of the Active Phase of training major positive changes occurred in many of the spontaneous speech measures. There was a dramatic increase in the developmental level of the syntactical structures used by Andrew in his spontaneous speech. Test results indicate very little change in the boy's ability to express his ideas as measured by the average number of words in a unit of communication. As was noted in Chapter III, Andrew did speak fluently prior to inclusion in this research project but he did not express his own original ideas.

The dramatic changes noted on the graph for maze behavior, used to assess speech tangles, occurred during the Active Phase of training--one initially with the opening of selectivity and the second with the introduction of the final or Training subphase.

Language Style measures showed their greatest improvement during the Active Phase of training. Andrew's stories became more dynamic and better organized although initially unrealistic bringing in unconventional and unusual content for his age. However this began to show positive change toward the end of the Remedial Training Program. During the Active Phase the boy showed great improvement in integrating his own personal

experiences effectively with both the content in the picture and the examiner's statements. During this time Andrew also began to complete the story telling task without structural assistance from the examiner.

In general, while cognitive control measures and measures of voice quality showed their most positive change during the Passive Phase of Remedial Training, measures used to assess changes in spontaneous speech demonstrated positive change during the Active Phase of training.

Subject 2 - Brian

Cognitive Controls

Table 5 lists the numerical results of Brian's performance on the Cognitive Control Tests during the fourteen months of the present project. These results are depicted in Figures 23 through 26 inclusive and appear on pages 184 to 187. They are contrasted to the Mean score, plus and minus one standard deviation, of typical grade two students according to the norms of Santostefano. As in the case of Andrew, Testing Sessions (TS) 1 and 2 represent baseline phase; TS 2 to 7 the remedial training phase; and, TS 7 and 8, the follow-up phase.

Scattered Scanning Test. Figure 23 indicates that the measures taken during baseline are stable and above grade expectancy. On the first of the subtests, Number Correct, there is a marked positive spurt two months after the introduction of the remedial training phase. The second half of the graph is characterized by gradual positive marked changes until Brian is seen as functioning well above his grade expectancy at the termination of the training phase. There is a small negative change during follow-up.

Table 5

Results of Tests used to Assess Cognitive Control Functioning - Brian

Test	Date of Assessment - Brian								Typical Grade 2	
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77	Mean	SD
Scattered Scanning Test:										
Number Correct	30	29	38	31	38	41	41	56	20.3	1.08
Total Distance	195.2	196.0	220.5	179.0	220.8	192.4	236.0	180.5	127.8	5.23
Fruit Distraction Test:										
Time on Card II	77	57	60	69	67	80	83	62	54.7	2.03
Card III - Card II	3	14	6	-3	26	-25	22	18	0.8	1.32
Card IV - Card II	4	29	3	2	3	-13	-1	7	35.3	4.70
Leveling-Sharpening House Test:										
1st Stop Score	10	11	10	10	10	10	4	11	10.7	.80
Number Correct Changes	10	11	13	13	13	13	15	13	12.1	.28
L-S Ratio	15.6	15.5	13.8	13.6	15.1	14.0	8.8	13.9	14.0	.55
Object Sort Test:										
Number of Typical Groups	5	5	5	2	6	3	9	6	9.4	.69
Mean Concept Score	5.8	5.8	5.6	5.0	5.5	5.7	5.7	5.3	5.1	.13

The graph for the second subtest is variable in performance but all scores are above expectancy during the remedial training phase. The marked negative change in follow-up appears to be part of the fluctuating pattern.

Fruit Distraction Test. On the first subtest (II) of Figure 24 the baseline scores are not stable. At best Brian was able to complete the task within the amount of time expected of a typical grade two student. The graph curve suggests that there was a gradual but marked negative change throughout the remedial training phase. The follow-up phase shows a marked positive change.

The graph depicting Brian's performance in the face of geographical distractions (III-II) indicates instability of baseline measures. The early part of the training phase is characterized by small and marked positive changes while the second half of this phase shows dramatic variability. Follow-up is relatively stable at which time Brian was performing at a level much lower than expected for his chronological age and grade.

On the third subtest (IV-II) baseline measures indicate dramatic instability, however both results suggest that Brian handles contextual distractions more efficiently than would be expected for his age and grade. Two months after the introduction of the training phase there is a dramatic positive change (yet only equal to the initial testing session) which remains stable through much of the training phase. There is a marked positive spurt in the later half of the training-phase and a small negative change over the follow-up phase.

Leveling-Sharpener House Test. Figure 25 indicates that the results for the First Stop Score are stable during baseline; and remain stable

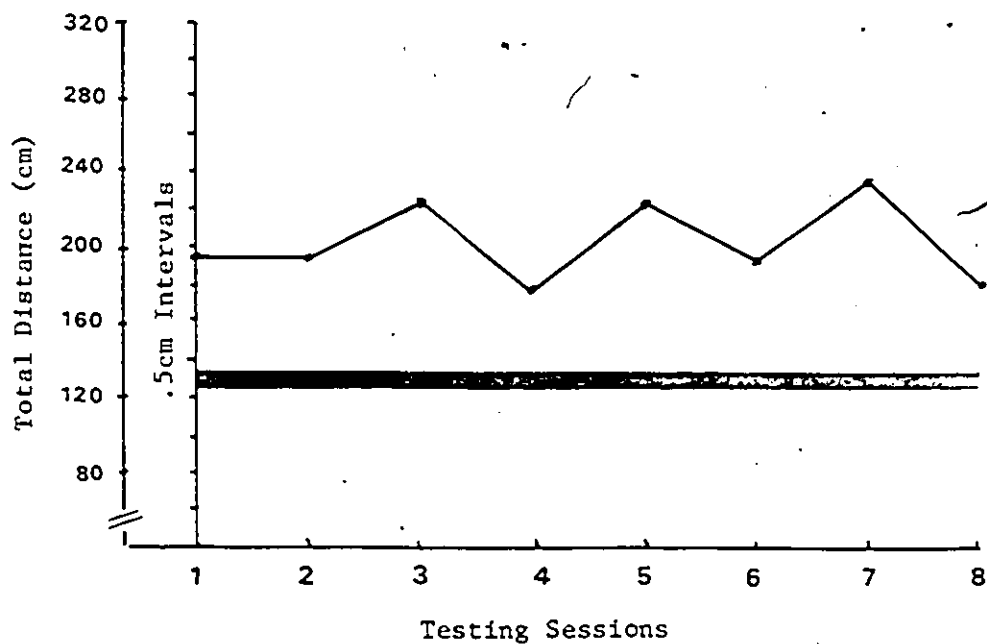
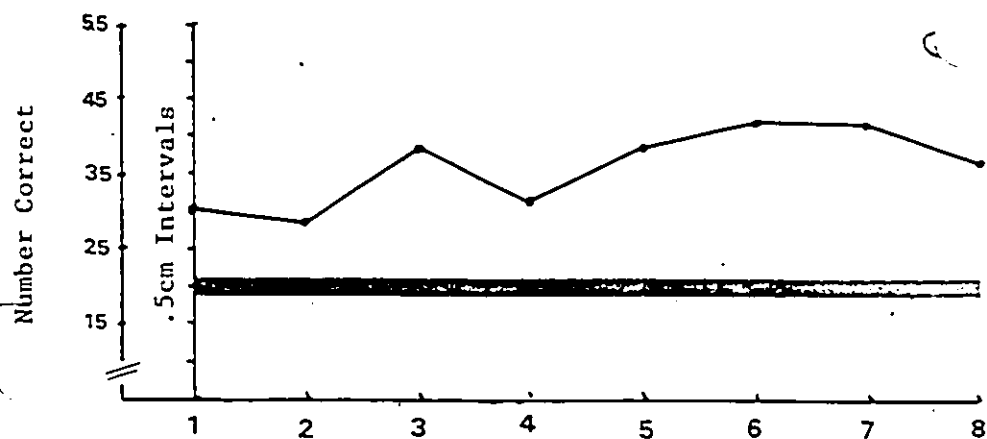
for most of the training phase with a marked positive change on the final testing session. All results indicate that Brian performs this part of the LSHT task as well as the typical grade two student. There is marked negative change during follow-up which returns to the stable measures of the training phase.

The graph depicting Number of Correct Changes shows small variability in baseline with both scores indicating that Brian was functioning at a level below that expected of a grade two student. The early part of the training phase is characterized by a marked positive change. Scores remained stable throughout most of the training phase with a further marked positive change in the final testing session of the training phase. A marked negative change occurred during follow-up.

Baseline measures are stable in the figure depicting L-S Ratio. Although there is a small variability throughout the remedial training phase Brian appears to function in line with age and grade expectancy. There is a marked positive change at the close of the training program. There is likewise a marked negative change during follow-up.

Object Sort Test. The result in TS 2 of Figure 26 suggests that Brian formulated considerably fewer groups, with the material presented, than would be considered typical for his age and grade. Results during the training phase indicate small and marked variability in the results of the various testing sessions. At the close of the training phase, the boy formed a "typical" number of groups. There was a small negative change during follow-up.

The second subtest, Concept Score, indicates stable performance throughout the various testing sessions at a level consistent with grade expectation.



■ Typical Grade Two
— Brian

Figure 23. Scattered Scanning Test - Brian

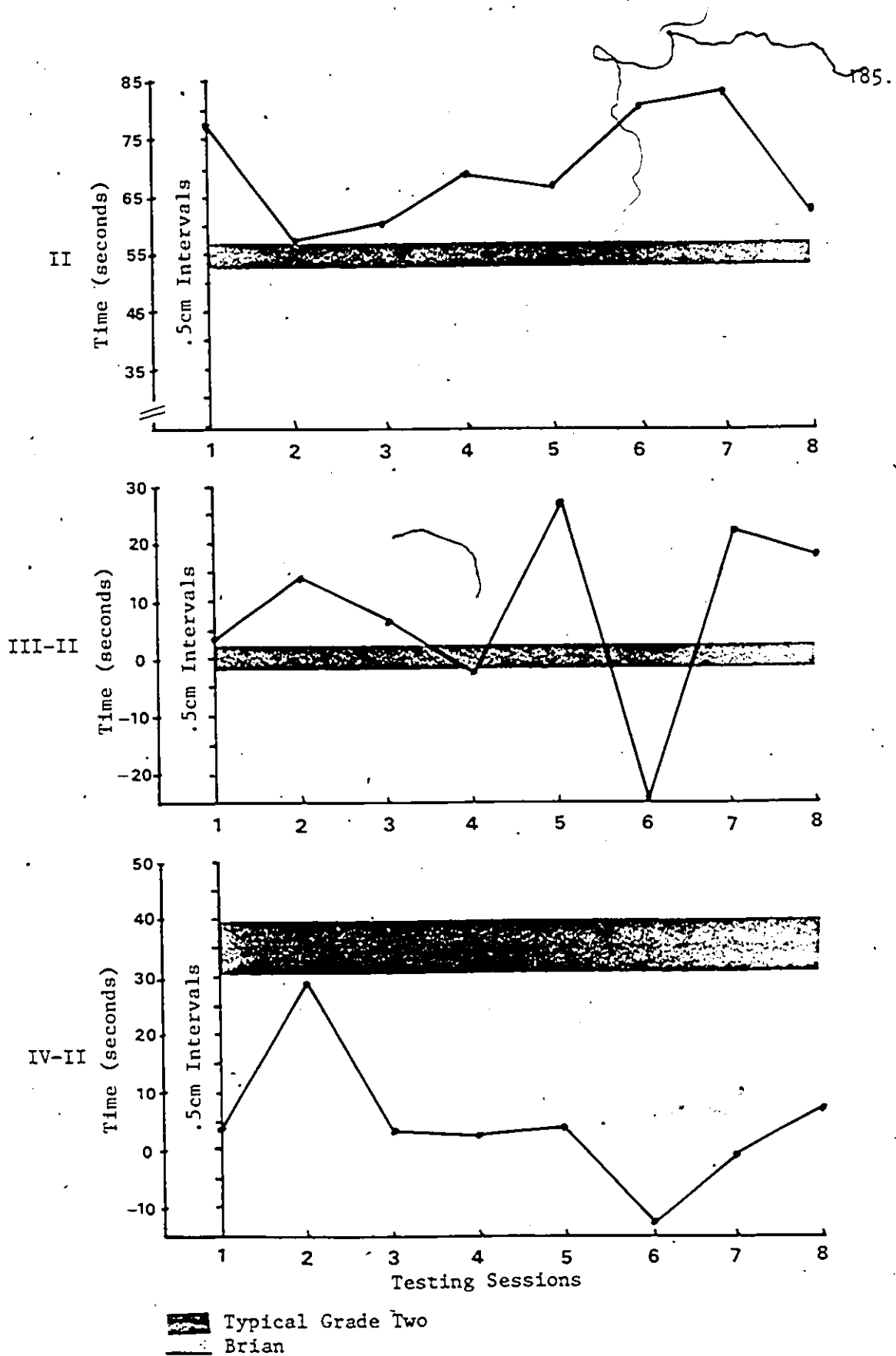


Figure 24. Fruit Distraction Test - Brian

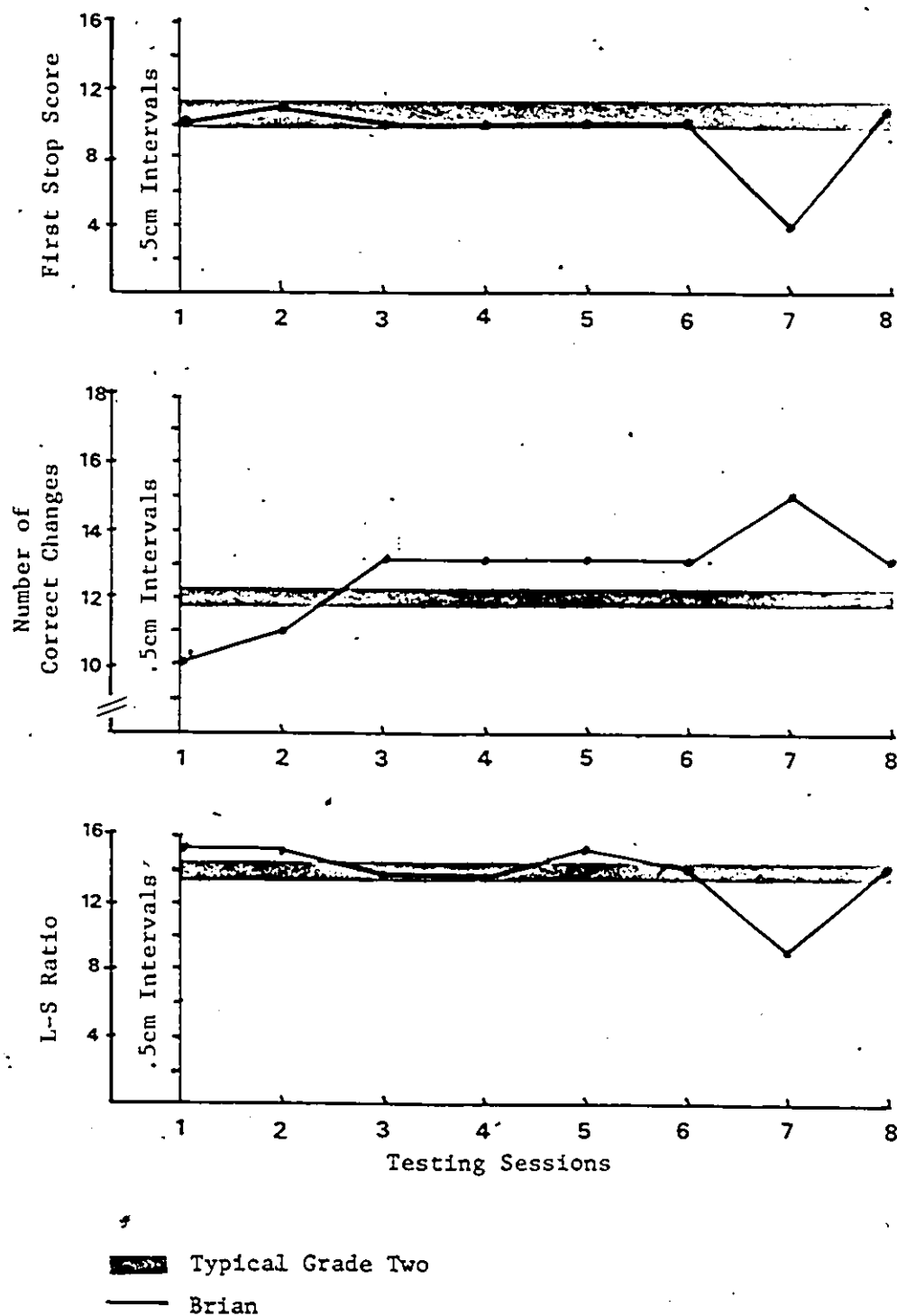


Figure 25. Leveling-Sharpeneing House Test - Brian

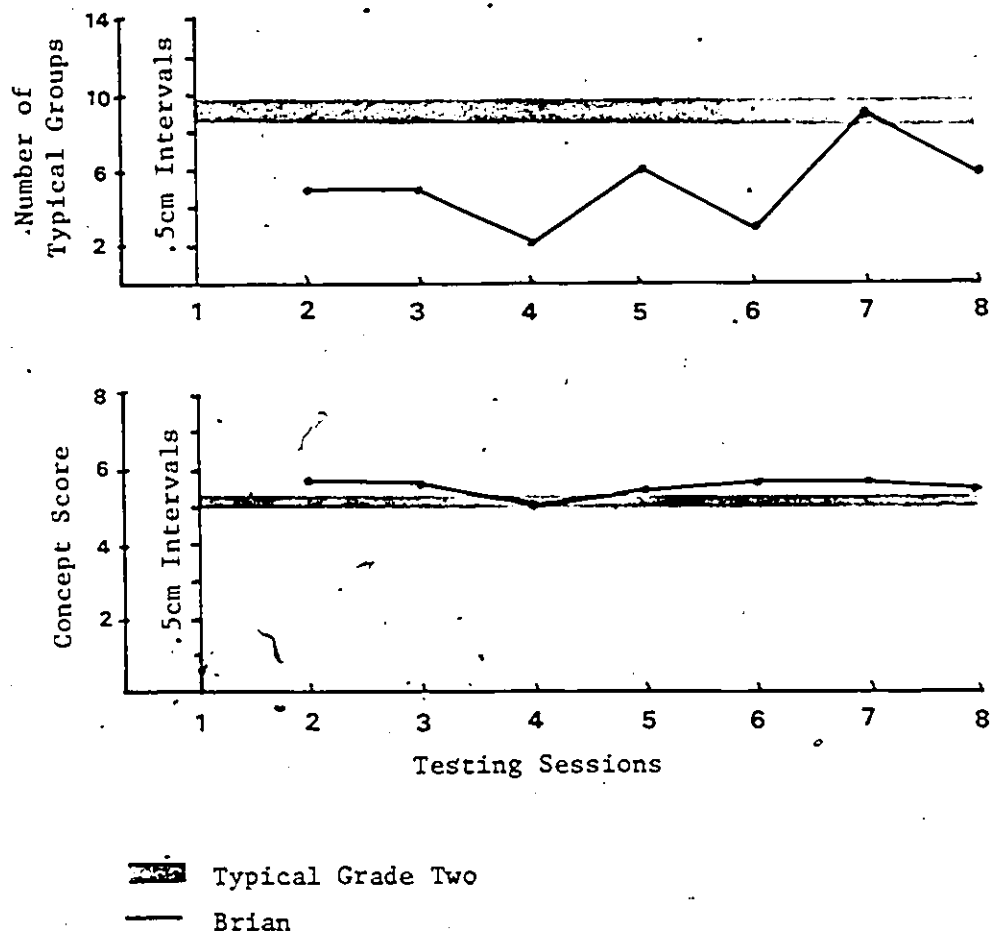


Figure 26. Object Sort Test - Brian

Summary of Cognitive Control Test Results. The first to develop of the cognitive controls, that is Focal Attention as assessed by the SST, showed greater maturity than any of the other measures during the baseline phase. The other three levels of cognitive control functioning were typical or slightly lower than would be expected of a grade two child. The cognitive control test showing the most dramatic variability and negative change during the training phase was FDT used to assess Field Articulation. The positive gains shown in the seventh testing session for the LSHT and Object Sort Test - Number of Typical Groups, were lost during the follow-up period.

Spontaneous Speech

Developmental Sentence Scoring. Brian received the following scores over the eight testing sessions in this test used to assess the level of syntactical development in the subject's spontaneous speech.

December 1975	10.04
February 1976	7.26
April 1976	9.08
June 1976	9.44
August 1976	7.92
October 1976	11.66
December 1976	9.20
February 1977	11.24

These scores are shown graphically in Figure 27 in comparison to the Mean scores, plus and minus one standard deviation, of the group of Normals and the group of Dyslexics in Vogel's 1975 study. The baseline phase is characterized by a dramatic negative change. Measures taken during the training phase are characterized by marked and then dramatic variability. At the sixth testing session Brian's level of syntactical structures was average for his age. The follow-up phase also indicates a marked positive change at which time the boy again used syntactical structures in accordance with his age.

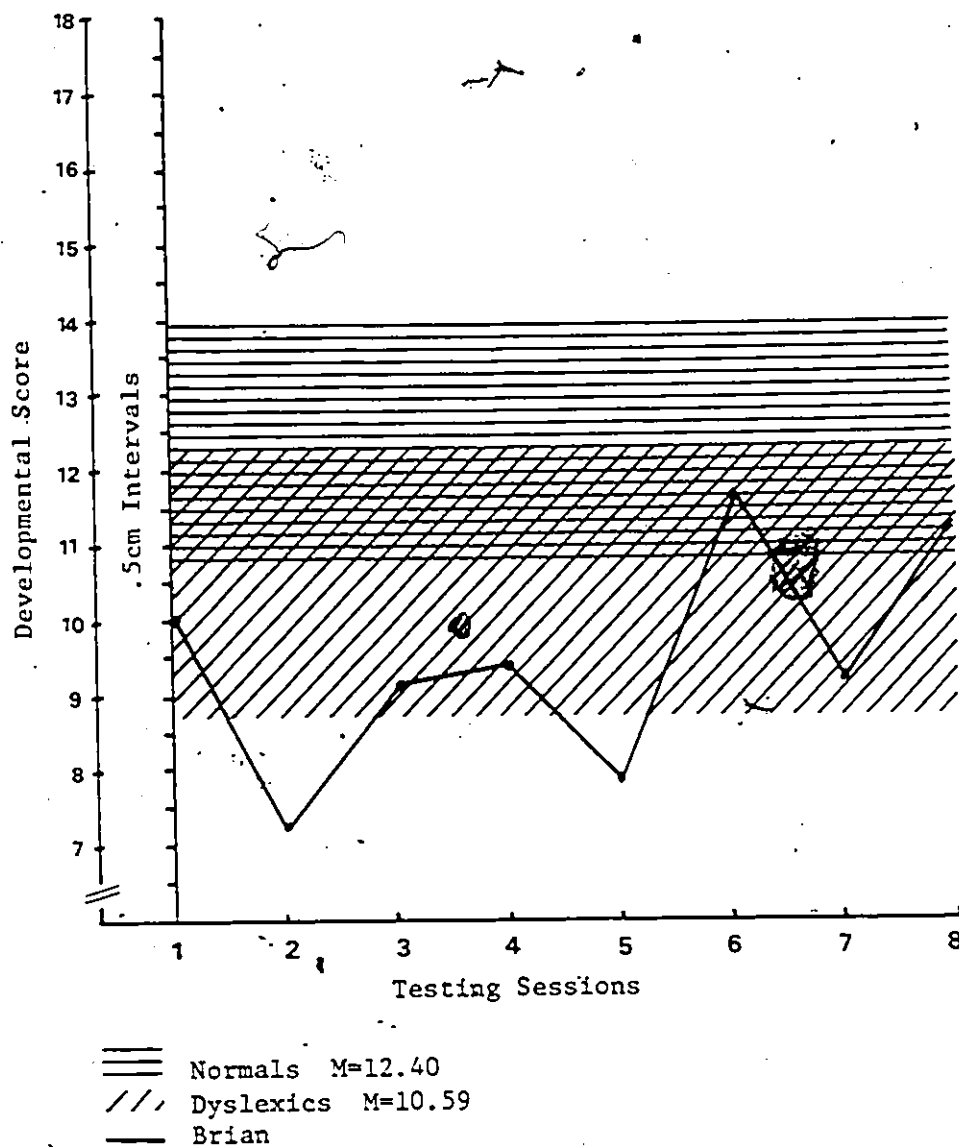


Figure 27. Developmental Sentence Scoring - Brian

Table 6 lists the scores obtained by Brian in the analyses of Communication Units and Maze Words of the spontaneous speech samples. Figures 28 and 29 show these results in comparison to the High and Low groups in Loban's 1976 Normative Study.

Words per Communication Unit. Baseline measures demonstrate a small variability and show that the average length of Brian's units of communication is similar to the Low group of Loban's study. The most characteristic feature of this graph is the marked negative change in the middle of the training phase. This is followed by a gradual dramatic positive change over the balance of this training phase. At the end of the training intervention Brian's Communication Units are lengthier, on the average, than the Low group but shorter than the High group in Loban's studies. This new level of performance was maintained in follow-up.

Percentage of Maze Words. Baseline measures show dramatic variability with the better of the two results indicating that Brian used a smaller percentage of Maze words in his spontaneous speech than even the High group of Loban's studies. There is a dramatic increase in the percentage of Maze Words used by Brian during the first four months of the training phase. At this point he uses a larger percentage of Maze Words than the Low group in Loban's studies. The middle months are rather stable followed by another dramatic increase or negative change at the close of the training phase. A dramatic positive change occurs during follow-up.

Language Style. Table 7 lists the scores obtained by Brian on the five point rating scale used to assess Language Style. These scores are depicted in Figures 30, 31 and 32 found on pages 196-198. Figure 30 shows that baseline measures for the Analysis of Story Content were stable.

Table 6
Analysis of Communication and Maze Units in Spontaneous Story Telling - Brian

Test	Date of Assessment - Brian						Loban's a Groups			
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77	Low	High
W P U ^b	6.9	6.3	6.2	7.3	5.1	5.9	7.7	7.7	6.7	8.1
Total Words ^c	215	106	268	260	192	294	320	368		
Percentage of Maze Words ^d	10.7	5.7	7.5	10.0	9.4	9.2	11.6	6.3	8.3	6.2*

^aGroups at the Grade 2 level.

^bAverage number of words per Communication Unit.

^cCommunication words plus Maze words.

^dPercentage of Maze words to total words.

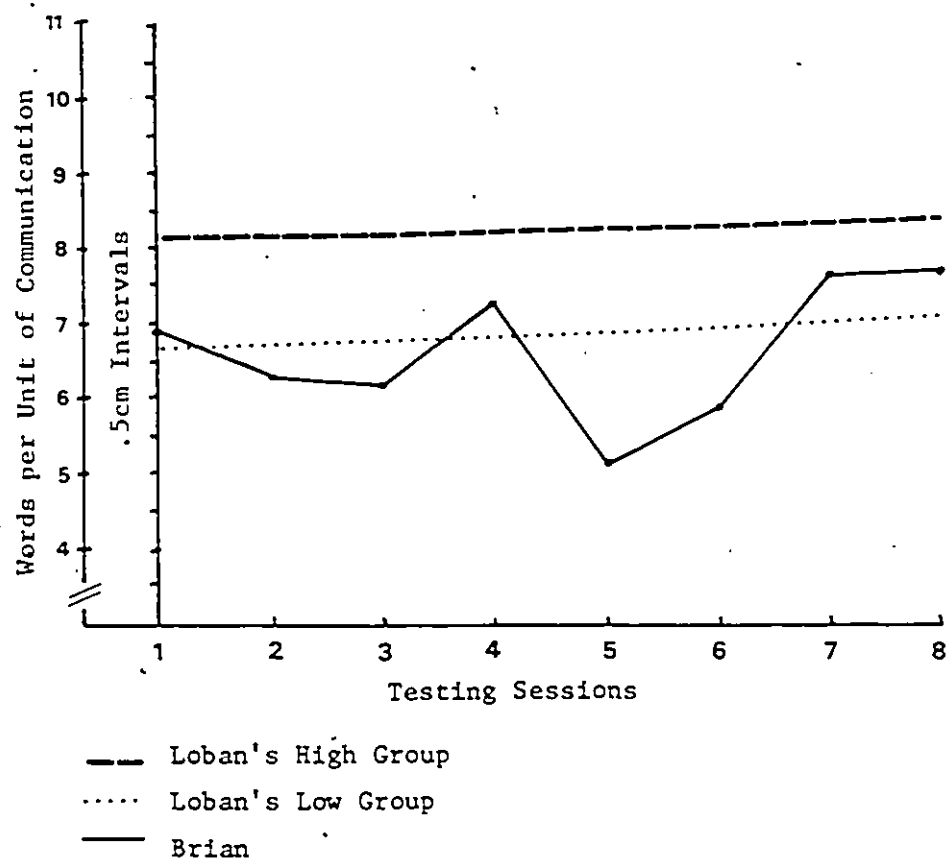


Figure 28. Number of Words per Communication Unit - Brian

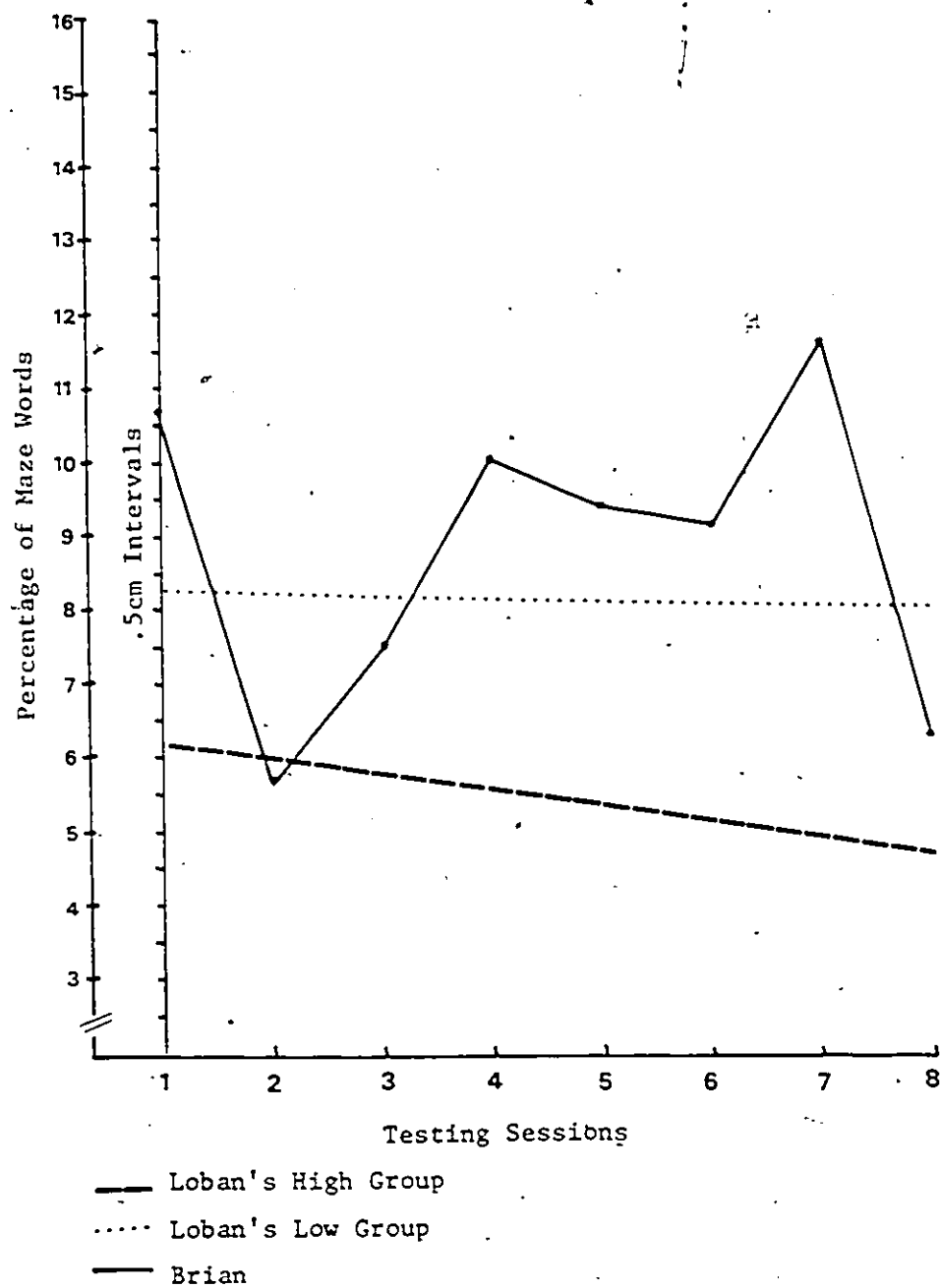


Figure 29. Percentage of Maze Words to Total Words - Brian

Table 7
Measures of Language Style on a Five Point Rating Scale - Brian

Trait	Date of Assessment							
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77
Story Content:								
Descriptive - Dynamic	1.3	1.3	1.3	2.3	1.3	1.7	2.0	4.0
Disorganized - Organized	1.7	2.3	2.0	4.0	1.7	2.7	2.0	4.3
Unrealistic - Realistic	4.7	4.7	4.7	4.7	4.7	4.3	5.0	4.7
Interpersonal Aspects:								
Ego-Centric - Social.	3.7	4.0	3.7	4.0	3.0	4.0	4.0	4.7
Other Directed - Self Directed	1.0	1.0	1.3	3.0	1.3	1.7	2.3	3.0
Voice Qualities:								
Halting - Fluent	1.0	1.7	2.7	2.0	1.0	2.3	2.7	4.0
Monotone - Expressive	1.3	1.3	2.7	1.7	1.7	3.3	2.3	3.3
Mumbled - Distinct	1.0	2.7	2.0	2.0	2.0	3.3	2.3	3.3

With the exception of one small positive spurt Brian consistently formulated stories that were descriptive rather than dynamic. A marked positive change occurred during the follow-up phase. Also, with the exception of one marked positive spurt, Brian's stories tended to be disorganized in content throughout the training phase. Again there is a marked positive change over the follow-up phase. Brian's stories were consistently realistic in content throughout all three phases of the research project.

Figure 31 depicts the results of the interpersonal analysis of the story telling tasks. Baseline measures are stable and suggest that Brian interacted moderately well with the examiner but he required a great deal of structural questioning to complete the story telling task. Generally Brian's sociability in the two person story telling task was maintained throughout the training and follow-up phases. There is a marked positive spurt in Brian's ability to structure his own story, four months after the introduction of the remedial training phase. Subsequent gains are slight and at the end of training this boy still requires much assistance to complete the task. The follow-up measures indicate a slight positive change.

Only one of the three voice measures depicted in Figure 32 shows a small variability over the baseline measures. At this time Brian spoke with a halting, monotonous and slightly mumbled voice. In the first graph of Figure 32 there is an early small positive spurt during training followed by a small negative spurt. At the end of training Brian's voice was moderately fluent. During follow-up there was a further small positive gain. The second and third graphs indicate rather stable use of a monotonous mumbled voice during the early and middle phases of training.

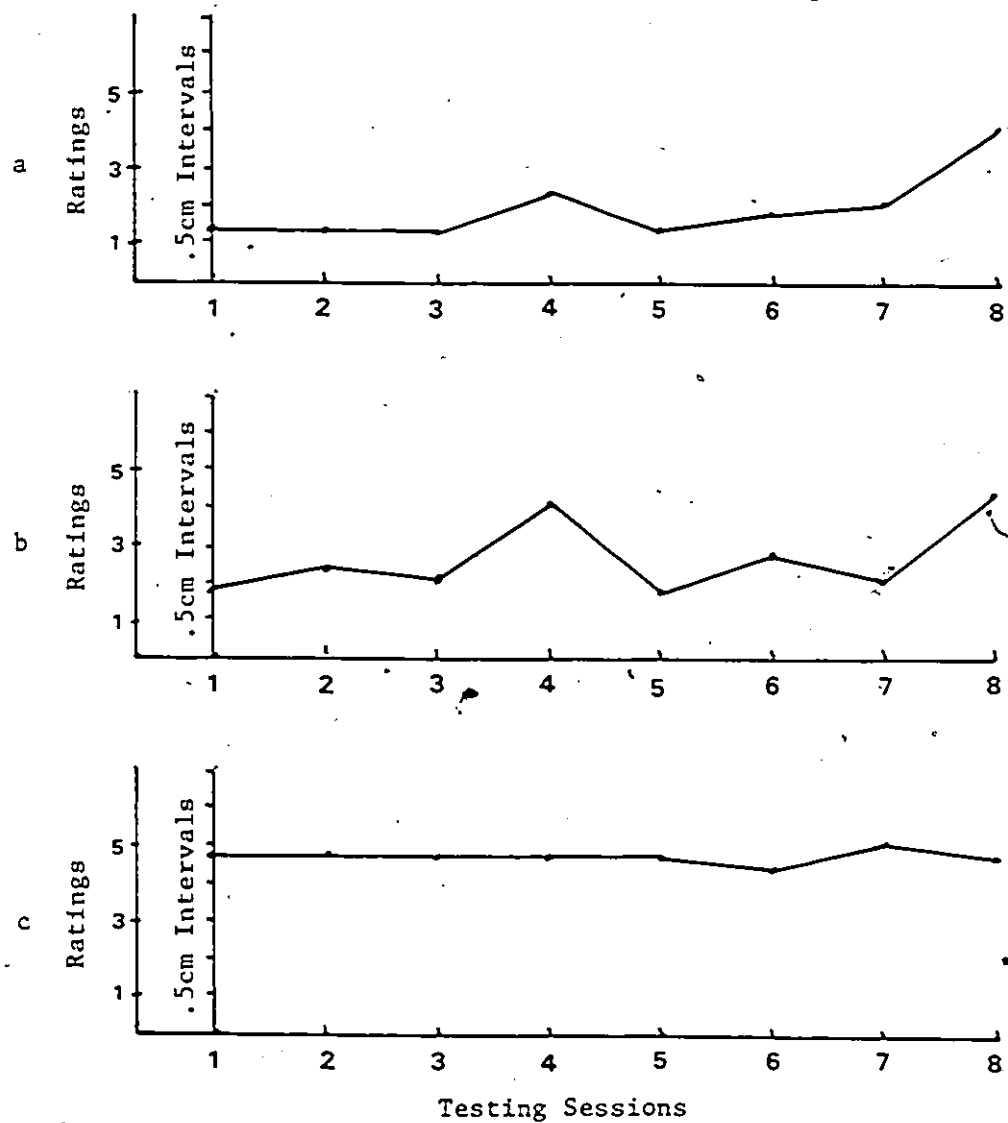


Figure 30. Analysis of Story Content - Brian
a) Descriptive to Dynamic
b) Disorganized to Organized
c) Unrealistic to Realistic

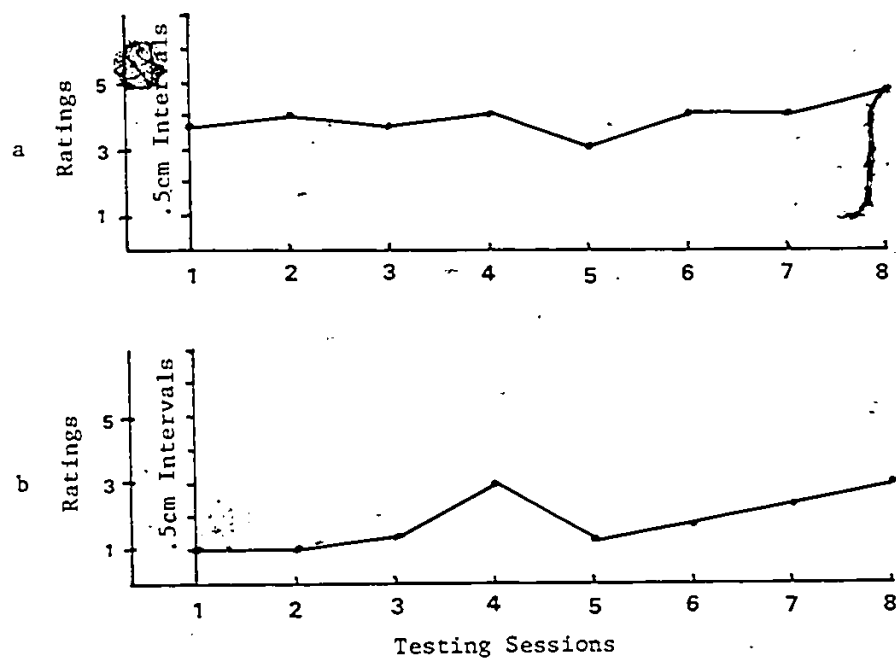


Figure 31. Analysis of Interpersonal Aspects - Brian
a) Ego Centric to Social
b) Other Directed to Self Directed

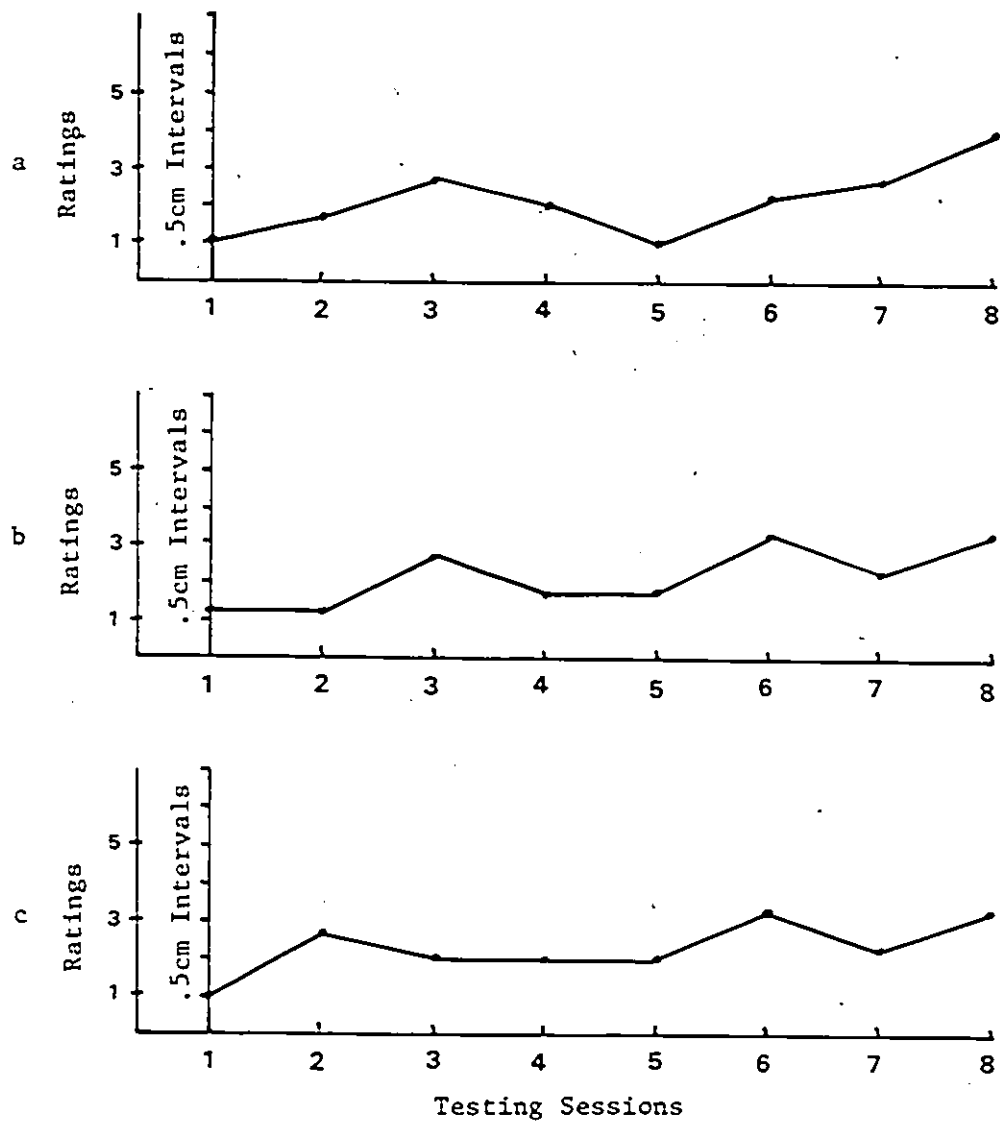


Figure 32. Analysis of Voice Qualities - Brian
a) Halting to Fluent
b) Monotone to Expressive
c) Mumbled to Distinct

There were small positive spurts in both measures on the sixth testing session. Again one must note the small positive change during follow-up.

Summary of Spontaneous Speech Analyses. Measures used to assess the level of syntactical functioning (DSS); ability to communicate ideas through lengthier units of communication (WPU); hesitations or tangles in speech (Percentage of Maze Words); and voice quality showed variability during the baseline phase. Changes occurring during training tended to be in a positive direction, with the exception of Maze Behavior, but did not reach a level which could be considered adequate for Brian's chronological age and grade placement. Most of the measures showed their positive gains during the follow-up phase.

Test Results compared to individualized APP Program

In Brian's case, the Passive Phase of remedial training lasted a total of three months. During this phase test results indicate positive changes in the first three levels of cognitive control functioning: Focal Attention (assessed by SST); Field Articulation (assessed by FDT); and Leveling-Sharpening (assessed by LSHT). While Focal Attention was already adequately developed prior to the remedial training intervention, Field Articulation and Leveling-Sharpening were reorganized to a level consistent with Brian's age and grade placement. Measures for use of mature syntactical structures (DSS) as well as the ability to communicate one's ideas (WPU) remained little changed and below expectancy during the Passive Phase of remedial training. The percentage of Maze Behavior in Brian's spontaneous speech, however increased consistently during this Passive Phase. Measures of Language Style remained basically unchanged.

There were some noticeable changes in test results during the Active Phase of training. The first level, that is Focal Attention, of cognitive control functioning continued to change in a positive direction throughout this phase of training. Field Articulation and Equivalence Range were very variable during this time while Leveling-Sharpening showed another positive gain at the very end of the training program.

The DSS results, used to assess the level of syntactical structures being used in spontaneous speech samples, showed marked variability throughout this Active Phase of training although there was a general trend toward age expectancy. The positive change noted in Brian's use of longer units of communication occurred gradually over the duration of the Active Phase.

The percentage of Maze structures used by Brian in his spontaneous speech remained fairly consistent during most of the Active Phase until the introduction of the final subphase when a further increase of such behavior was noted. Generally the measures of Language Style remained unchanged throughout the remedial training program. However one should note the spurt toward better organization, of both Brian's own story content as well as his ability to complete the story telling task without undue assistance, at the fourth testing session which coincides with the onset of the Active Phase of training. However this positive change is not maintained. Also during this Active Phase Brian's voice did become gradually more fluent.

In general, variability or no change were the two characteristics of Brian's test profiles. Positive gains in cognitive control functioning did occur during the Passive Phase of training. However the most consistent

gain was in Focal Attention, already well developed for Brian's age and grade. Language measures of syntactical growth and the ability to communicate ones ideas did tend toward a positive direction during the Active Phase of training.

Subject 3 - Charles

Cognitive Controls

Table 8 lists Charles' results for the various subtests of the cognitive control assessments and compares these to the Mean Score and Standard Deviation obtained by typical grade two students. These same results are depicted graphically in Figures 33, 34, 35, and 36 found on pages 204 to 207.

Scattered Scanning Test. Figure 33 indicates that the baseline measures for both subtests of the SST remained stable and that Charles was functioning at a level below that considered typical for his age and grade. On the first of the subtests, Number Correct, there is a marked positive change after the first two months of training to a level well above expectancy. The balance of the curve is characterized by a gradual small positive change. Follow-up performance remained stable. In the second subtest, Total Distance, there is a dramatic positive change early in the training phase followed by a marked negative change with all scores in the remedial training phase being well above that considered typical of a grade two student. During follow-up there occurs a marked positive change.

Fruit Distraction Test. Figure 34 shows marked variability in two out of three subtests. Overall one must consider the possibility that Charles can function at grade expectancy on all subtests. On the base

Table 8
Results of Tests used to Assess Cognitive Control Functioning - Charles

Test	Date of Assessment - Charles							Typical Grade 2	
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77	Mean SD
Scattered Scanning Test:									
Number Correct	18	16	30	30	36	39	34	38	20.3 1.01
Total Distance	110.9	116.3	209.0	286.5	246.5	199.0	200.5	263.7	127.8 5.23
Fruit Distraction Test:									
Time on Card II	65	52	53	40	40	44	42	46	54.7 2.03
Card III - Card II	-3	-4	-3	8	14	8	8	14	0.8 1.32
Card IV - Card II -	48	23	21	33	40	48	10	13	35.3 4.70
Leveling-Sharpening House Test:									
1st Stop Score	10	10	4	5	4	5	6	5	10.7 .80
Number Correct Changes	14	14	16	16	16	17	16	17	12.1 .28
L-S Ratio	14.8	11.6	6.1	6.8	6.8	6.6	8.0	5.1	14.0 .55
Object Sort Test:									
Number of Typical Groups	11 ²	7	9	9	9	9	9	7	9.4 .69
Mean Concept Score	5.6	5.7	5.6	5.6	5.9	5.7	5.1	4.9	5.1 .13

card (II) Charles' performance was initially stable during training, followed by a marked positive change on the fourth testing session. This level was maintained throughout the balance of the training and follow-up phases. The second subtest (III-II) indicates a marked negative change during the middle of the training phase at which time Charles was taking longer to respond, when faced with geographical distractions, than would be expected for his grade two placement. This poor level of functioning was generally maintained throughout the balance of the training and follow-up phases. The third subtest graph (IV-II) likewise indicates a gradual but dramatic negative change over most of the training phase with a dramatic positive change at the very end of the remedial training phase. The new level remained stable during follow-up.

Leveling-Sharpening House Test. With the exception of the L-S Ratio, Figure 35 indicates stability during the baseline. On all three subtests Charles functions at a level better than would be expected for his chronological age and grade placement. All three subtests show the same pattern during the training phase. That is, each shows marked positive change after the initial two months of training followed by stable performance. Two of the three subtests indicate a small positive change during follow-up.

Object Sort Test. The first graph in Figure 36 shows a small negative spurt early in the training phase followed by a stable performance at which time Charles formulated a number of groups considered typical for his age and grade. There is a small negative change during follow-up. Scores on "Concept Score" are consistently above expectancy.

Summary of Cognitive Control Test Results. During the baseline phase Charles was functioning below expectancy on the tests used to assess Focal

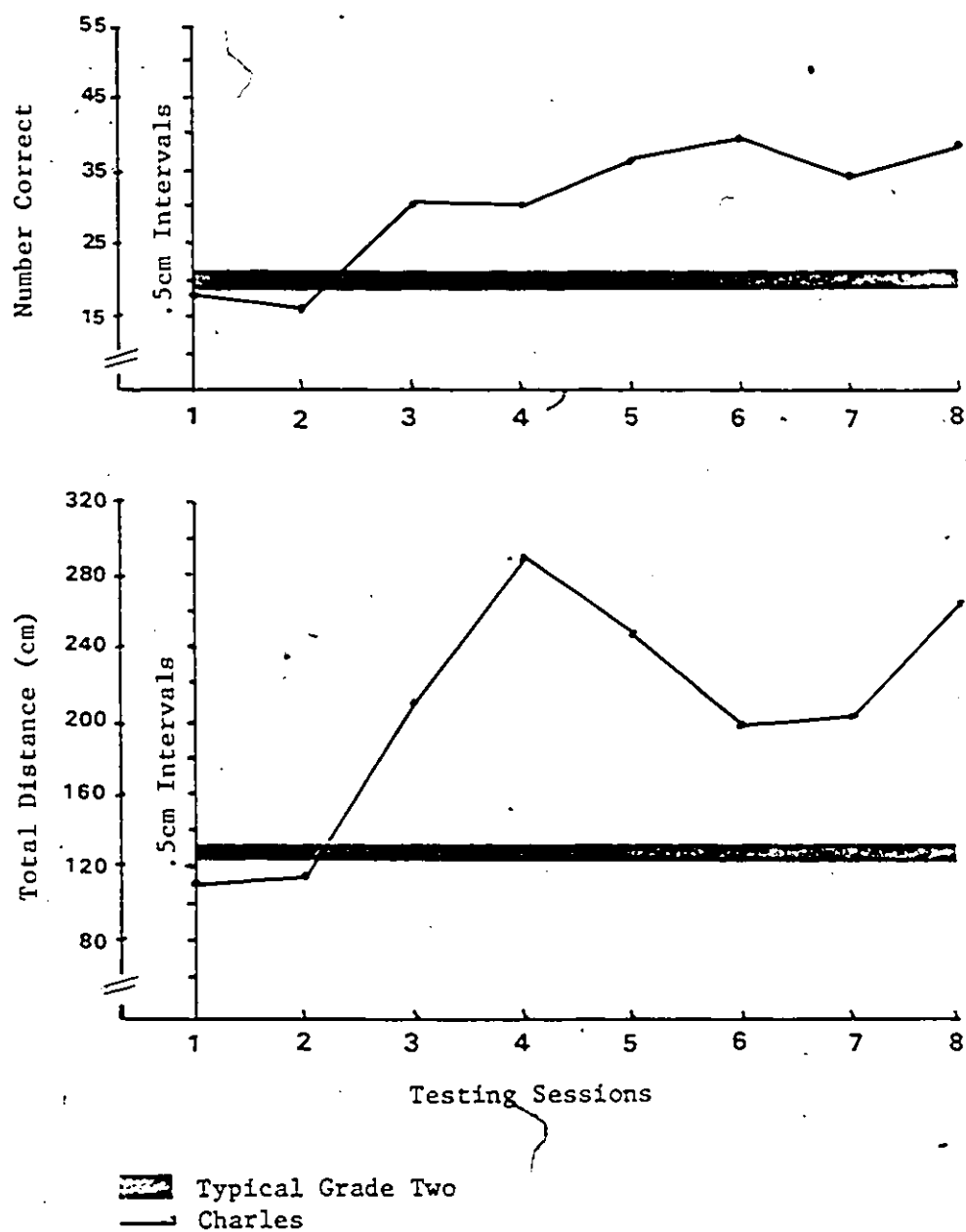


Figure 33. Scattered Scanning Test - Charles

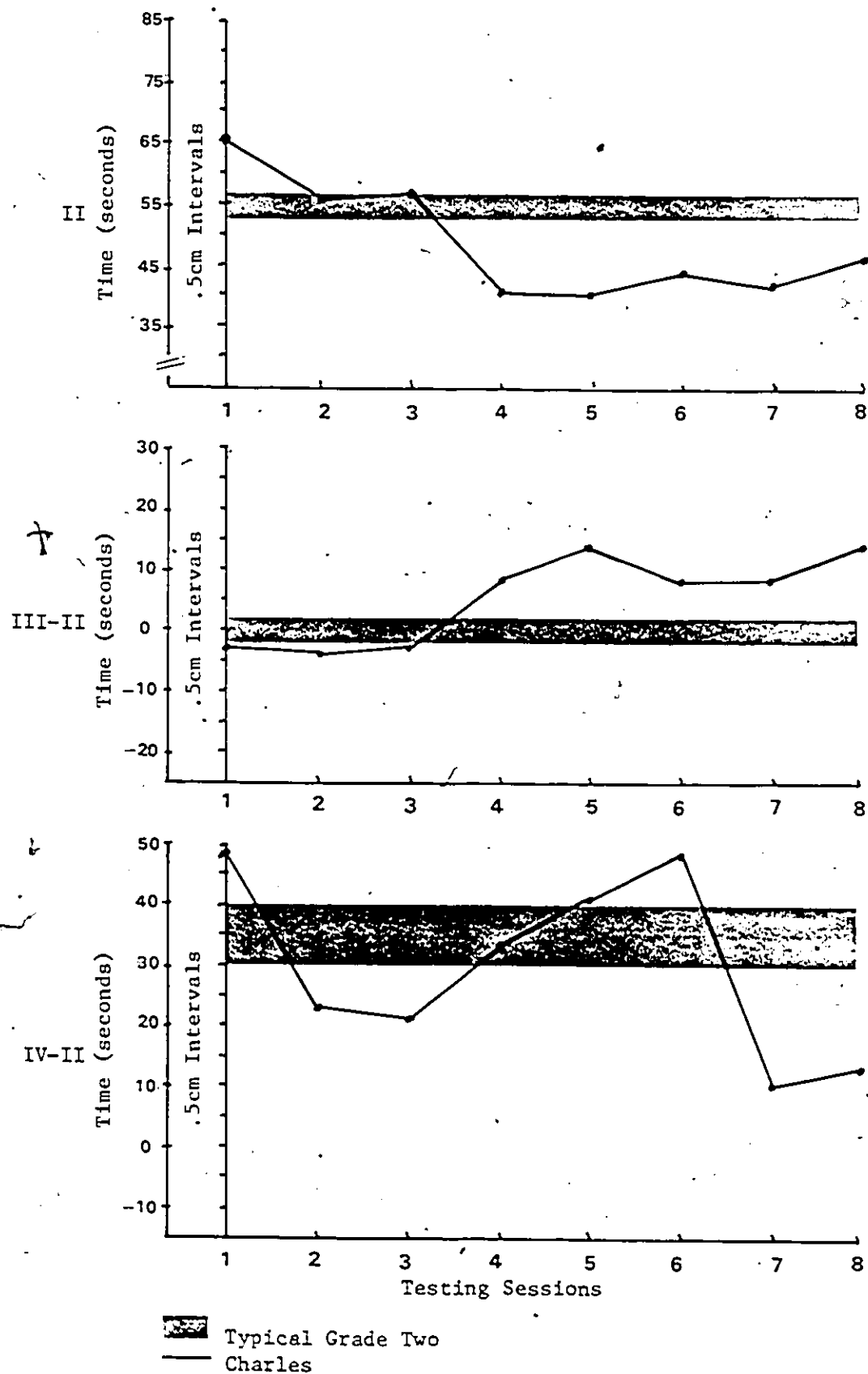
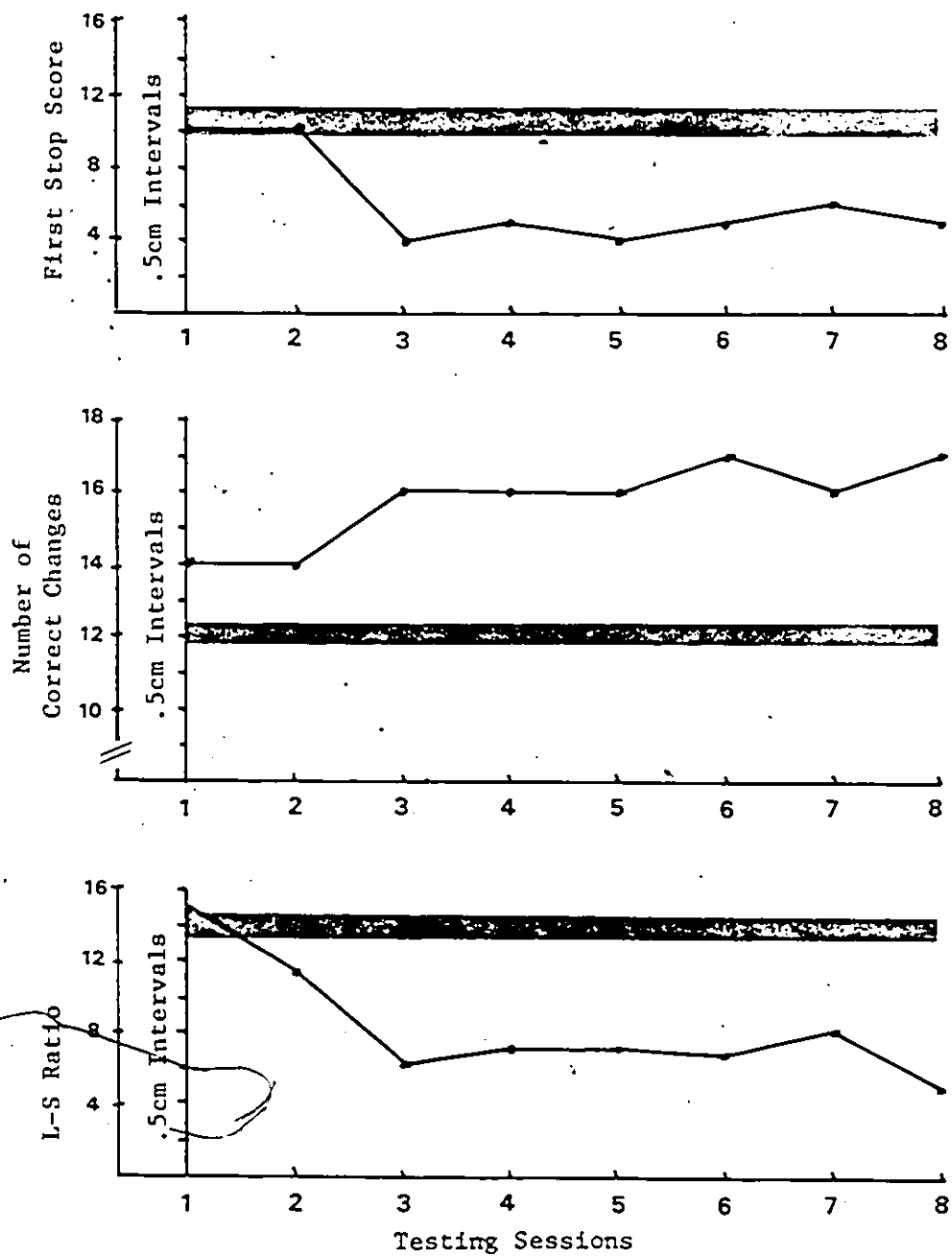


Figure 34. Fruit Distraction Test - Charles



Typical Grade Two

Charles

Figure 35. Leveling-Sharpener House Test - Charles

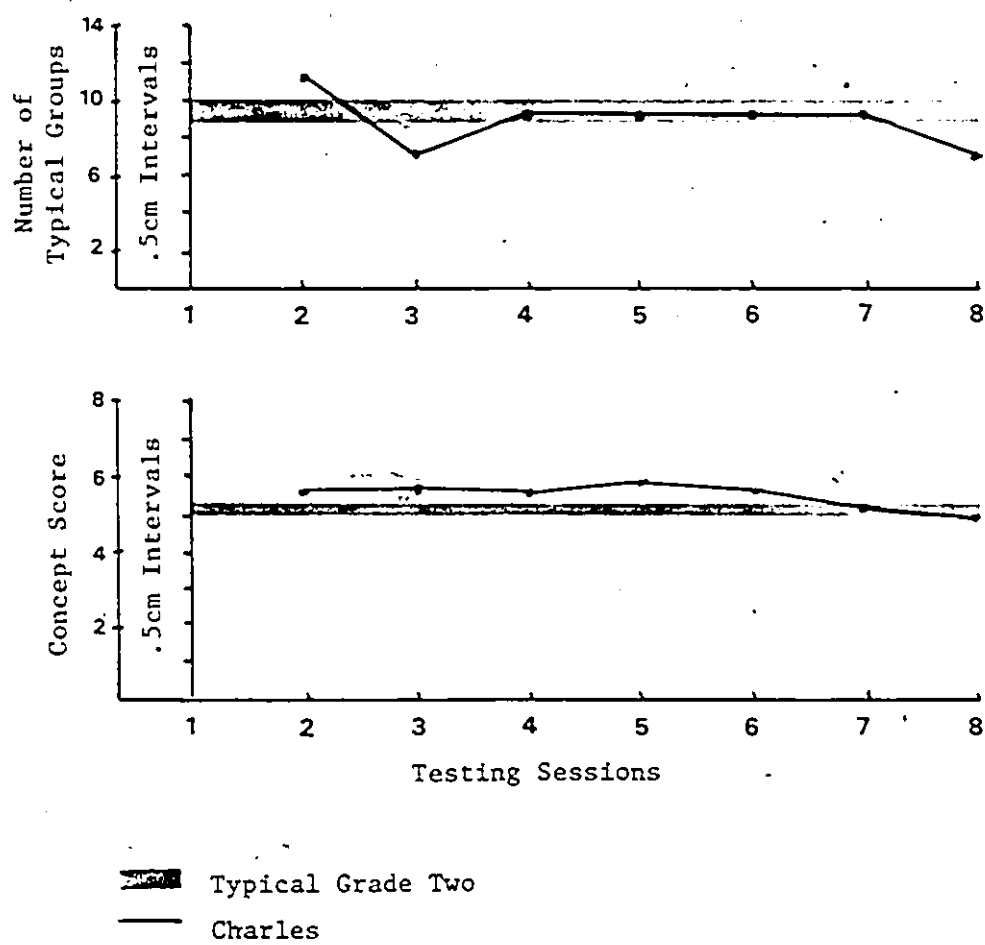


Figure 36. Object Sort Test - Charles

Attention (SST), while performing adequately on the tests used to assess Field Articulation (FDT); Leveling-Sharpening (LSHT); and Equivalence Range (Object Sort Test). With the introduction of the training phase SST and LSHT results showed immediate positive change which was maintained throughout the balance of the remedial training phase. Therefore two months after the onset of the training program Charles was functioning above expectancy on all tests used to assess the Cognitive Control Principles. During the greater part of the training phase the lad experienced more difficulty in handling distracting material both geographical and contextual (FDT III-II & IV-II). While he handled the base card (II) extremely quickly he became progressively worse in his performance when faced with distractions.

Spontaneous Speech

Developmental Sentence Scoring. Following are the Mean DSS scores obtained by Charles over the eight testing sessions:

December 1975	11.34
February 1976	10.16
April 1976	11.58
June 1976	9.54
August 1976	14.48
October 1976	11.58
December 1976	12.46
February 1977	13.42

In Figure 37 these results are depicted in relation to the Mean score, plus and minus one standard deviation, of the Normal and Dyslexic groups in Vogel's 1975 study. There is marked variability in the scores of the baseline phase. At best Charles appears to be capable of using syntactical structures, in his spontaneous speech, which are considered to be at a normal developmental level for his age. While the general slope of the

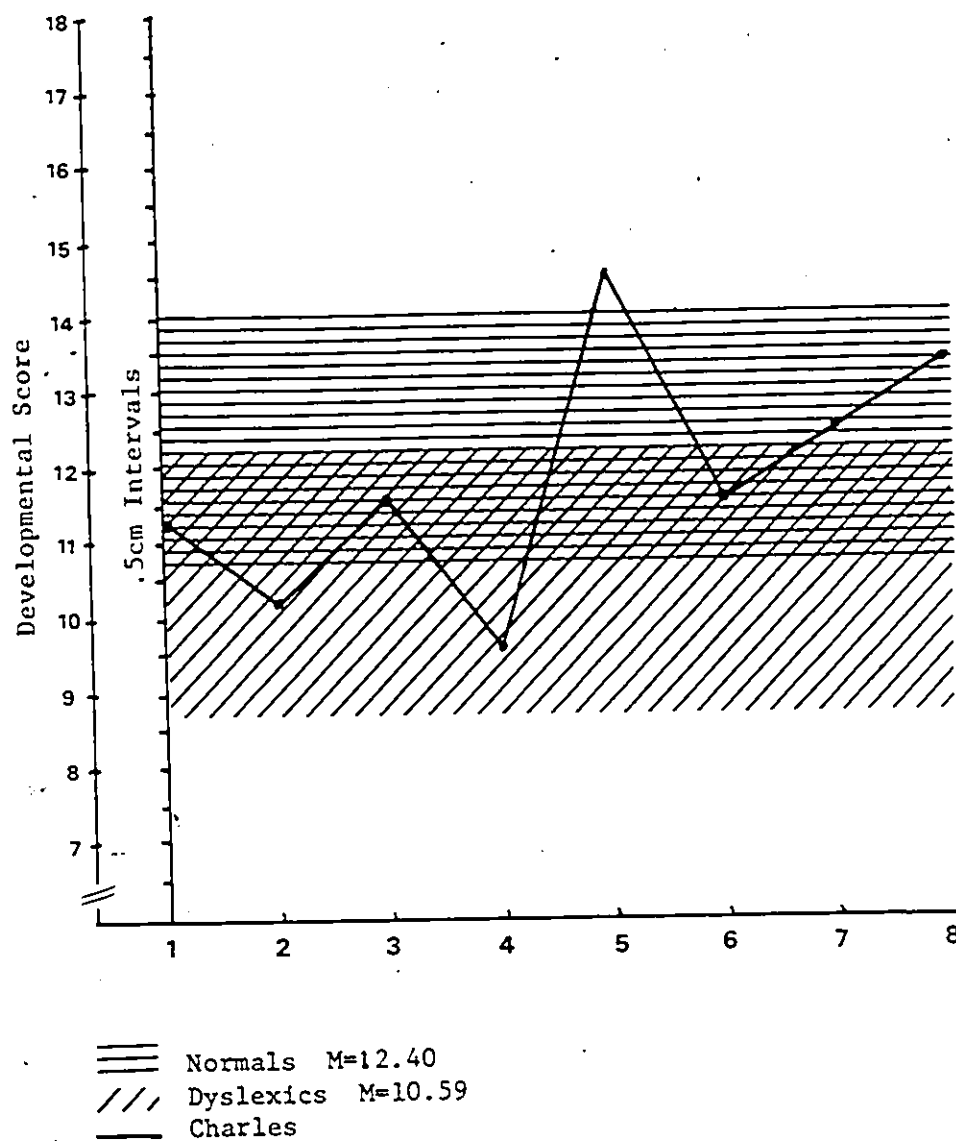


Figure 37. Developmental Sentence Scoring - Charles

curve is toward a positive change during the training phase, the early part of the phase indicates marked variability in performance while the later half is characterized by dramatic variability. Charles at times functioned below the "Normals" in the early part of the training but his performance was within the normal range throughout the second half. There was a marked positive change during the follow-up phase.

Table 9 lists the scores obtained by Charles in the analyses of Communication Units and Maze Words of the spontaneous speech samples. Figures 38 and 39 show these results in comparison to the High and Low groups in Loban's 1976 Normative Study.

Words per Communication Unit. Figure 38 graphically depicts the scores for the average number of words used by Charles in the communication units of his spontaneous speech samples. There is a small variability in the two performances of the baseline phase. At this time Charles' units were longer than those of Loban's Low group but shorter than those of the High group. During the initial four months of the training phase there was a marked positive change and the boy functioned, at least in this area, at a level consistent with the High group of Loban's normative study. The balance of the curve is characterized by marked variability.

Percentage of Maze Words. Baseline measures (Figure 39) are not stable and both are well below even the Low group of Loban's study. That is, Charles used a much greater percentage of Maze words in his spontaneous speech than would have been expected of poor language developers. During the initial four months of the training phase there is a dramatic positive change. Charles' percentage of maze behavior had fallen close to the percentage used by the High group. Gradually, over the next three

Table 9.

Analysis of Communication and Maze Units in Spontaneous Story Telling - Charles

Test	Date of Assessment - Charles							Loban's ^a Groups	
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77	Low High
W P U ^b	7.7	7.0	8.7	8.2	6.9	8.4	7.5	7.8	6.7 8.1
Total Words ^c	309	447	303	263	288	734	790	624	
Percentage of Maze Words ^d	10.4	12.5	11.6	6.5	8.7	8.7	10.1	15.2	8.3 6.2

^aGroups at the Grade 2 level.^bAverage number of words per Communication Unit.^cCommunication words plus Maze words.^dPercentage of Maze words to total words.

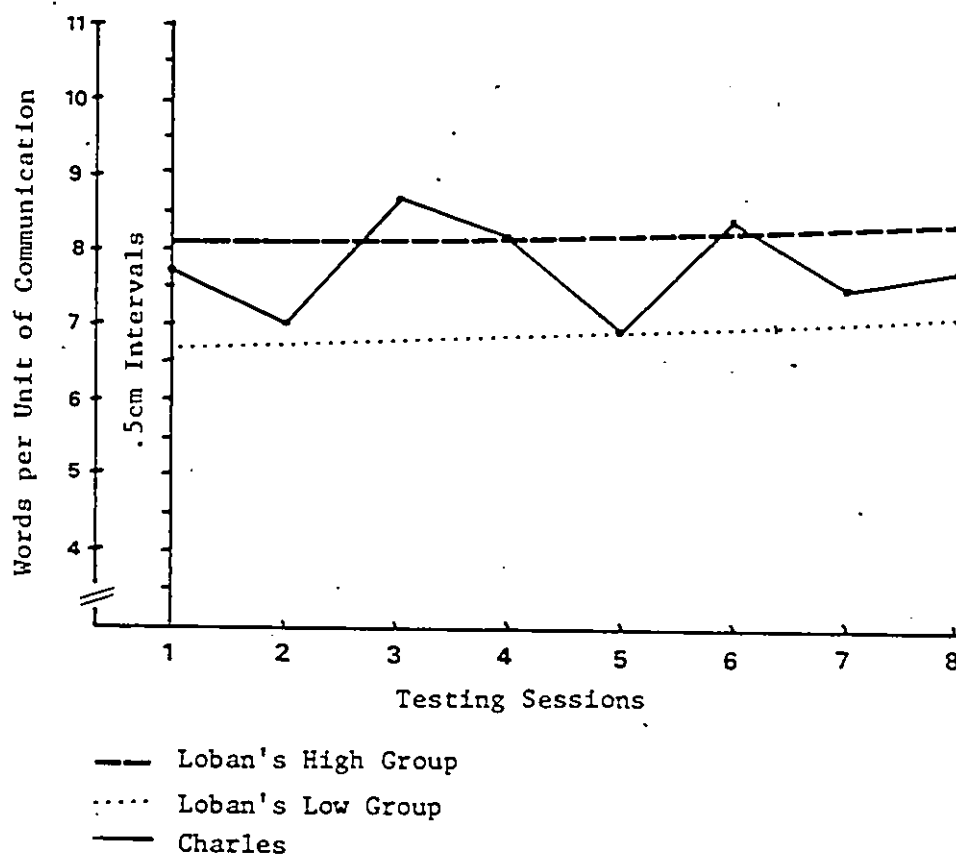


Figure 38. Number of Words per Communication Unit - Charles

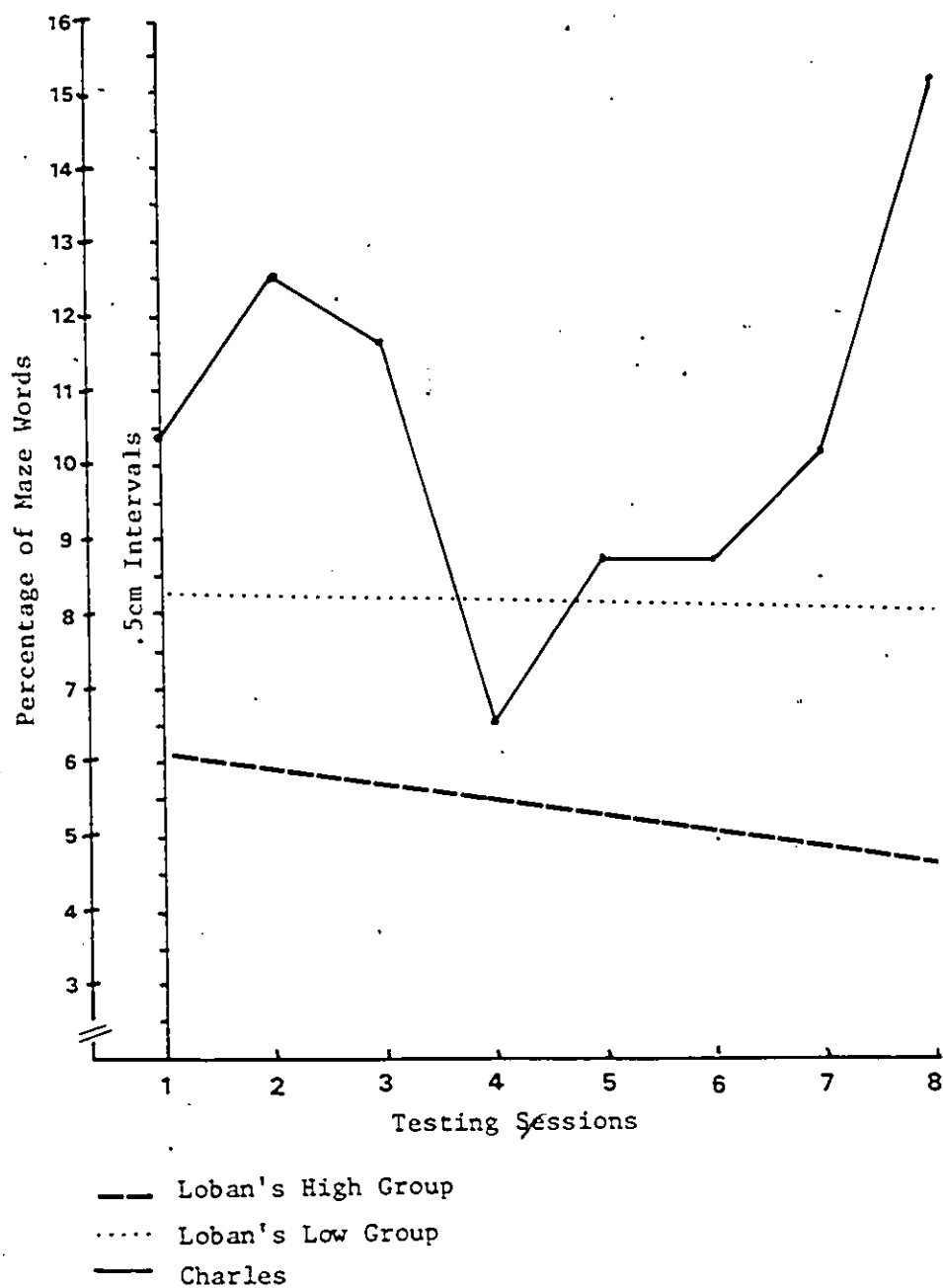


Figure 39. Percentage of Maze Words to Total Words - Charles

testing sessions there is a dramatic increase in percentage of maze behavior. During the follow-up there is a further dramatic increase.

Language Style. The results of the eight aspects of Language Style assessed on a five point scale, are reported in Table 10 and depicted graphically in Figures 40, 41 and 42 which are located on pages 217 to 219. Five of the eight measures show variability in the baseline phase. The two measures dealing with Interpersonal Aspects of story telling (Figure 41) as well as fluency of speech (Figure 42) can be considered stable. Considering Figure 40, in the first graph we note that despite variability Charles gradually tells a more dynamic story until, at the end of the training phase, he performs at a level considered excellent for his age and grade. His stories likewise become more organized early in the training phase and remain so. Both measures are maintained during follow-up. While Charles' stories gradually became more realistic during most of the training phase there appears a marked drop (TS 6) at which time story themes became unrealistic in terms of the average eight or nine year old's experiential background. This was maintained during the final months of training and story themes became even slightly more unrealistic during the follow-up phase.

The first of the Interpersonal Aspects (Figure 41) studies showed an initial marked positive change after two months of training. This high level of interpersonal interaction with the examiner and the test content, was consistent throughout the balance of the training phase. There was a marked negative change during the two month follow-up phase. There was a very gradual marked positive change in this boy's ability to structure his own stories throughout the training phase. There was a marked negative change during follow-up.

Table 10
Measures of Language Style on a Five Point Rating Scale - Charles

Trait	Date of Assessment							
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77
Story Content:								
Descriptive - Dynamic	1.3	2.7	1.7	3.7	2.3	4.7	4.3	4.3
Disorganized - Organized	1.7	3.0	2.3	3.7	4.0	4.3	3.7	3.7
Unrealistic - Realistic	2.3	3.0	3.3	3.7	4.3	2.0	1.7	1.0
Interpersonal Aspects:								
Ego-Centric - Social	1.0	1.7	3.7	4.0	4.0	4.0	3.7	1.3
Other Directed - Self Directed	1.0	1.3	1.7	2.3	1.7	3.0	4.0	1.0
Voice Qualities:								
Halting - Fluent	2.7	3.3	2.0	2.7	2.3	4.7	4.7	4.3
Monotone - Expressive	1.3	3.0	2.0	2.0	2.3	4.3	4.3	4.7
Mumbled - Distinct	1.0	2.7	1.7	2.7	2.3	4.3	4.3	3.7

Voice qualities (Figure 42) all indicated a marked positive change two months prior to the termination of training. At this time Charles spoke fluently with expression and distinctly. These results remained essentially unchanged during the balance of the research project.

Summary of Spontaneous Speech Analyses. Immediate positive changes were noticed in the average ~~number of words used~~ in a unit of communication (WPU); percentage of maze words used in the total spontaneous speech sample; and the social interaction within the story telling framework. Syntactical growth, as measured by DSS, made its greatest gains during the later part of the training program as did the dynamic aspects of composing a story and all measures of voice quality. Maze behavior and realistic versus unrealistic story themes demonstrated dramatic and marked negative changes respectively, toward the close of the training phase. Follow-up measures were often negative.

Test Results compared to Individualized APP Program

This young lad worked his way quickly through the early phases of the remedial training program. Both filtered sounds and sonic birth sub-phases of remedial training were completed during the first two months of training. During this time Focal Attention (SST), the first to develop of the cognitive controls, showed a positive change which brought the boy from a performance level below age and grade expectancy to one that was above expectancy. The third level of cognitive control functioning, Leveling-Sharpener (LSHT), also demonstrated positive change during this Passive Phase of training while Field Articulation (FDT) and Equivalence Range (Object Sort Test) remained rather stable. Any change in the use of syntactical structures during this early stage of training cannot be

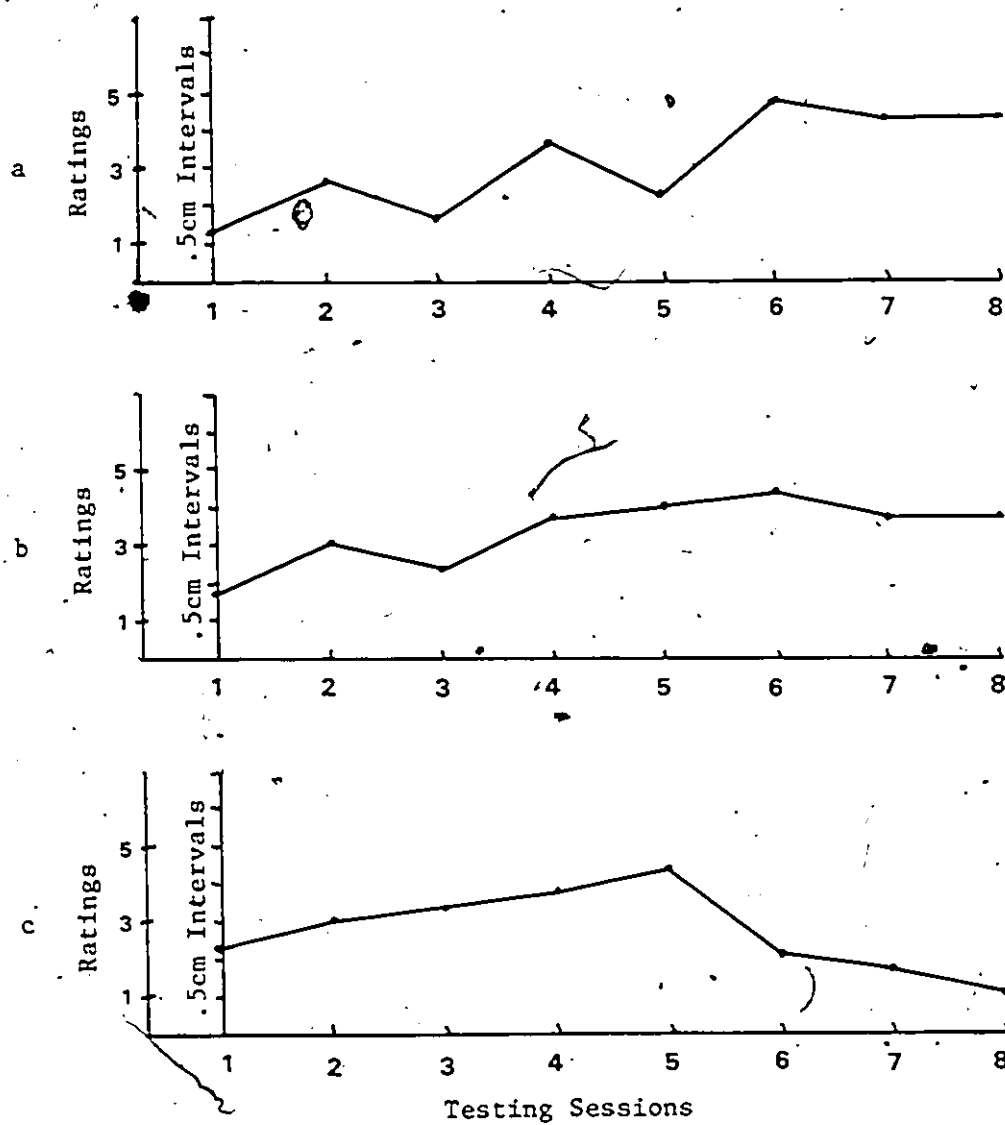


Figure 40. Analysis of Story Content - Charles
 a) Descriptive to Dynamic
 b) Disorganized to Organized
 c) Unrealistic to Realistic

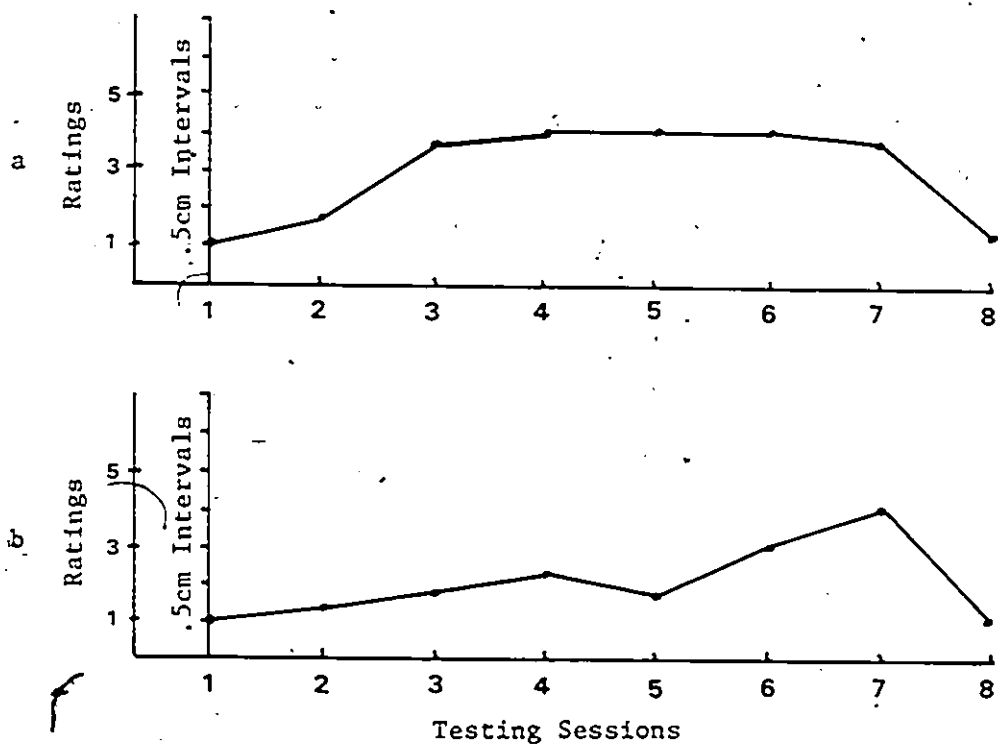


Figure 41. Analysis of Interpersonal Aspects - Charles
a) Ego Centric to Social
b) Other Directed to Self Directed

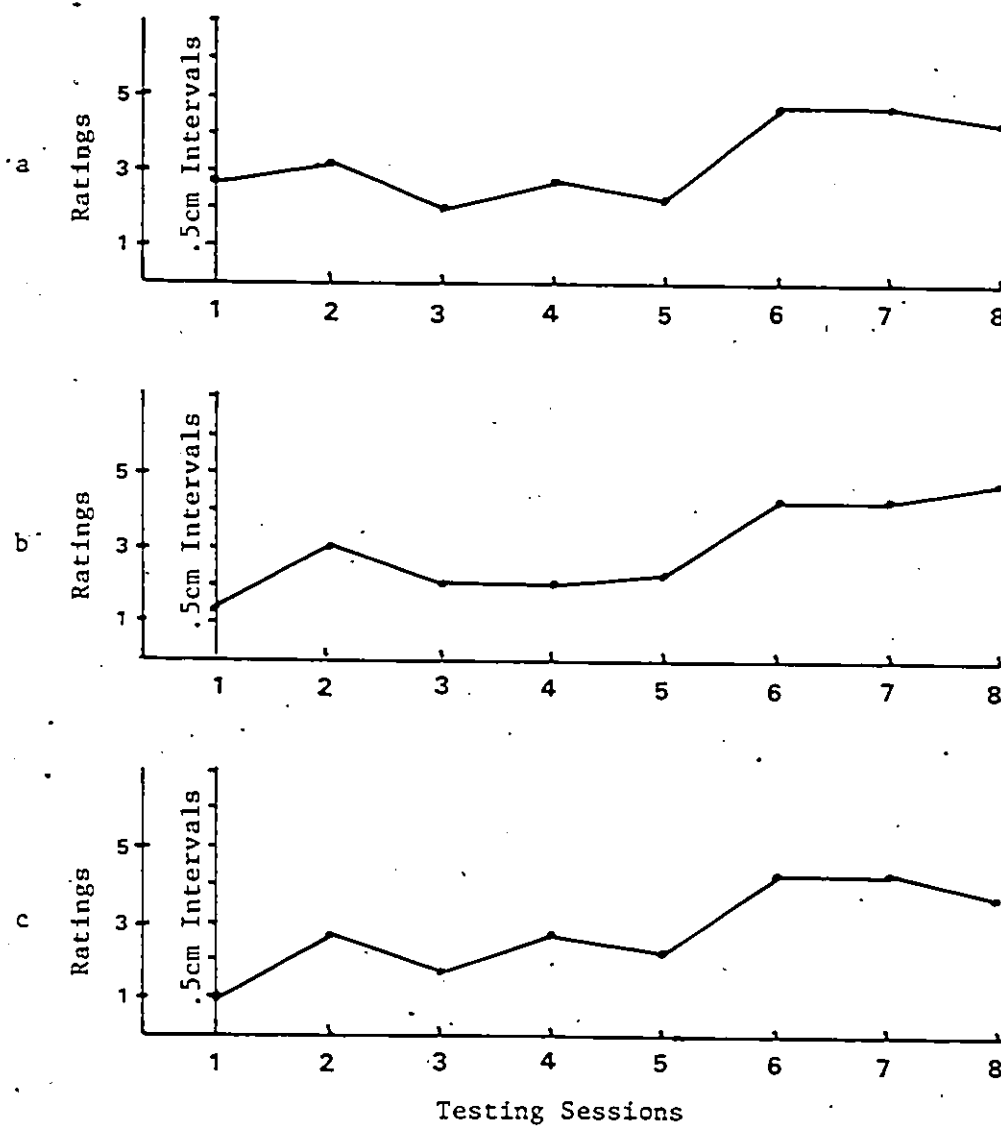


Figure 42. Analysis of Voice Qualities - Charles

- a) Halting to Fluent
- b) Monotone to Expressive
- c) Mumbled to Distinct

considered as reliable since the general pattern was one of variability. There was however a very positive change in the boy's ability to communicate ideas, as assessed by the average number of words in a unit of communication. This is reflected in the testing session completed after the termination of the Passive Phase (TS 3). Meanwhile Charles' Maze Behavior showed positive change over the same period of time. During the Passive Phase of training the biggest positive change in the Language Style measures occurred in the Ego-Centric to Social dimension. It was during this phase of training that Charles began to integrate his experiences with the realities of the picture and the examiners comments. While the content of his stories remained concrete and disorganized the themes were slightly more realistic. Voice qualities remained poor.

For Charles, eight of the ten months of remedial training were devoted to the Active Phase of training; the first two on the Performing subphase, and the balance on the Training subphase. While Focal Attention, Leveling-Sharpening and Equivalence Range levels of cognitive control functioning remained stable or indicated positive change during the Active Phase, Field Articulation demonstrated negative change. That is, Charles became less and less capable of handling both geographical and contextual distractions.

The test results continue to indicate variability in the use of syntactical structures during the Active Phase of training but the general trend is of a positive nature. That is, the variability is consistently within that expected for Charles' age, whereas previously the variability was below expectancy. In the early part of this Active Phase Charles maintained his ability to express his ideas (WPU) but his performance became more variable as training progressed. Maze Behavior, which had shown

positive change during the Passive Phase and the Performing subphase of the Active Phase, began to deteriorate toward the end of the training.

Charles' story content became more organized and realistic early in the Active Phase of training with the dynamic aspect taking longer but building up in a positive manner. However in the last four months of the APP program Charles' stories became very unrealistic and absurd. While Social Interactional aspects of his stories maintained the high level achieved during the Passive Phase of training, the structural aspects showed a gradual positive change throughout the Active Phase. Voice Quality changes occurred at the close of the Active Phase of training and all three were of a positive nature.

In general, levels of cognitive control functioning, the ability to communicate ideas and social awareness in the testing situation, all indicated a positive change during the Passive Phase of remedial training. There were, on the other hand, both positive and negative changes during the Active Phase of training. While organizational ability and use of syntactical structures improved, such aspects as distractibility (assessed by the cognitive control test of Fruit Distraction) and story content began to deteriorate.

Subject 4 - Darryl

Cognitive Controls

Table 11 contrasts the numerical scores obtained by Darryl on the cognitive control tests to those achieved by the typical grade four student. The fourth grade norms were used in this study because to date there are no norms available at the third grade level. Considering the superior intellectual potential of the two older boys the grade four

Table 11
Results of Tests used to Assess Cognitive Control Functioning - Darryl

Test	Date of Assessment - Darryl							Typical Grade 4	
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77	SD
Scattered Scanning Test:									
Number Correct	18	28	32	35	51	43	41	43	27.9 1.28
Total Distance	107.5	129.2	154.0	186.0	301.5	221.0	210.4	224.7	177.9 7.36
Fruit Distraction Test:									
Time on Card II	44	39	36	42	38	39	40	32	43.1 2.08
Card III - II	3	5	24	.12	5	-1	3	-2	3.7 1.48
Card IV - II	46	16	7	11	3	12	2	13	24.8 2.05
Leveling-Sharpening House Test:									
1st Stop Score	10	10	8	10	7	7	7	7	11.7 1.52
Correct Changes	13	15	16	17	17	18	17	18	12.9 .42
L-S Ratio	12.5	7.3	5.1	4.6	4.2	3.3	3.7	4.4	13.1 .81
Object Sort Test:									
Typical Groups	9	13	9	9	11	6	5	7	10.0 .66
Mean Concept Score	5.6	5.4	6.0	5.5	5.3	5.4	5.4	5.4	5.0 .31

norms should not be difficult for them to achieve. These results are depicted graphically in Figures 43, 44, 45 and 46, located on pages 225 to 228.

Scattered Scanning Test. Figure 43 indicates that there are small variabilities in the baseline measures of the SST results. Darryl shows evidence of being able to function at a level typical of fourth graders on the measure used to assess activity of scanning (Number Correct), but is below expectancy on that used to assess breadth of scanning (Total Distance). The patterns of both curves are similar. By the fourth testing session the boy functions better than the typical grade four student in both activity and breadth of scanning. There are marked and dramatic spurts of positive change on activity and breadth respectively. Darryl continues to function above the grade four level throughout the balance of the training phase. Follow-up measures remain stable.

Fruit Distraction Test. Figure 44 suggests that on the base card (II) Darryl's performance is stable during baseline and throughout the training phase of the research project. It is also consistently better than the typical grade four performance. There is a small positive change during the follow-up phase. The subtest dealing with the boy's ability to handle geographical distractions (III-II) indicates that Darryl's performance was stable during baseline. There was a marked negative change after two months in the training program. This was followed by a gradual dramatic positive change over the duration of the training phase. During the second half of training Darryl's scores were as good as the typical grade four student. Follow-up scores remained stable.

In his handling of contextual distractions (IV-11) Darryl showed dramatic variability in his baseline measures. The better of the two suggests that he could cope with such distractions at a level better than the typical grade four child. Performance remained excellent throughout the training and follow-up phases.

Leveling-Sharpening House Test. Figure 45 shows that while the baseline remains stable in the first subtest it is markedly unstable in the other two. However all scores indicate that Darryl functions at a level above that expected of the typical grade four student. All three graphs indicate small positive changes in the early part of the training phase followed by stable performance. Follow-up measures are likewise stable.

Object Sort Test. Figure 46 suggests that Darryl's performance on the subtest "Number of Typical Groups", although variable during the early part of the training phase, indicated that he divided the test materials into groupings considered typical of a grade four child. Toward the end of the remedial training phase he formulated fewer groups. There was a small positive change during the follow-up. Darryl's Concept Score, for the level of abstraction used in labeling his groups, showed the boy to be achieving beyond the typical grade four student. His performance here was stable during the training and follow-up phases of this research project.

Summary of Cognitive Control Results. During the baseline phase Darryl was functioning below expectancy on the first to develop of the cognitive controls, that is Focal Attention, as assessed by the SST. After four months of training he was functioning as well as the typical grade four student on all Cognitive Control measures with the exception

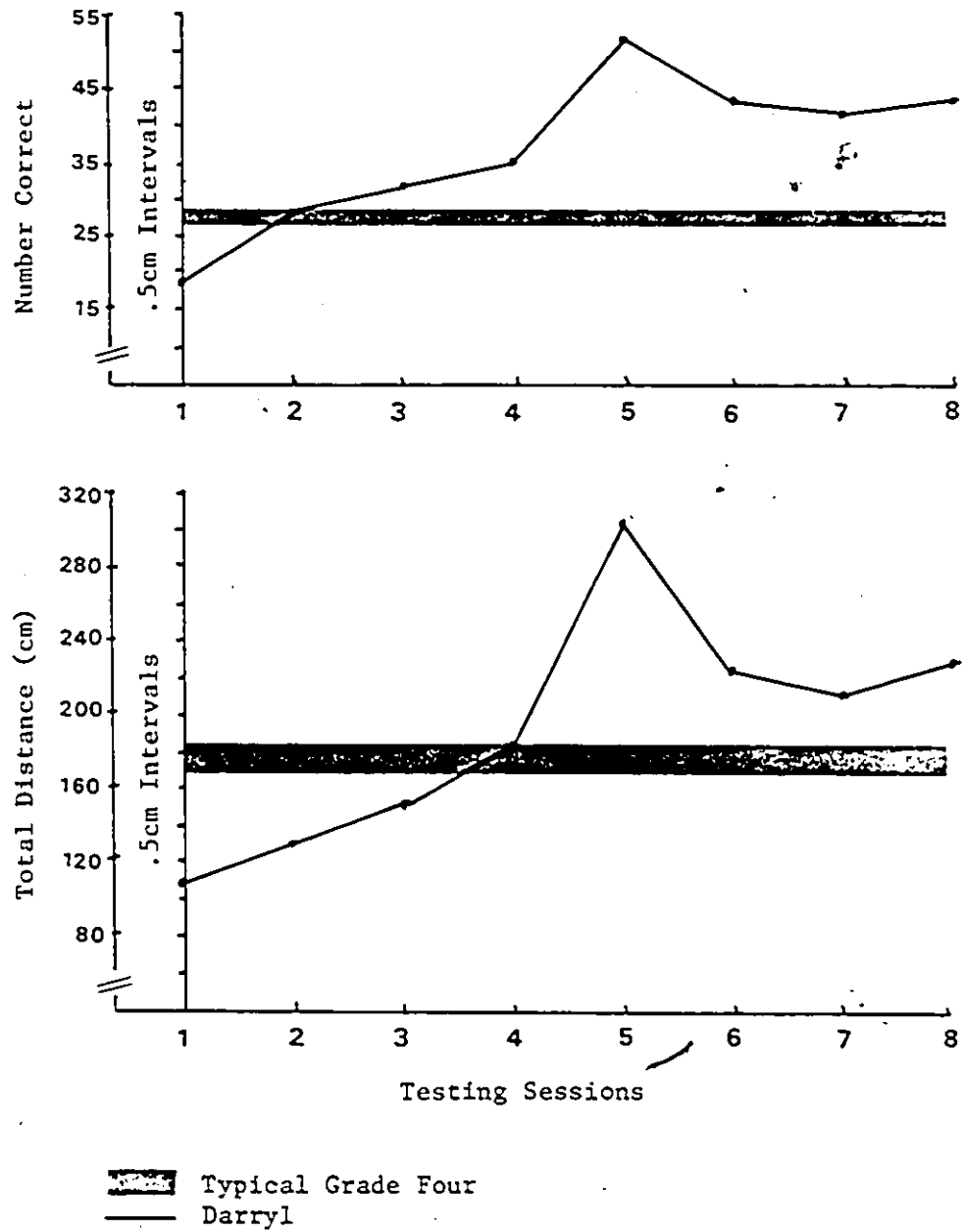


Figure 43. Scattered Scanning Test - Darryl

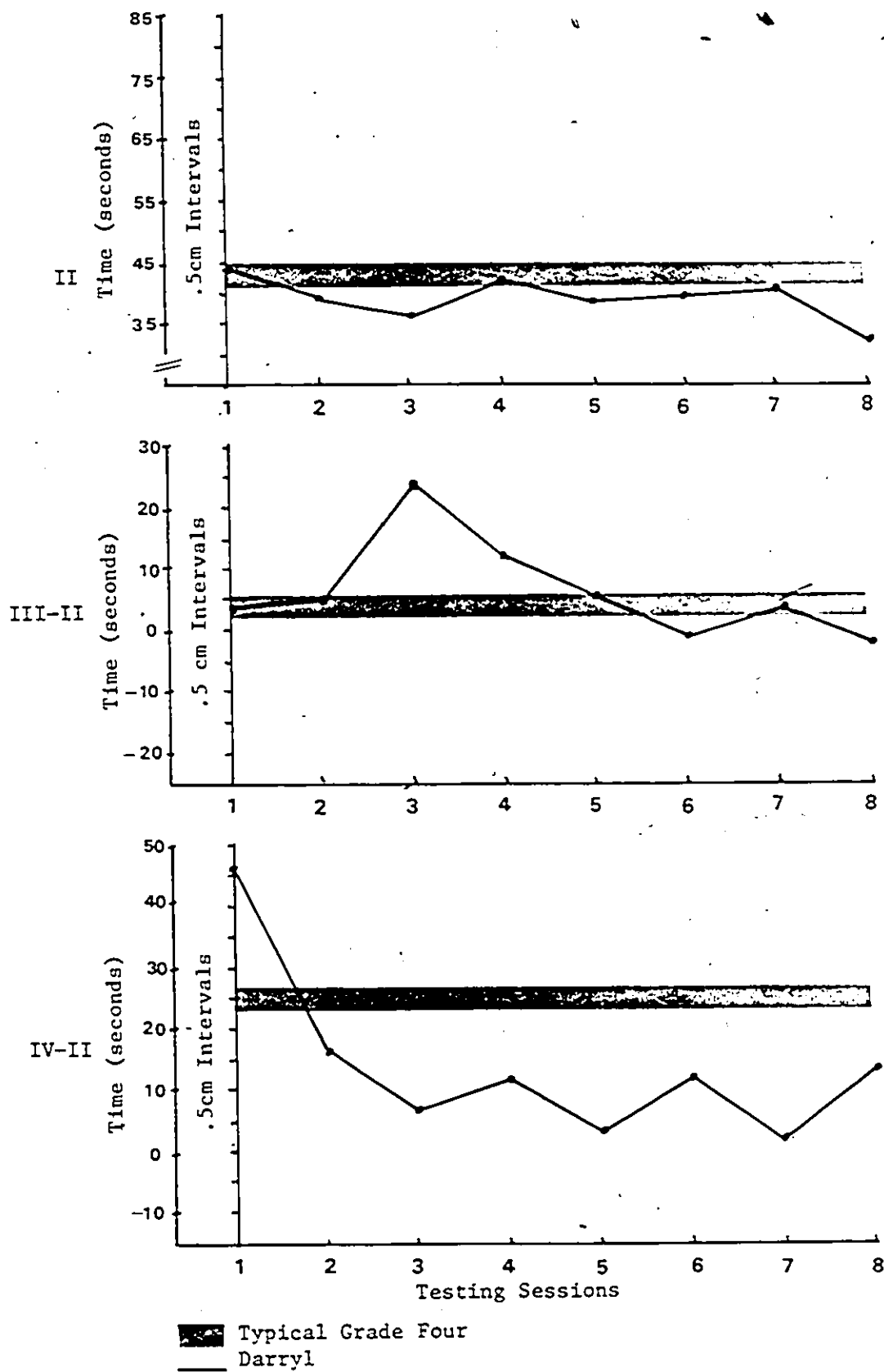


Figure 44. Fruit Distraction Test - Darryl

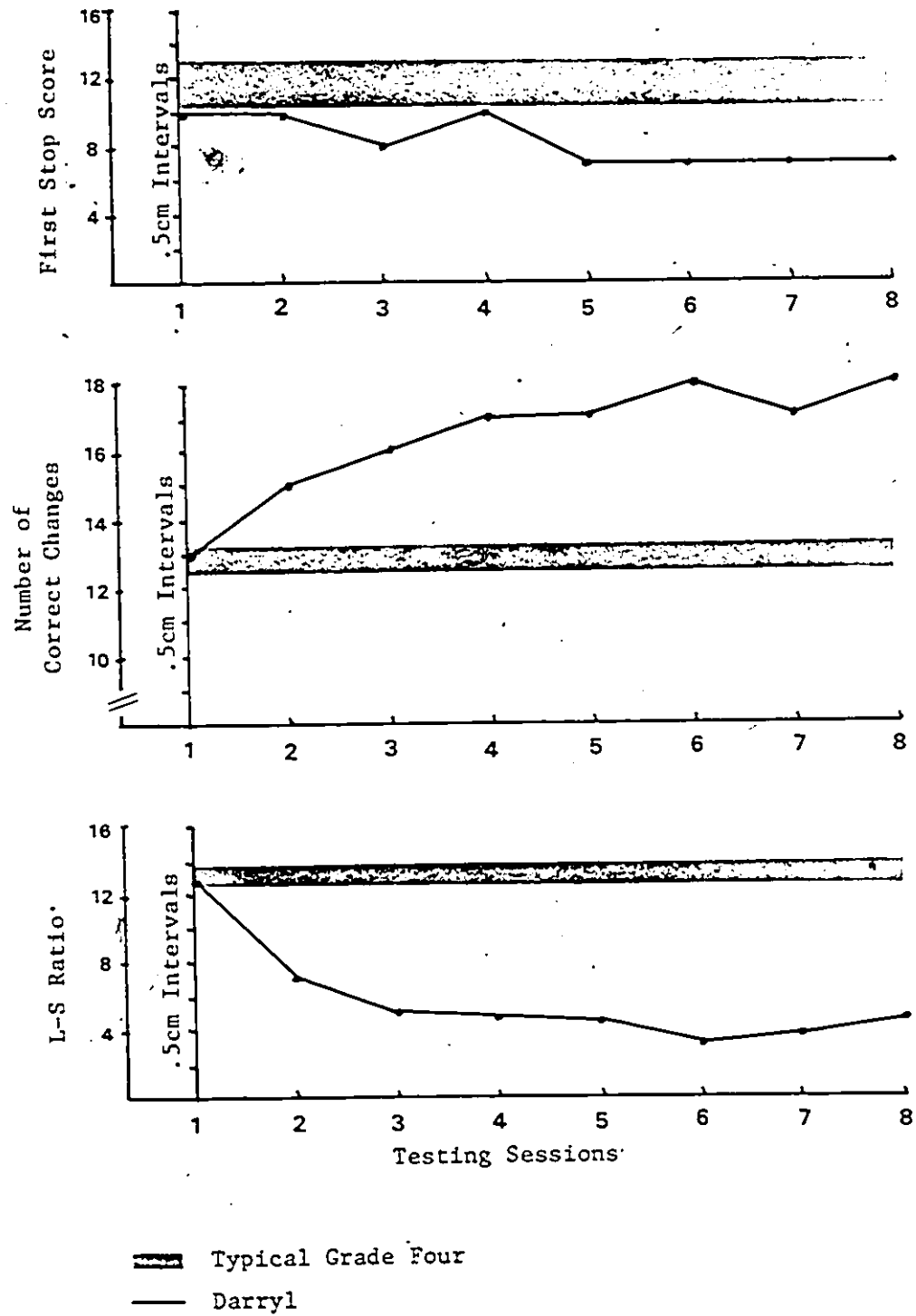


Figure 45. Leveling-Sharpening House Test - Darryl

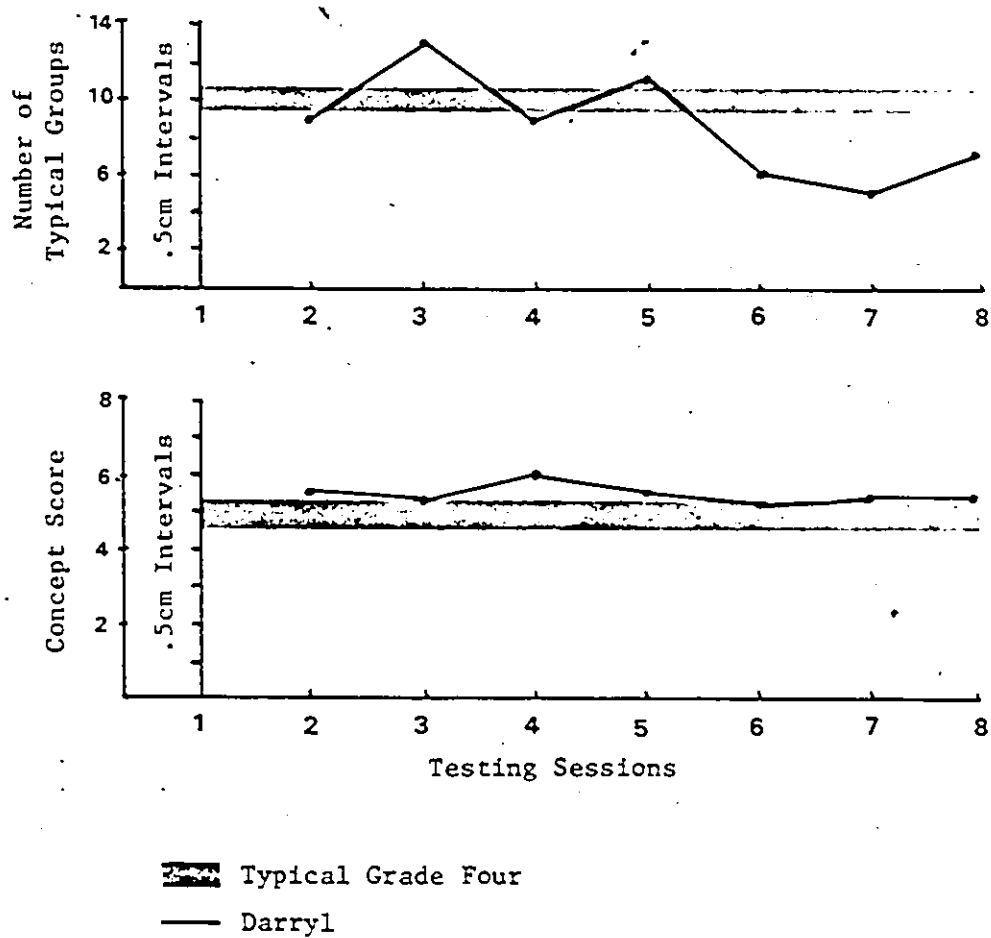


Figure 46. Object Sort Test - Darryl

of FDT (III-II), a measure of geographical distractibility, which reached this same high level two months later. These high levels of cognitive control functioning were maintained throughout the second half of the remedial training program and during the follow-up phase.

Spontaneous Speech

Darryl's results on the DSS over the eight testing sessions were as follows:

December 1975	11.62
February 1976	12.26
April 1976	12.00
June 1976	14.70
August 1976	14.76
October 1976	15.72
December 1976	15.60
February 1977	14.38

These are depicted graphically in Figure 47 where they are contrasted to the Mean score, plus and minus one standard deviation, of the Normal and Dyslexic groups in Vogel's 1975 study. As these final two children of the study are older than the children used by Vogel, we would expect them to achieve somewhat better than the groups used by Vogel. Baseline phase shows a small variability in DSS performance. However at this point Darryl was using syntactical structures at a developmental level in line with the Normal Group of Vogel's study. There is a dramatic positive change early in the training phase followed by more gradual positive changes. There was a marked negative change during the follow-up phase.

Words per Communication Unit. Table 12 lists the numerical results depicted in Figures 48 and 49. The graph in Figure 48 shows a small variability in baseline measures. Darryl appears to use fewer words in his communication units than did the Low group of Loban's normative study.

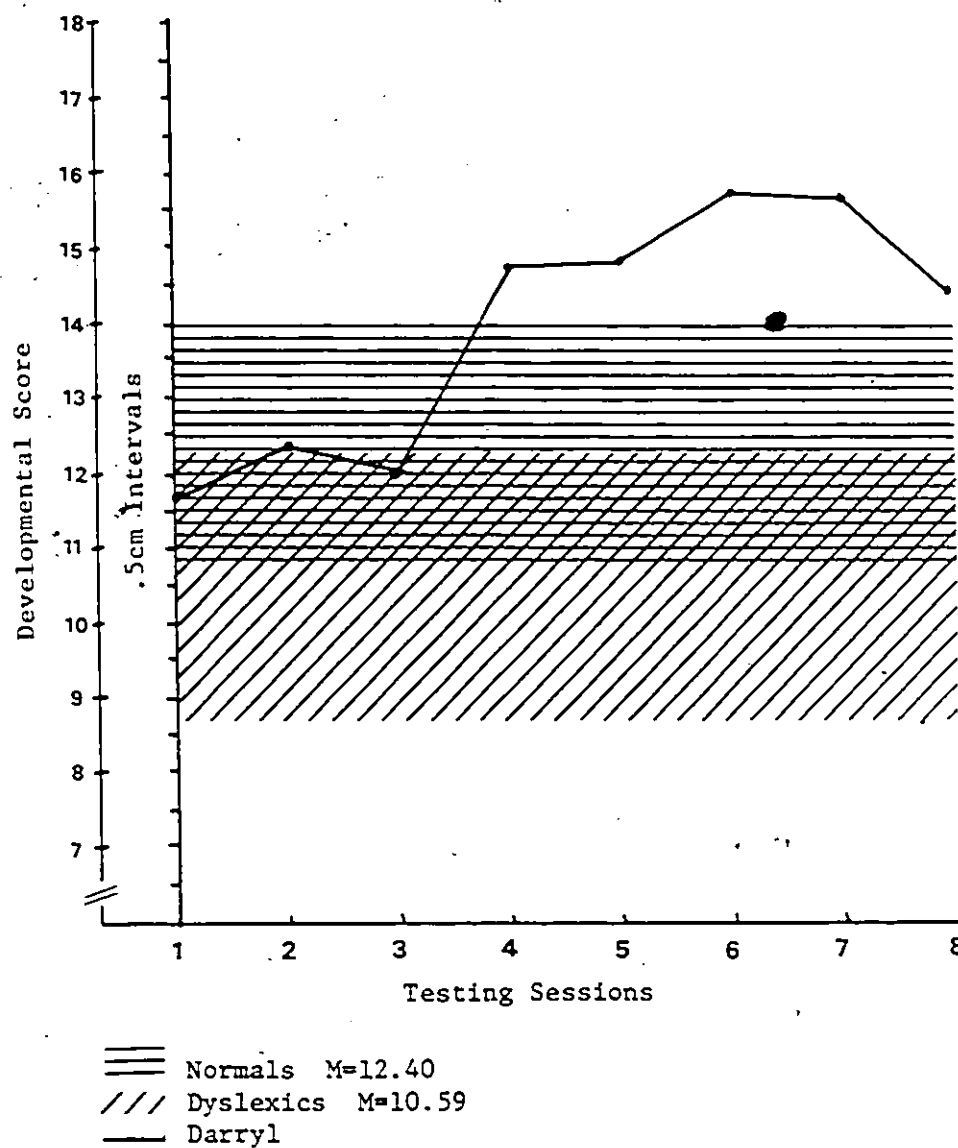


Figure 47. Developmental Sentence Scoring - Darryl

Table 12

Analysis of Communication and Maze Units in Spontaneous Story Telling - Darryl

Test	Date of Assessment - Darryl								Loban's ^a Groups	
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77	Low	High
W P U ^b	7.1	6.4	7.8	7.4	7.6	7.4	8.2	8.1	7.1	8.4
Total Words ^c	271	300	442	346	460	554	483	404		
Percentage of Maze Words ^d	7.7	6.3	4.3	3.8	15.7	8.5	7.0	6.2	8.0	4.7

^a Groups at Grade 3 level.^b Average number of words per Communication Unit.^c Communication words plus Maze words.^d Percentage of Maze words to total words.

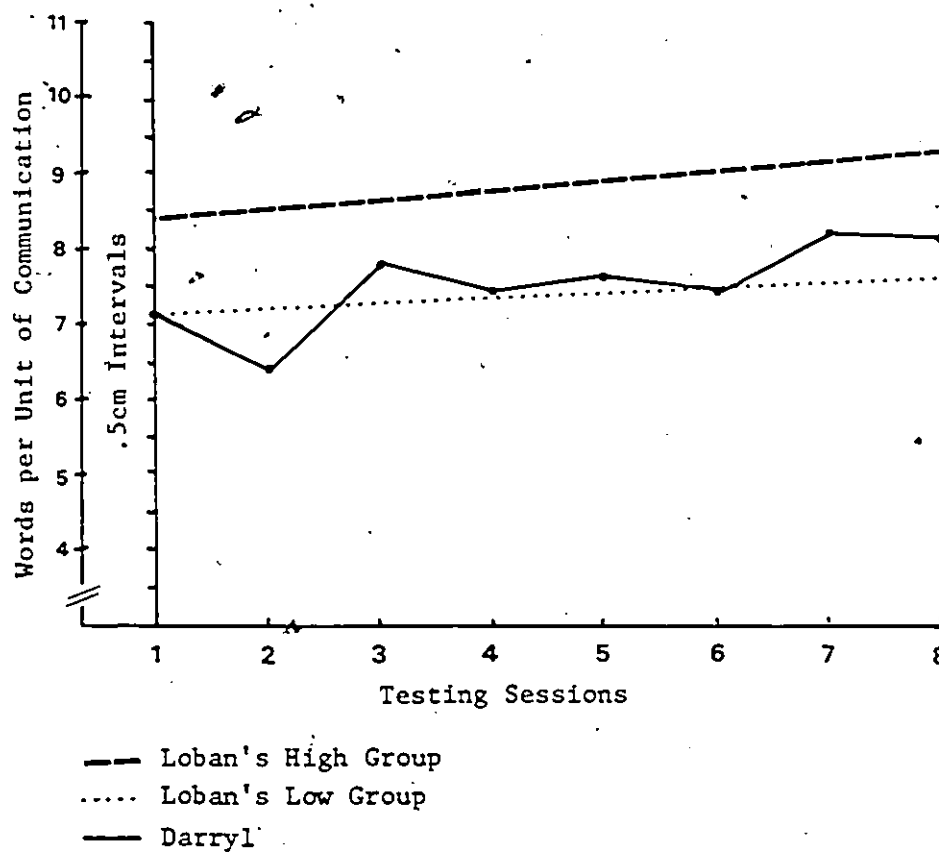


Figure 48. Number of Words per Communication Unit - Darryl

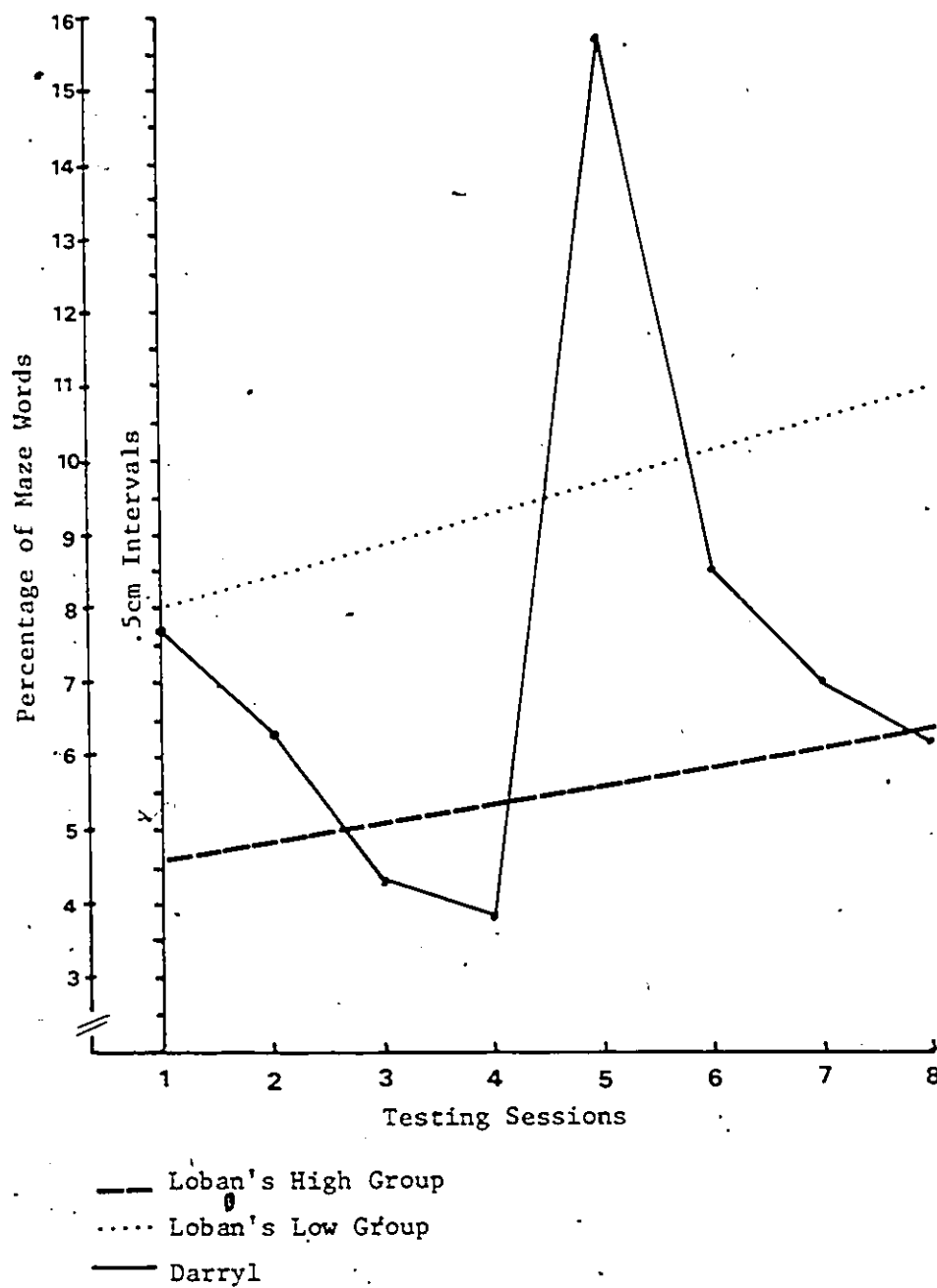


Figure 49. Percentage of Maze Words to Total Words - Darryl

There is an initial marked positive change early in the remedial training phase; followed by a fairly stable performance, and, a small positive change at the end when Darryl used a greater average number of words in his communication units than did the Low group of Loban's studies.

Percentage of Maze Words. There is marked variability in the baseline measures as indicated in Figure 49. During the early part of the training phase Darryl used a markedly smaller percentage of maze words in his spontaneous speech samples. At this point his speech was less encumbered than the High group of Loban's study, for the same age and grade. There is a dramatic negative spurt about the middle of the training phase followed by a further marked improvement. The graph indicates a small positive change during follow-up.

Language Style. Table 13 lists the scores, on a five point scale, for Language Style measures depicted graphically in Figures 50, 51, and 52 found on pages 237 to 239. Two of the three baseline measures in Figure 50 show variability of performance. Two months after the introduction of the training program Darryl's stories were more dynamic, better organized and slightly more realistic than they had been in the baseline measures. Further slight positive changes later in the training phase showed Darryl to be functioning, on these three measures, at a level considered excellent for his age and grade placement. This positive performance was retained during follow-up although there was a small negative change in the boy's ability to relate a dynamic story.

Figure 51 indicates stability during baseline. Early small positive changes in the training phase show that Darryl is social in his relationship with the examiner during the story telling task. This level of

Table 13
Measures of Language Style on a Five Point Rating Scale - Darryl

Trait	Date of Assessment							
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77
Story Content:								
Descriptive - Dynamic	1.3	3.0	4.0	2.3	2.3	3.0	4.3	3.0
Disorganized - Organized	3.0	3.0	3.7	3.0	2.3	3.3	3.7	4.0
Unrealistic - Realistic	4.7	3.7	4.3	4.7	4.0	5.0	4.7	4.3
Interpersonal Aspects:								
Ego-Centric - Social	3.3	2.7	3.0	4.0	4.0	4.0	4.0	4.0
Other Directed - Self Directed	1.3	1.7	2.3	2.7	3.0	3.0	3.7	3.3
Voice Qualities:								
Halting - Fluent	3.0	3.3	2.3	4.0	3.0	3.7	4.0	3.7
Monotone - Expressive	1.7	2.3	3.7	2.0	2.0	2.7	2.3	2.7
Mumbled - Distinct	2.0	2.3	3.3	2.3	1.3	2.0	3.3	2.3

functioning remains stable during the balance of the training phase and throughout the follow-up phase. The second graph, on this figure, indicates that Darryl originally required much structuring in order to complete the story telling task. A series of slight positive changes throughout the training phase brought him to the point of supplying most of his own structuring by the end of this phase. Follow-up measures can be considered stable.

Voice quality evaluations depicted in Figure 52 show stability over the baseline phase. At this point Darryl tended to speak in a halting monotonous mumbled fashion. The top graph on Figure 52 indicates a small variability during the training phase but with a general trend toward positive change so that by the close of this phase Darryl's speech pattern is definitely more fluent and considered good in relation to his chronological age. This level is maintained during follow-up. On the second graph there is a small positive spurt two months after the introduction of the training phase but the graph indicates a more stable use of a monotonous voice. This is maintained in the follow-up phase. The final graph in this figure, indicates a similar positive spurt two months after the introduction of the remedial training program. Although there is a second small positive spurt at the end of the training phase, the general characteristic of this graph indicates that Darryl tended to mumble in his speech. There was a small negative change during follow-up.

Summary of Spontaneous Speech Analyses. Darryl showed a dramatic positive change in a more mature use of syntactical structures as measured by the DSS, four months after the introduction of the training phase while a more mature use of communication units (WPU) was not obvious until the

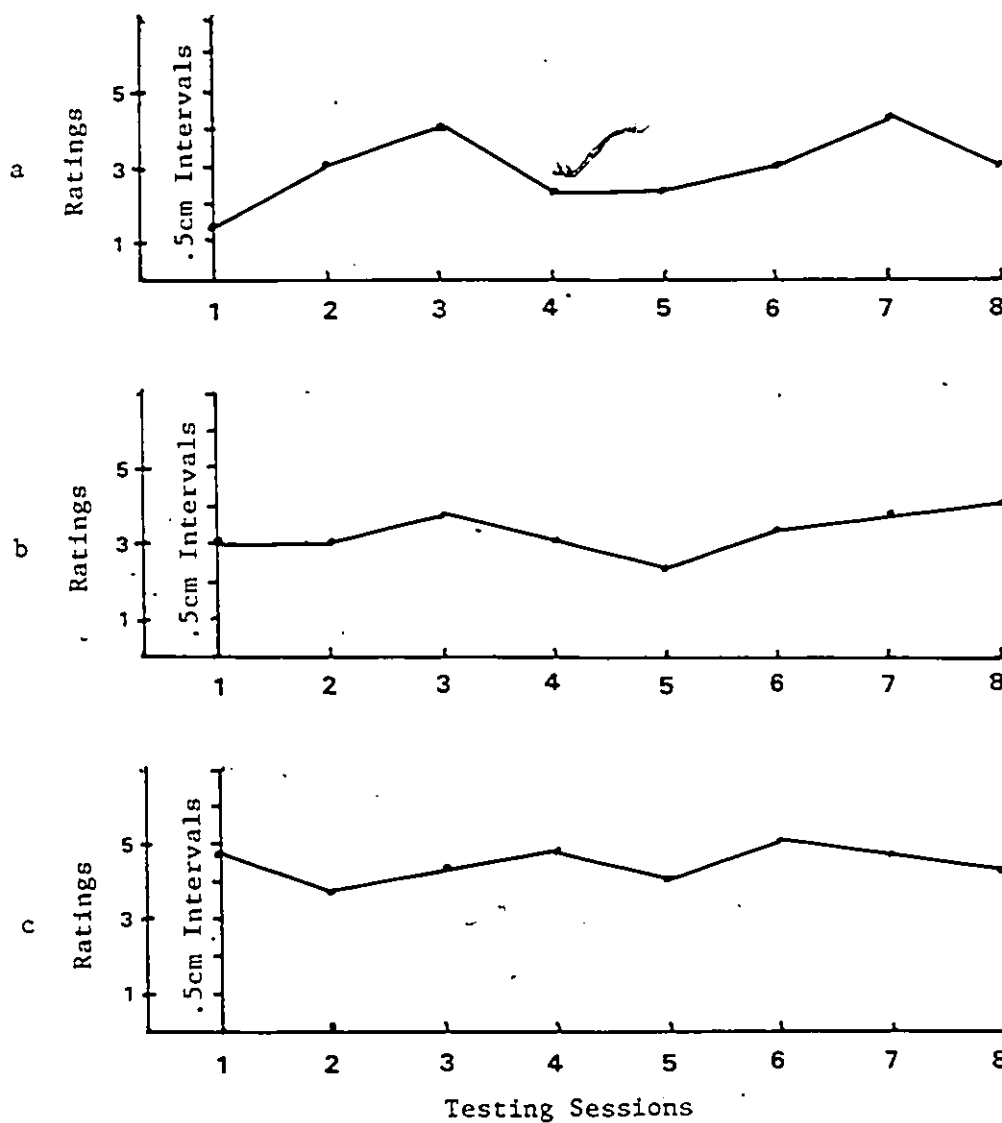


Figure 50. Analysis of Story Content - 'Darryl

- a) Descriptive to Dynamic
- b) Disorganized to Organized
- c) Unrealistic to Realistic

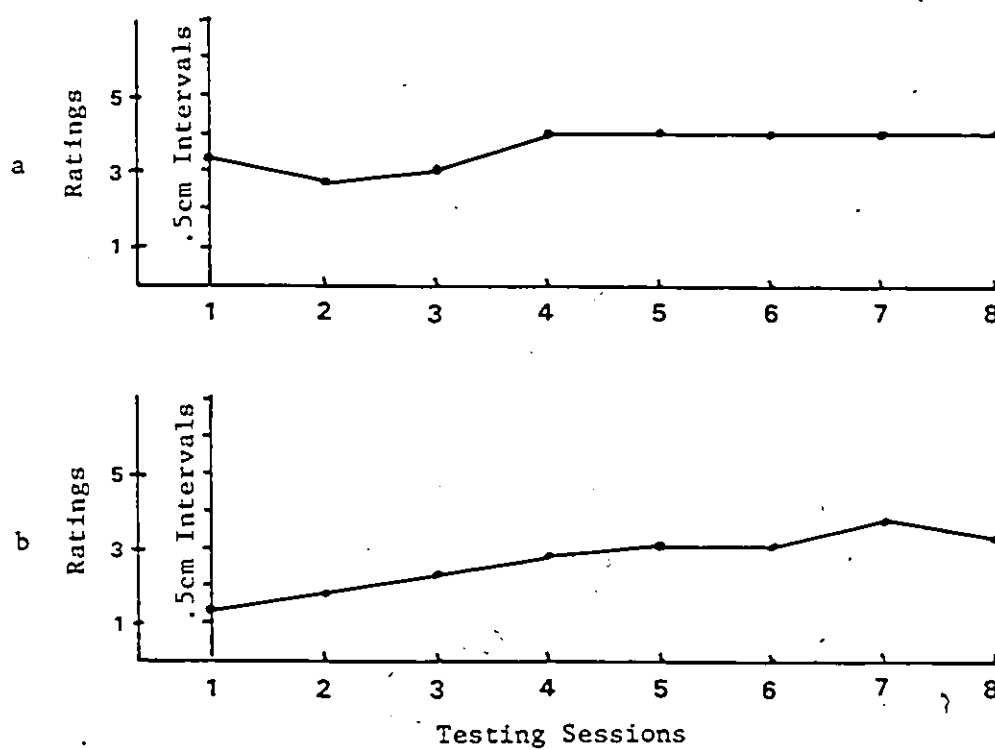


Figure 51. Analysis of Interpersonal Aspects - Darryl
a) Ego Centric to Social
b) Other Directed to Self Directed

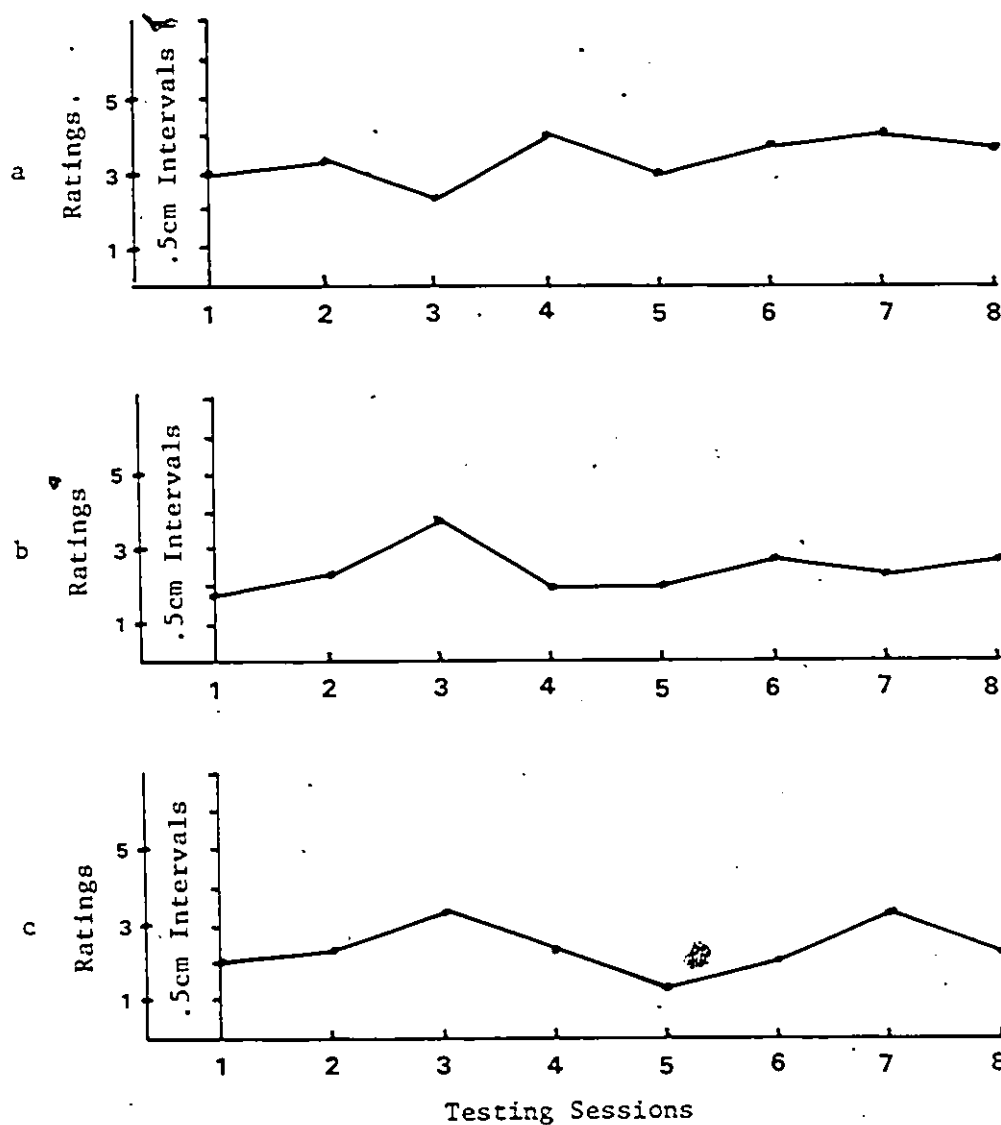


Figure 52. Analysis of Voice Qualities - Darryl

- a) Halting to Fluent
- b) Monotone to Expressive
- c) Mumbled to Distinct

very end of this phase. The graph indicating the percentage of language tangles used in spontaneous speech (Maze Behavior) shows considerable positive change early in the training phase. The second half of the training program was characterized by a dramatic negative increase in the percentage of Maze Behavior. The analyses of the language style measures suggest that Darryl made positive changes early and late in the training phase on his ability to organize and relate the story content; positive consistent growth in the interpersonal aspects of the story telling task and, slight positive over all gains in voice quality.

Test Results compared to Individualized APP Program

The Passive Phase of Darryl's remedial training program lasted a total of five and one half months. This phase therefore includes the results from TS 2, 3, 4, and possibly 5. During this time period the first level, Focal Attention, of the cognitive control principles showed the most positive change. Here Darryl changed from performing below expectancy to a level above expectancy. Level III, Leveling-Sharpening, also indicated positive change during this phase while Level IV, Equivalence Range, remained fairly stable. However a negative change is noted in Darryl's ability to handle geographical distractions (Figure 44, III-II) with the introduction of this first phase of remedial training.

During the Passive Phase of training the spontaneous speech measure for syntactical development (DSS) showed a marked improvement toward the end of the phase while the measure for expression of ideas (WPU) remained fairly consistent.

Maze Behavior improved positively during this Passive Phase of training. While there were early positive changes on all three measures of

story content these were not maintained throughout this phase. The positive changes noted in Darryl's ability to be social in his story telling (Figure 51) were made during the Passive Phase of training. At the same time there were some positive changes in the lad's ability to structure his own three fold story telling response. Darryl's voice immediately became more expressive and distinct but more halting. However, at the close of the Passive Phase his voice was fluent but less expressive and less distinct.

With the introduction of the Active Phase of remedial training, Cognitive Control measures took on levels considered excellent for Darryl's age and grade expectancy and remained fairly stable throughout the rest of the remedial training program. At the same time Darryl showed a positive increase in the developmental level of the syntactical structures used in his spontaneous speech. However the boy's ability to express his ideas succinctly, as assessed by the number of words in a unit of communication, only began to show improvement at the end of the training program.

There was a dramatic increase in the percentage of Maze Behavior, i.e. tangled speech, with the opening of selectivity. However during the subsequent Active Phase the percentage of Maze Behavior occurring in Darryl's spontaneous speech became smaller and smaller.

All three measures of Story Content (Figure 50) showed positive change during the Active Phase of training as did the lad's ability to structure the story telling task by himself. The gains made on the Ego-Centric-Social dimension during the Passive Phase were maintained throughout the Active Phase. Darryl's voice became more fluent but only moderately distinctive and expressive.

In general then, cognitive control measures made their most significant gains during the Passive Phase of training while the measures for spontaneous speech showed their most positive and stable changes late in the Passive or in the Active Phase.

Subject 5 - Ernest

Cognitive Controls

Table 14 lists the Cognitive Control test results obtained by Ernest over the eight testing sessions and compares them to the Mean Score and the standard deviation obtained by the "typical" grade four students reported in Santostefano's research. These results are presented graphically in Figures 53, 54, 55 and 56, found on pages 245-248.

Scattered Scanning Test. Figure 53 indicates instability in this boy's baseline measures and that he was functioning considerably below expectancy on these tasks. Two months after the introduction of the remedial training phase there is a marked positive change in performance on both subtests indicating that Ernest can now function at a level consistent with the typical grade four student. With the exception of small and marked negative spurts, for the two subtests respectively, the results remain stable and slightly above grade expectancy. Both graphs show a small positive change during the follow-up phase.

Fruit Distraction Test. The first two graphs of Figure 54 indicate stability in baseline measures and show that Ernest could not complete the base card (II) in accordance with expectancy but was able to adequately handle geographical distractions (III-II). There is a small variability in the baseline measures of the subtest used to assess the effect on performance, of contextual distractions (IV-II). On this particular task

Table 14

Results of Tests used to Assess Cognitive Control Functioning - Ernest

Test	Date of Assessment - Ernest							Typical Grade 4	
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77	Mean SD
Scattered Scanning Test:									
Number Correct	18	14	28	27	35	30	34	42	27.9 1.28
Total Distance	118.9	62.8	169.0	166.0	192.5	138.0	194.0	235.3	177.9 7.36
Fruit Distraction Test:									
Time on Card II	56	52	46	39	34	40	40	41	43.1 2.08
Card III - Card II	0	-1	12	9	1	3	1	3	3.7 1.48
Card IV - Card II	16	7	12	16	16	10	5	10	24.8 2.05
Leveling-Sharpening House Test:									
1st Stop Score	16	12	6	10	6	7	7	7	11.7 1.52
Number Correct Changes	13	16	15	14	16	16	16	16	12.9 .42
L-S Ratio	12.0	7.3	7.4	8.1	4.4	9.2	7.0	6.6	13.1 .81
Object Sort Test:									
Number of Typical Groups	8	10	7	7	8	8	6	7	10.0 .66
Mean Concept Score	5.8	5.4	5.7	5.7	5.6	5.5	5.7	5.6	5.0 .31

Ernest performs better than would be expected for his chronological age and grade placement. The first graph (11) shows a series of small positive changes throughout most of the remedial training phase. After two months in the training phase Ernest was functioning close to his expectancy level. The positive gains seen during the training phase were maintained during follow-up.

The second graph indicates a marked negative change with the introduction of the training phase at which time Ernest was less capable, than the typical grade four child, of handling geographical distractions. The balance of the curve is characterized by a gradual marked positive change and stable performance. This adequate level of functioning was maintained during follow-up.

All scores on the third subtest (IV-11) are consistently better than expected for age and grade.

Leveling-Sharpening House Test. All the baseline measures in Figure 55 indicate marked inconsistency of performance during the baseline phase. At the same time they indicate that this lad functioned above his expectancy level on the tests used to assess the Leveling-Sharpening level of Cognitive Control functioning. Although there are indications of fluctuation in behavior particularly during the first half of the remedial training phase, all results are consistently above expectancy. Follow-up measures remained positive and stable.

Object Sort Test. Generally Ernest formulated fewer groups (Figure 56 top) than would be expected for his age and grade placement. His performance was fairly stable on this task with a small negative change in the final testing session of the remedial training phase. This was

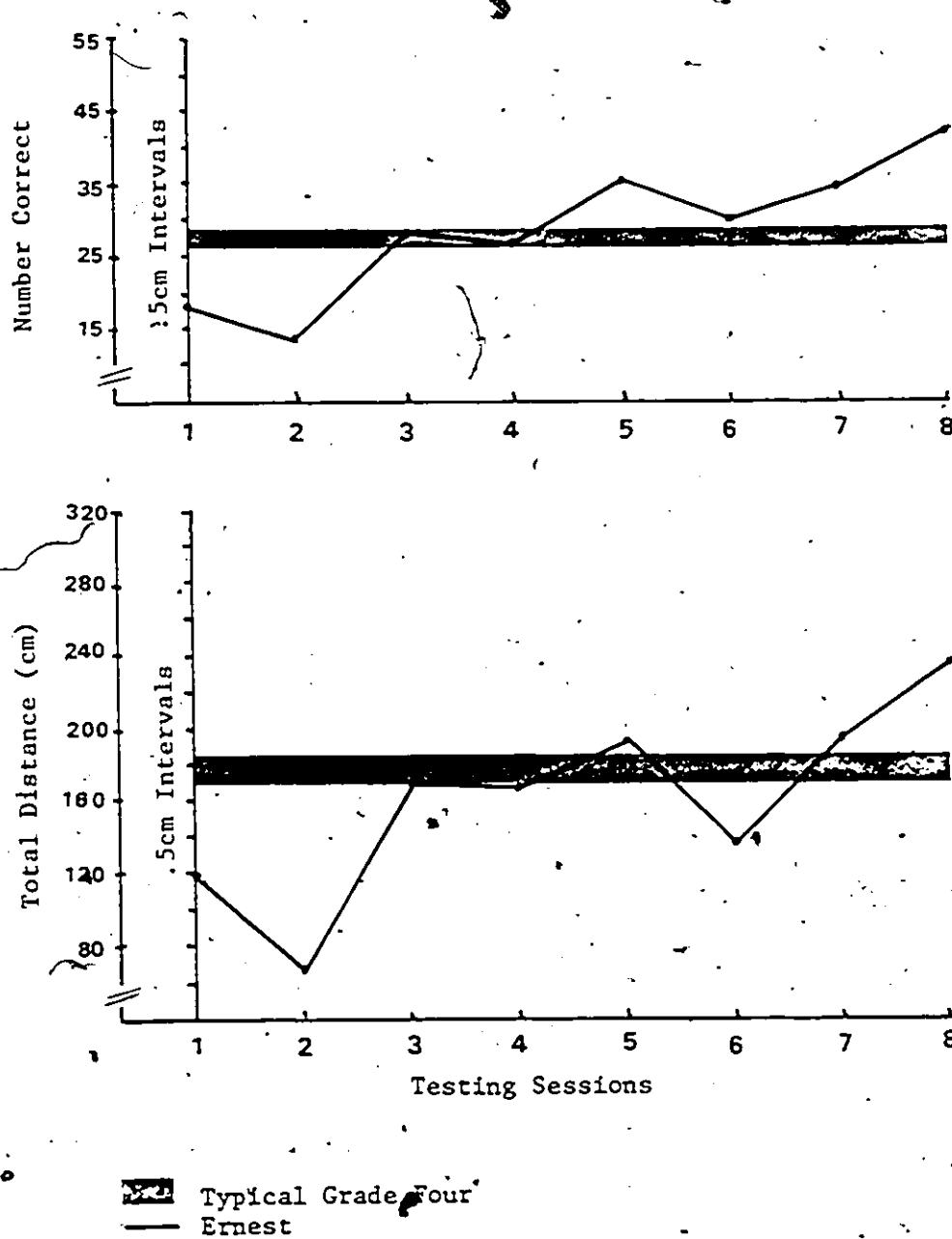


Figure 53. Scattered Scanning Test - Ernest.

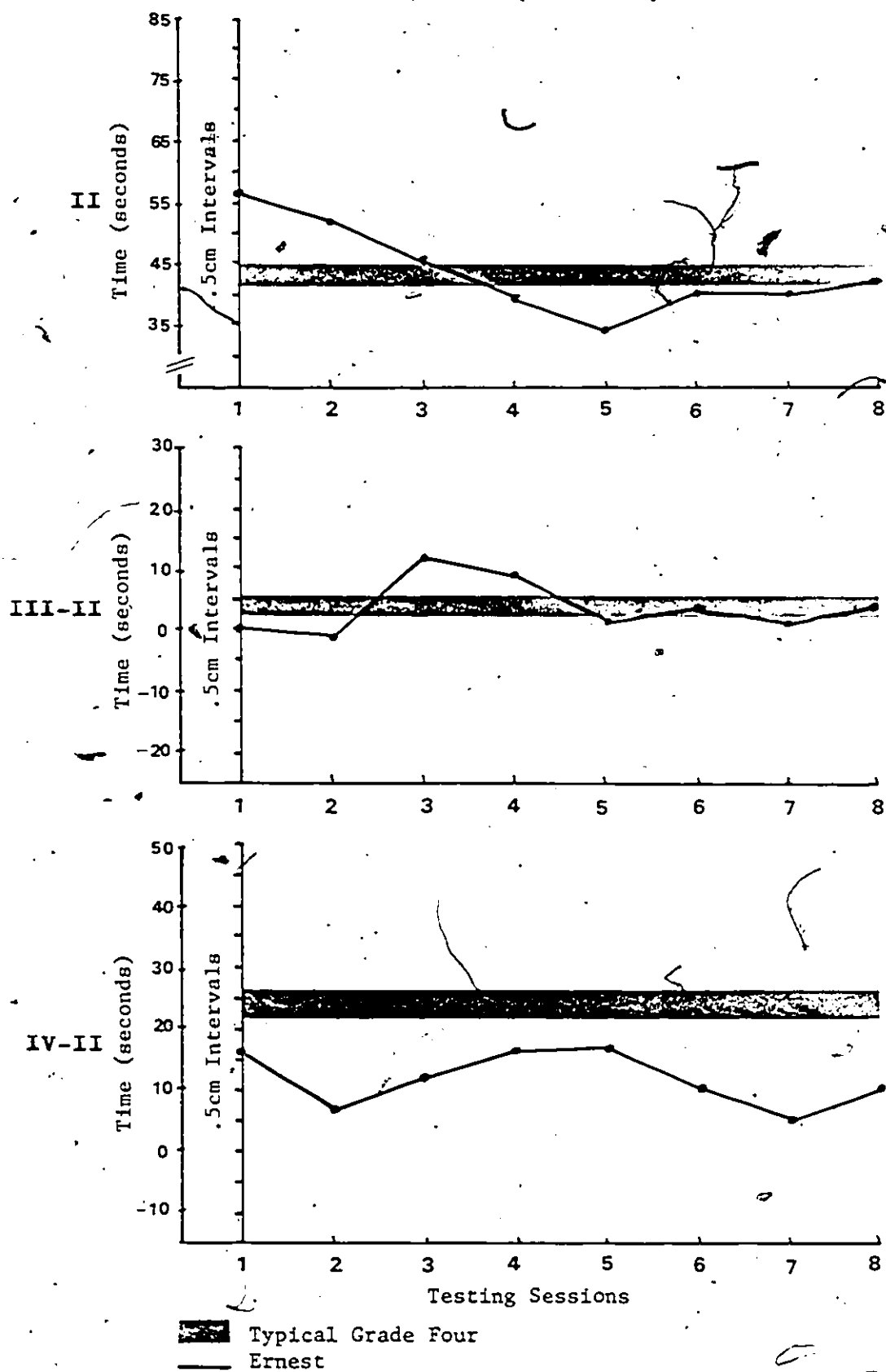


Figure 54. Fruit Distraction Test - Ernest

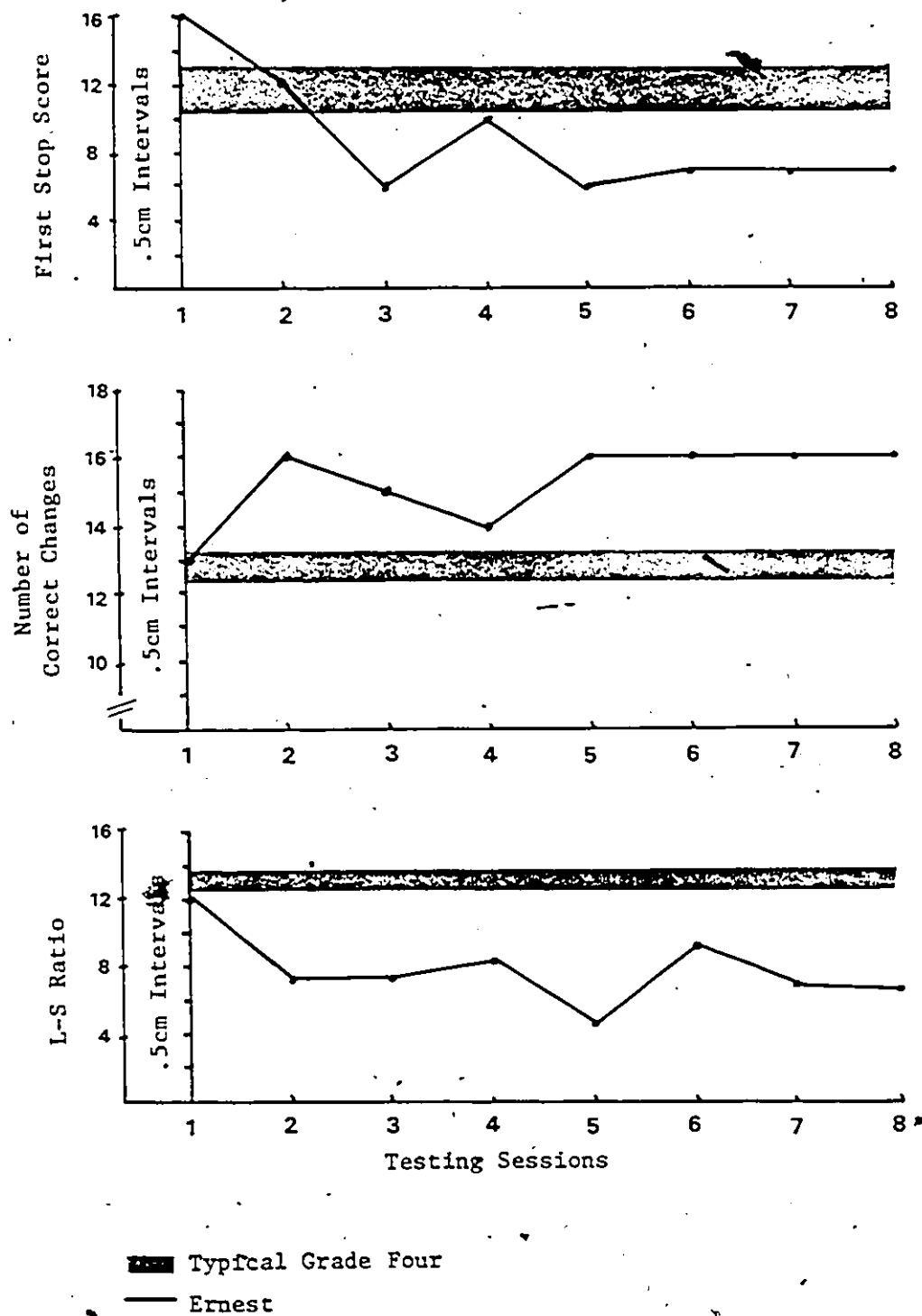


Figure 55. Leveling-Sharpening House Test - Ernest

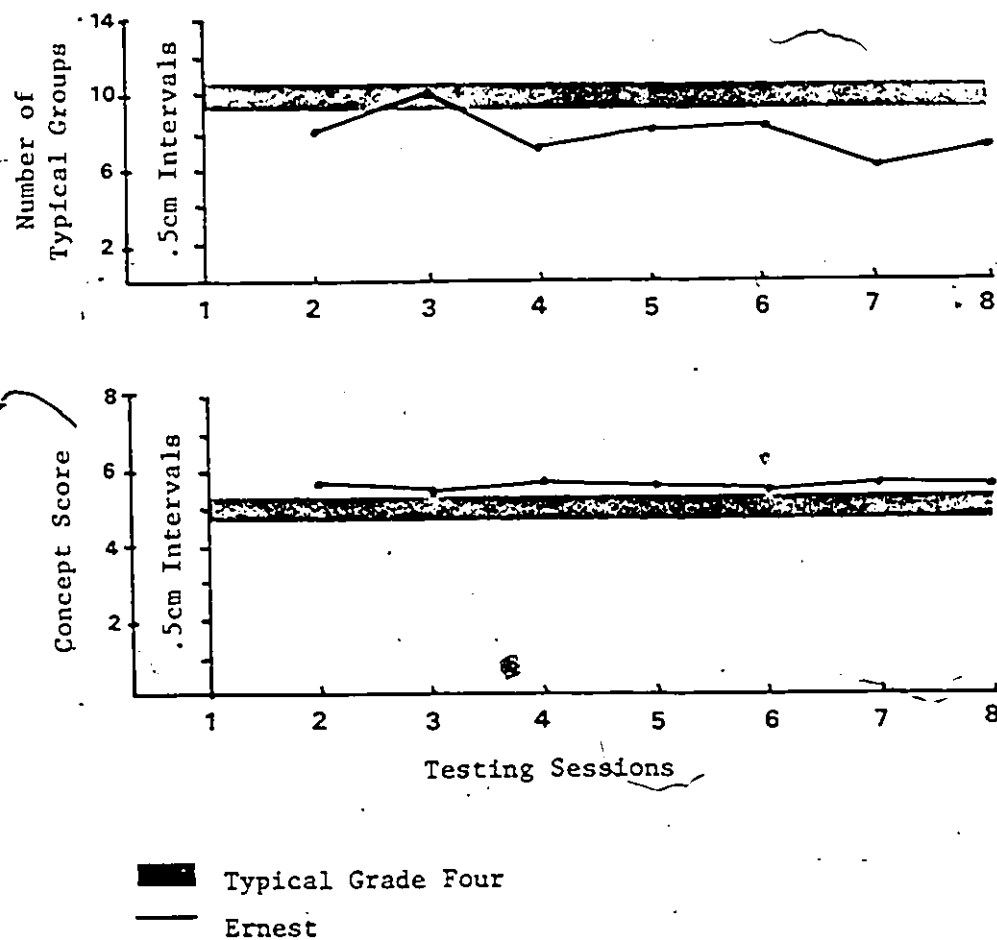


Figure 56. Object Sort Test - Ernest

slightly recuperated during follow-up. Ernest's Concept Score, indicating the level of abstraction used in labeling his groups, was consistently at the high end of expectancy.

Summary of Cognitive Control Test Results. Baseline measures were not stable. However taking into consideration the better of the two scores for each subtest, this lad showed marked immaturity in the results of the SST used to assess the earliest to develop of the cognitive controls, that is Focal Attention. On all other levels Ernest performed at a mature level for his age and grade placement. The biggest gains in the SST results occurred two months after the introduction of the remedial training phase at which time all levels of cognitive control functioning could be considered mature. Despite some variations these higher levels of functioning on all levels were maintained during the balance of the training phase and during the follow-up phase of this research project.

Spontaneous Speech

Developmental Sentence Scoring. Ernie obtained the following scores on the DSS analysis over the eight testing sessions:

December 1975	9.94
February 1976	9.16
April 1976	12.66
June 1976	12.08
August 1976	11.02
October 1976	12.46
December 1976	12.88
February 1977	13.86

These are depicted graphically in Figure 57 where they are contrasted to the Mean score, plus and minus one standard deviation, of the group of Normals and the group of Dyslexics used in Vogel's 1975 research. There is a small variability in the baseline measures. At this time Ernest

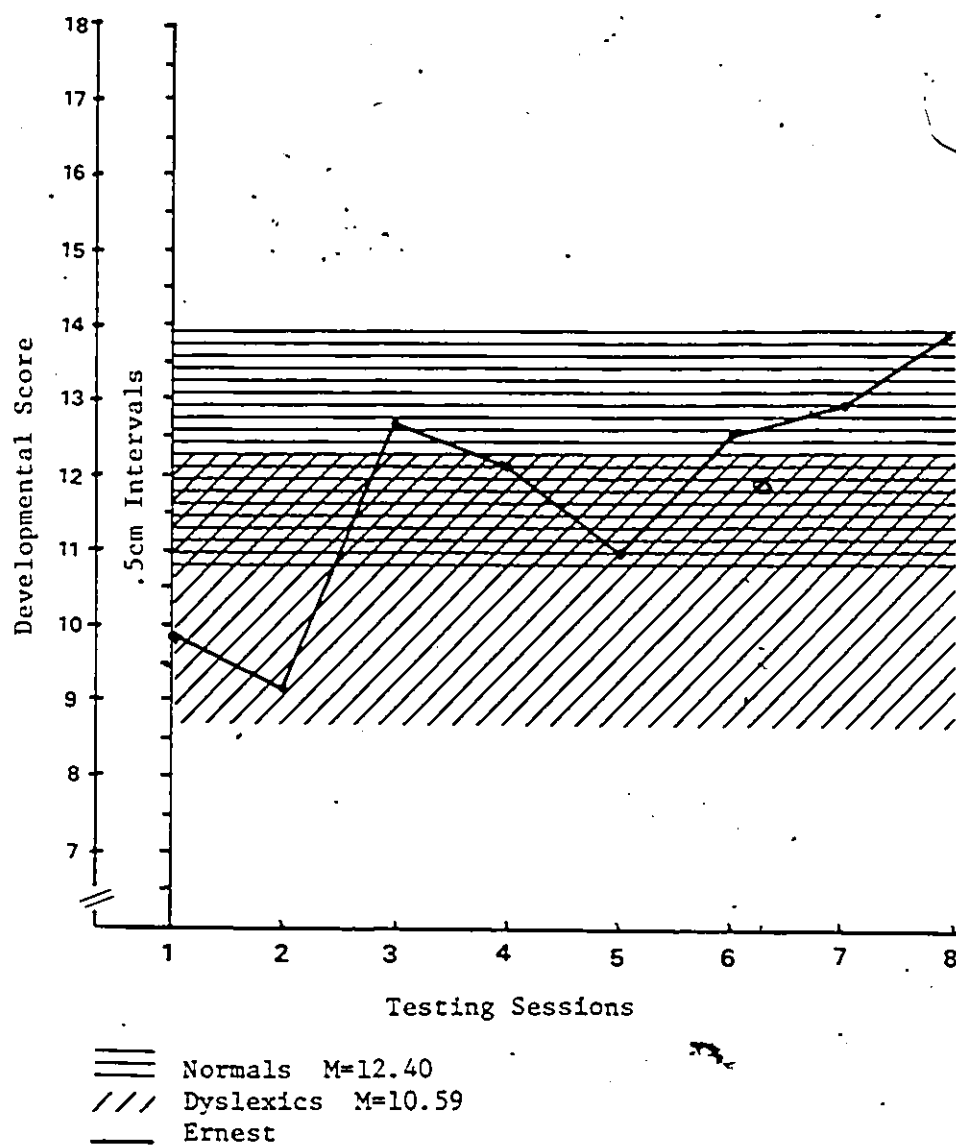


Figure 57. Developmental Sentence Scoring - Ernest

was functioning at a level well below what would be expected for his age. Two months after the introduction of the remedial training program the boy showed a dramatic positive change in the maturity of the syntactical structures used in his spontaneous speech samples. The next section of the profile is characterized by small and marked negative changes followed by a marked positive change. He received his most mature scores at the close of the training phase. There is a small positive change over the follow-up phase.

Table 15 numerically displays the results for the analysis of the Story Telling task. These include the average number of words in a Communication Unit and the percentage of Maze Words used in the same speech sample.

Words per Communication Unit. Figure 58 indicates that baseline measures are stable and during this phase Ernest uses a good average number of words in his units of communication. His score is close to that of the High group in Loban's study. The general trend of the profile is negative. That is, Ernest used less and less words in his units of communication until during the first part of the second half of the training phase the boy uses fewer words in his units of communication than did the Low group in Loban's studies. There is a marked positive change in the final testing session of the training phase, bringing the lad's performance up to a level closer to the High group of Loban's study. There is a small negative change during follow-up.

Percentage of Maze Words. There is a small variable performance indicated in the baseline measures depicted graphically in Figure 59. With the exception of a dramatic increase in such tangled speech at the fourth

Table 15

Analysis of Communication and Maze Units in Spontaneous Story Telling - Ernest

Test	Date of Assessment - Ernest								Loban's Groups ^a	
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77	Low	High
W P U ^b	8.0	8.0	7.5	7.9	6.9	7.0	8.4	8.1	7.1	8.4
Total Words ^c	349	324	297	377	267	320	393	771		
Percentage of Maze Words ^d	8.3	9.3	9.1	15.9	9.7	10.3	12.2	12.6	8.0	4.7

^aGroup at Grade 3 level.^bAverage number of words per Communication Unit.^cCommunication words plus Maze words.^dPercentage of Maze words to total words.

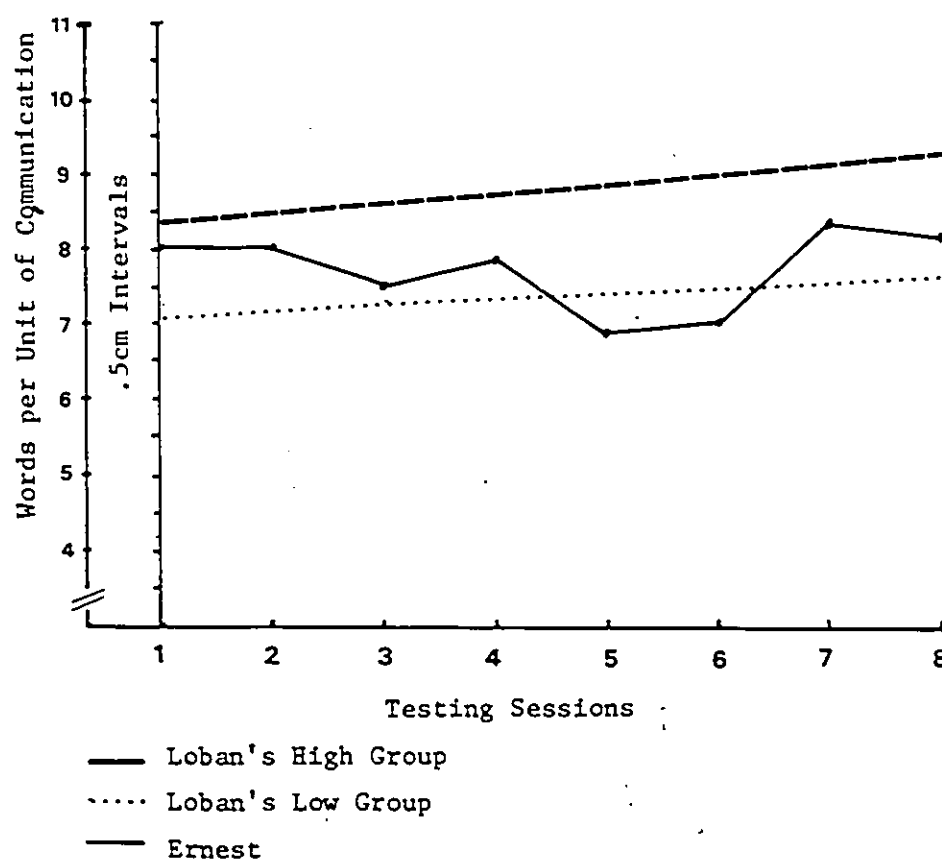


Figure 58. Number of Words per Communication Unit - Ernest

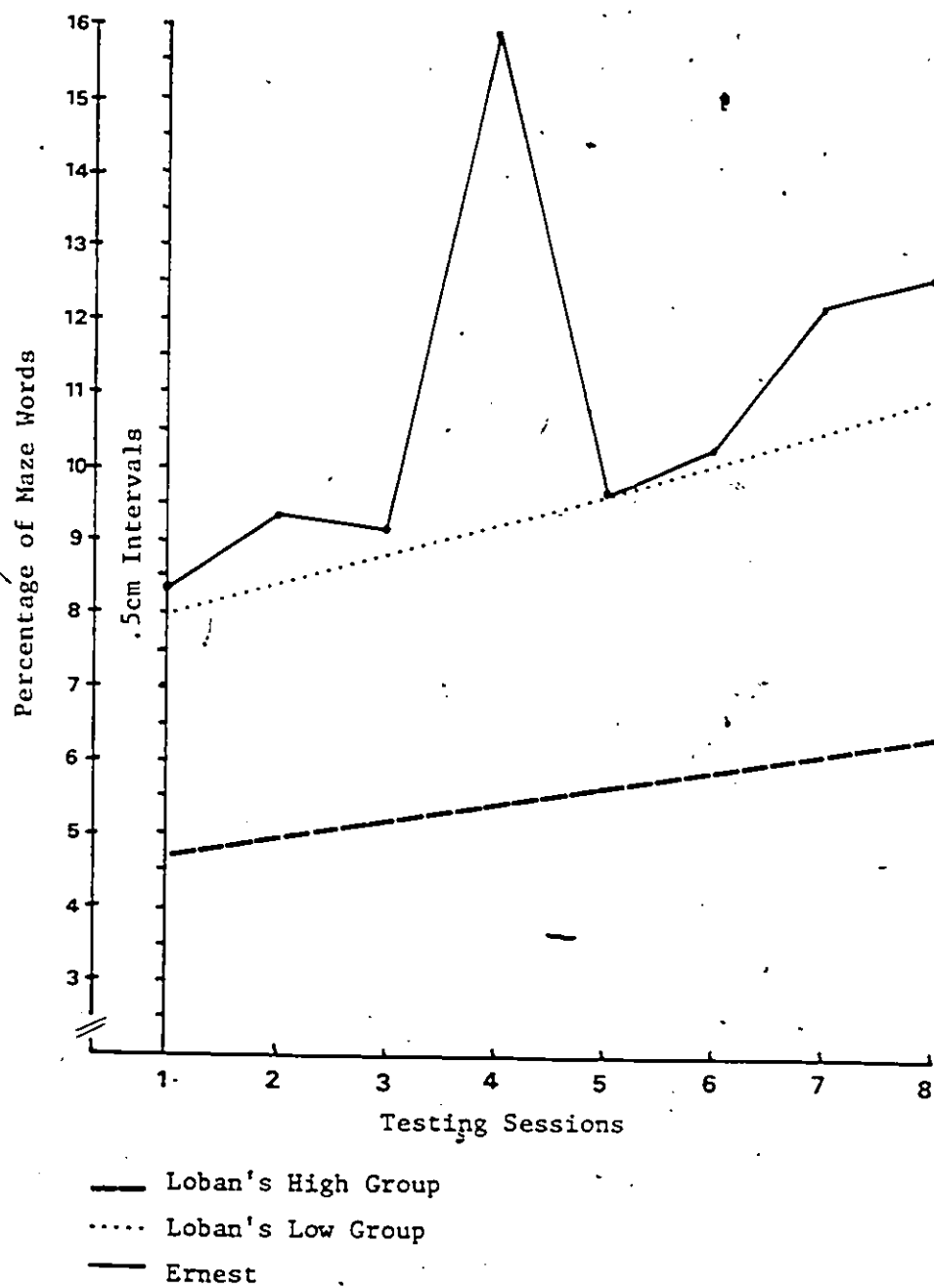


Figure 59. Percentage of Maze Words to Total Words - Ernest

testing session, Ernest's scores parallel the trend of the scores obtained by the Low group in Loban's studies. There is a marked increase in Maze percentage (negative change) at the close of the remedial training phase. There is a small negative change during follow-up.

Language Style. The scores for the dimensions of Language Style are listed in Table 16, depicted graphically in Figures 60, 61 and 62 and found on pages 257-259. All measures, with the exception of the Ego-Centric - Social dimension, show variability in baseline measures.

Figure 60 indicates that Ernest had difficulty formulating a dynamic story during the training phase. At the very end his stories were as dynamic as they had been in the initial testing session. Early in the training phase the boy had considerable difficulty organizing his thoughts into stories. Gradual improvement enabled him to perform at the close of the training program, as he had in the initial session. The third graph on Figure 60 indicates consistent stable and good performance.

Figure 61 indicates a consistent high level of functioning on the Social Aspects of the story telling task. The second graph again shows weak performance early in training with a marked positive change at the end. This same pattern is repeated with the Analysis of Voice Quality shown in Figure 62.

The high performance level obtained by the end of the remedial training on all eight measures of Language Style was maintained during follow-up.

Summary of Spontaneous Speech Analyses. The measure used to assess the developmental level of syntactical structures appearing in spontaneous speech (DSS) indicates that Ernest made his most positive improvement in

Table 16
Measures of Language Style on a Five Point Rating Scale - Ernest

Trait	Date of Assessment							
	12/75	2/76	4/76	6/76	8/76	10/76	12/76	2/77
Story Content:								
Descriptive - Dynamic	4.0	2.3	1.3	3.0	1.7	2.7	4.3	4.7
Disorganized - Organized	4.0	2.3	3.0	3.7	2.3	4.0	4.0	4.0
Unrealistic - Realistic	3.7	4.7	4.7	4.3	4.7	4.7	4.0	4.0
Interpersonal Aspects:								
Ego-Centric - Social	4.0	4.0	3.7	3.7	3.7	4.0	4.3	4.0
Other Directed - Self Directed	3.3	1.3	1.0	2.0	1.0	3.7	3.0	3.7
Voice Qualities:								
Halting - Fluent	4.0	1.7	2.0	4.0	2.0	4.0	4.0	4.3
Monotone - Expressive	3.7	2.0	1.3	4.0	1.7	3.7	4.3	5.0
Mumbled - Distinct	3.3	2.0	1.7	3.0	2.7	2.3	3.7	4.0

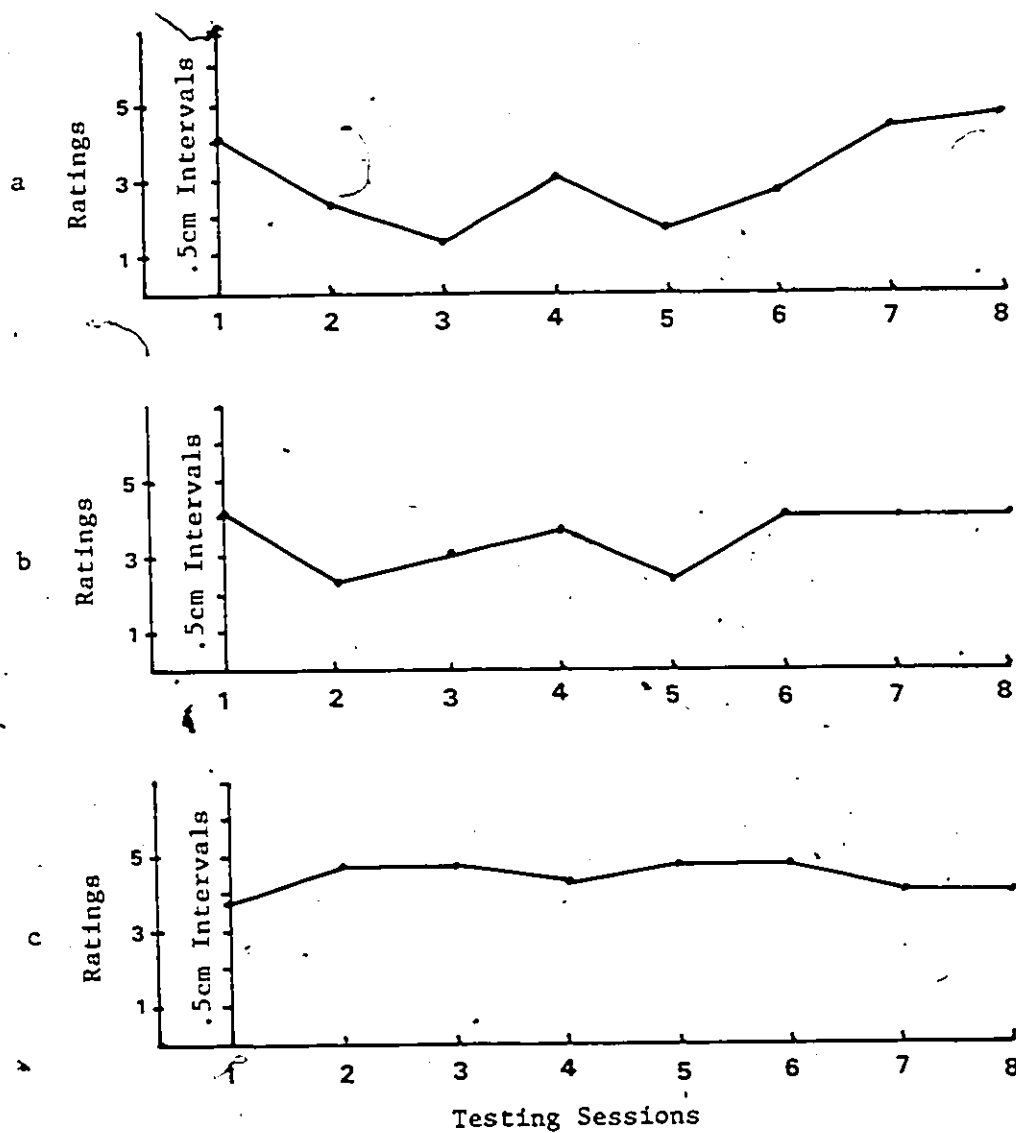


Figure 60. Analysis of Story Content - Ernest

- a) Descriptive to Dynamic
- b) Disorganized to Organized
- c) Unrealistic to Realistic

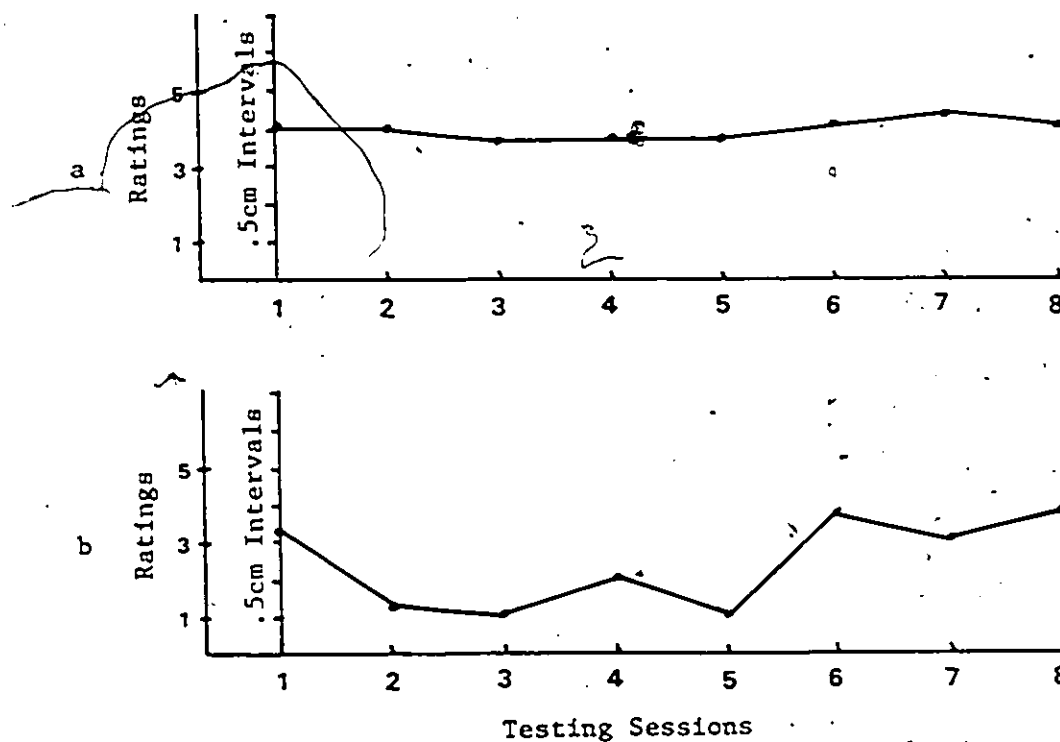


Figure 61. Analysis of Interpersonal Aspects - Ernest
 a) Ego Centric to Social
 b) Other Directed to Self Directed

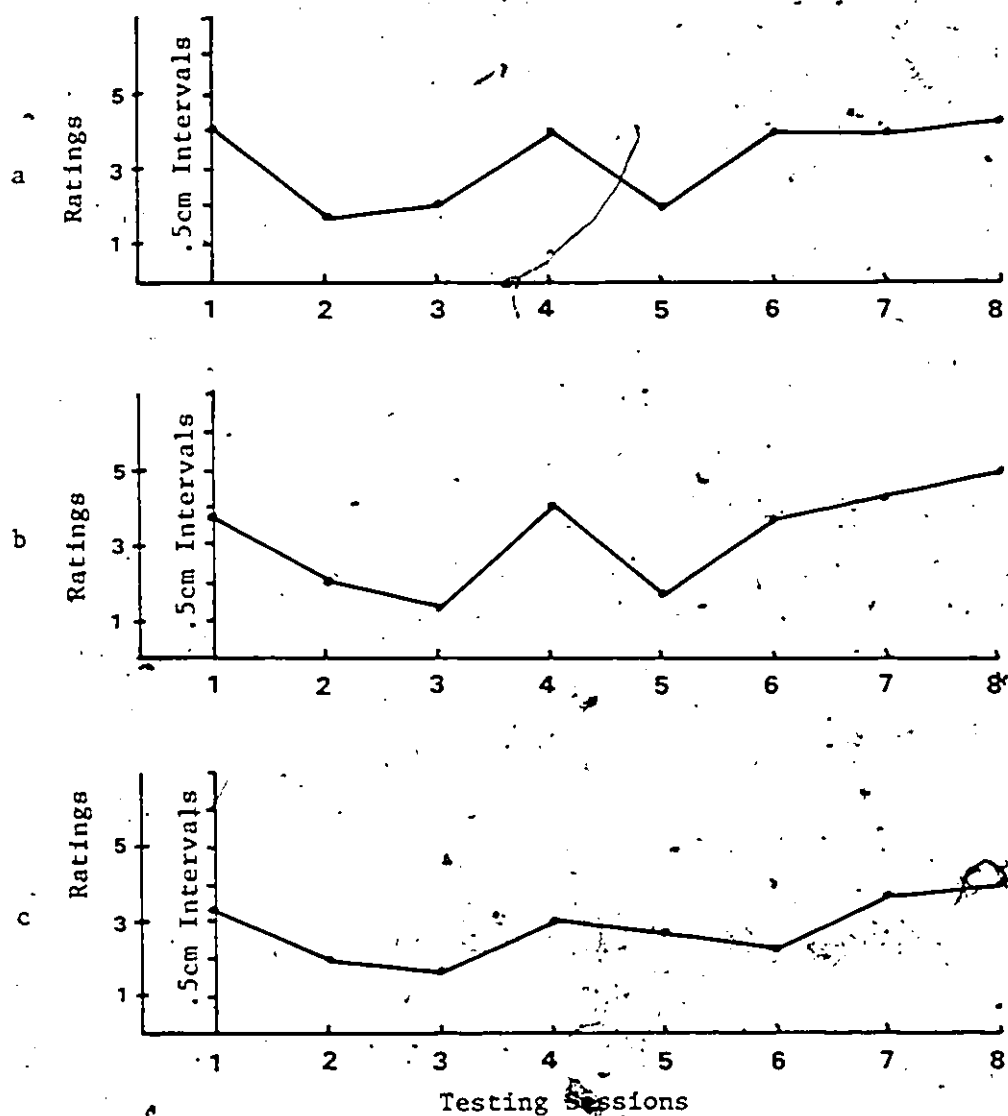


Figure 62. Analysis of Voice Qualities - Ernest

- a) Halting to Fluent
- b) Monotone to Expressive
- c) Mumbled to Distinct

the early part of the remedial training program. Tests used to assess length of Communication Units (WPU) and Language Style all show positive change at the very end of the training phase. Maze percentage, a measure of tangled speech, increases markedly at this point as well. Most of the spontaneous speech measures show a spurt of positive change at the fourth testing session. The percentage of maze words showed a dramatic increase at this time as well.

Test Results Compared to Individualized APP Program

During the Passive Phase of remedial training, which for Ernest lasted close to four months, there was a very positive change in the first to develop of the cognitive controls. Focal Attention, as assessed by SST, the only level considered underdeveloped for Ernest's age and grade, rose to above average two months after the introduction of training. At the same time there occurred a negative change in the lad's ability to handle geographical distractions (FDT, III-II) but this was recuperated two months later. Other levels of cognitive control functioning maintained their above average functioning so that by the close of the Passive Phase all four levels were highly developed for Ernest's age and grade. Also, with the introduction of the Passive Phase, there was an immediate improvement in the level of syntactical structures (as assessed by the DSS) used by Ernest. This was mostly accountable for by the increased verbal behavior appearing at this time. Previously Ernest spoke very little; every sentence was literally dragged from him. Such speech could hardly be termed spontaneous! Number of Words in a Unit of Communication (WPU) remained stable but poor during this phase of the training program. Maze behavior did not change until Selectivity was

opened at which time there occurred a dramatic increase in such tangled speech behavior. In the measures of Language Style, story content remained descriptive but realistic with a gradual positive change in organization of ideas. Interpersonal aspects showed consistent good social awareness in handling the story content and examiner relationship, but Ernest continuously required assistance from the examiner to complete the three step story telling task. Although early in the Passive Phase of training Ernest's voice became halting, monotonous and mumbled; at the close of the phase it was considered fluent, expressive and moderately distinct.

During the Active Phase of the remedial training program the cognitive control test results indicate a rather stable performance and maintenance of higher-than-expectancy on all four levels. With the introduction of this phase there was an initial drop in the level of syntactical structures used by Ernest in his spontaneous speech samples followed by a gradual and steady positive change. Ernest also had greater difficulty in expressing his ideas (WPU) than he had had during the Passive Phase of training. This difficulty shows a definite improvement at the close of the training sessions. With the introduction of the Active Phase one notes a dramatic increase in the percentage of maze behavior, that is tangled speech, used by Ernest in his spontaneous speech. However this quickly returned to its original level until the end of the training program when once again it rose.

In the analysis of Story Content, Ernest's stories remained realistic in content throughout the Active Phase of training while the organization of the themes in his stories showed improvement followed by a more dynamic

approach to the stories at the close of the remedial training sessions. Toward the end of the Active Phase of training Ernest also becomes capable of completing the story telling task without assistance from the examiner. The Voice Quality showed an initial deterioration with the introduction of the Active Phase of training. That is Ernest's voice became less fluent, more monotonous and mumbled. Over the following four months there were positive changes so that again at the end of the research project Ernie's voice was considered to be fluent, expressive and moderately distinct.

Generally the most positive and stable gains, during the Passive Phase of training, were those achieved in cognitive control functioning. That is Focal Attention, the first to develop of the cognitive controls, matured to above the level expected of the typical grade four child there by permitting a positive reorganization of the four levels of cognitive control functioning. The positive changes in use of syntactical structures and voice quality were not maintained. Positive changes occurred in most of the measures of spontaneous speech during the Active Phase of training. While WPU indicated initial negative changes, this was recuperated late in the training program.

This chapter has presented the results of the cognitive control and spontaneous speech tests for each of the five children individually. The following chapter will discuss these results in the light of the research expectations spelled out in the first chapter.

Chapter V

Discussion of Results

In this final chapter the writer will first discuss to what extent the research expectations spelled out in the first chapter, have been met. Next, the five individual remedial training program profiles will be examined to elicit general trends and unique performances in an effort to better understand the need for individualized treatment programs. A third section looks at the strengths and weaknesses of the present project while the final section deals with specific areas of research that might enlarge upon the trends suggested by the results of the present exploratory study.

Discussion of Research Expectations

The review of the literature in the first chapter led to the formulation of a General Research Expectation which was subdivided into five Specific Research Expectations in terms of specific changes which might occur in cognitive control functioning and spontaneous speech as remedial training progressed. The General Research expectation will be examined first, followed by a discussion of the Specific Research Expectations.

General Research Expectation

The General Research Expectation was stated as: Cognitive control functioning and spontaneous speech will demonstrate change during the individualized APP remedial programs. The results presented in Chapter IV generally indicate that in all five cases cognitive control functioning and spontaneous speech did indicate change during the individualized APP programs. Hence this general research expectation was met.

Four of the five boys (Andrew, Charles, Darryl and Ernest) were considered to have had a successful APP remedial training program. For these lads changes noted between the pretraining and post training phases were in a positive direction. The fifth lad, Brian, could not be considered as "remediated" by the termination of this research project. Actually some of the changes noted in cognitive control functioning and spontaneous speech were in a negative direction when one compares the pre and post remediation test results. For this lad many of his most positive changes were noted in the testing taken two months after the completion of the remedial training phase.

Specific Research Expectations

The general research expectation was subdivided in order to analyze more closely specific patterns of change.

First Research Expectation. The first of these five research expectations deals with the development of cognitive control functioning in accordance with Santostefano's biodevelopmental theory. It is stated thus: Poorly developed levels of cognitive control functioning should manifest change in the direction of increased maturity as formulated within Santostefano's biodevelopmental framework.

This research expectation was met in the four cases that were considered to have experienced a positive APP remedial training program. The one boy, Brian, whose remedial training program had not been positively completed at the close of this research project, did not show maturity in the expected direction. This finding would appear to confirm Santostefano's statements (1978) that a successful remedial program should reorganize or restructure the levels of cognitive controls in line with the biodevelopmental framework, making them all age appropriate. Although the training

program differed from that used by Santostefano the outcome was comparable. That is, this auditory approach to remediation produced similar effects on the cognitive control structures as does Santostefano's visually oriented cognitive control therapy. This fact alone lends some support to Santostefano's hunches about the possibility of cognitive control strategies in the auditory functioning of children (Santostefano, 1978, p. 751). Furthermore these results would tend to suggest that an auditory technique, such as APP training, has had a positive influence on the visual perceptual system. This effect might be understood in the light of Tomatis' theory of the neurointegrative systems (Tomatis, 1972, 1980). These three systems are: the vestibular integrator which centers on bodily experiences and allows the organism to relate to its environment; the visual or spatial integrator which focuses on outer experience and allows a person to have a feeling of direction in space; and, the cochlear or linguistic integrator which links the cortex to the cerebellum thereby integrating inner and outer experience through sound and through personalized listening-language functions. The remediation of language through APP training therefore may have an indirect effect on the development of the visual perceptual systems because of the integrative nature of these systems.

In all four cases the earliest to mature of the cognitive controls, that is Focal Attention, was the most immature at the time that the boys were admitted to the remedial training program. That is, these four boys visually scanned a given environment in a passive and limited fashion. With the first or Passive Phase of training both Focal Attention and Leveling-Sharpening showed positive change. The boys, that is, began to visually scan more actively and extensively; and, at the same time

improved their ability to maintain discrete impressions of past information, distinguishing these from a differentiated present. In all four cases Focal Attention showed the most positive change leading each of the boys from a level considered as immature for age and grade placement to a level beyond grade expectancy and more in line with their above average potentials. This pattern of immaturity in Focal Attention at the pre-training level is in agreement with Santostefano's findings (1978, p. 352). He found that kindergarten children, seen as possible candidates for future learning disabilities, showed deficiencies in Focal Attention and Field Articulation.

Broadbent (1958); Gibson (1969, 1971); LaBerge and Samuels (1974) all understand "attention" as the complicated process of centering in on important information while excluding irrelevant material. This occurred in the four boys who experienced a successful APP remedial training program but not in the fifth lad who had only completed the Passive Phase successfully. While Field Articulation itself was not immature in the test results of these four boys, this particular level of cognitive control functioning showed positive change during the Active Phase of the remedial training program. The boys' ability to learn to visually focus on relevant material while keeping the irrelevant suppressed coincided with the gradual process of language lateralization brought about through the modeling of speech and through listening to oneself, via the right ear. This auditory training of attending to and learning to discriminate on an auditory level once again appeared to lead to similar changes on a visual level. That is, the boys showed evidence of being better able to deal with relevant material while keeping the irrelevant at a distance.

By the termination of the training program all four boys were functioning at a level in line with age and grade expectancy.

The results of the present research are interesting in the light of modern research on maturation of attentional and memory mechanisms in children. Attentional mechanisms and short term visual memory factors showed positive change during the Passive Phase of the remedial training program. APP theory stresses that the Passive Phase of training, this is the listening to high frequency sounds, supplies greater energy to the cortex allowing the individual to sustain attention for a longer period of time thereby allowing the child to use the attentional skills that he/she possesses more effectively. Kinsbourne (1979) points out the fact that problem readers suffer less from visual or memory deficits than they do from a lack of sustained attention. In short they do not persist at the task long enough to develop the use of the strategies that they might have available for efficient memory. The writer suggests that the increase of cortical energy and concentration made available via the cochlear system to the cortex, allowed all five boys to be more active and extensive in their visual scanning tasks as well as permitting them to sustain attention long enough to attain and maintain discrete information and to differentiate this from past information.

Other authors (Douglas, 1976; Harris, 1976; and Meichenbaum, 1976) point out that the Learning Disabled child not only suffers from attentional deficits but that he also is incapable of focusing his attention on the problem (Learning) at hand. Their research led them to believe that self monitoring through language was important to sustain attention.

The present research showed that all five children improved in "attention" during the Passive Phase of training but that only four learned to focus their attention on relevant material and eventually to indicate progress in reading. Since it was during the Active Phase of the training program that the cognitive control principle of Field Articulation (focusing on relevant and suppressing irrelevant material) changed, it suggests that the gradual lateralization of language through APP training assists in the focusing of attention. Also, in these four cases, Leveling-Sharpening continued to improve during the Active Phase of training suggesting the development of more refined strategies for memory. This would suggest a certain maturity in the development of memory such as described by Kinsbourne (1979) and Meacham (1972). The fifth boy, Brian, did not show further improvement on this measure lending support to the theory that initial energy allowed him to use his available structures but the lack of improved language laterality may have prevented more mature development of memory mechanisms.

One cannot leave this discussion of the reorganization of cognitive control strategies without making some mention of the fourth or last to develop of the cognitive controls, Equivalence Range. This particular level of cognitive control functioning showed little change during the APP remedial training in any of the boys. All five boys entered the remedial training phase with an adequate ability to formulate abstract and realistic concepts and maintained this high level consistently throughout the training phase of this research project. That is, all of the boys could label categories or groups of objects at a level of abstraction considered excellent for their age and grade. For all of the children, except Charles,

some variability or change was noted in the number of typical categories they formulated with the objects presented. As Equivalence Range is the last to develop of the cognitive controls two factors may be involved here. First any reorganization taking place at earlier levels of cognitive control functioning may cause a temporary compensatory effect on other levels of functioning (Santostefano, 1978). Secondly Santostefano, in his research, has found that in the early school years this particular level of cognitive control functioning goes through short phases of stabilization followed by phases of reorganization. Since the boys in this project fall within these early school years one cannot expect a smooth profile on these test results. However it is clear that all of the boys could abstract at a level commensurate with their higher intellectual potentials. This level of cognitive control functioning was not in need of remediation for any of the boys.

Brian, whose remedial training program could not be considered successful, showed a different pattern of cognitive control functioning even during the pretraining phase. Unlike the others, he demonstrated an unusually keen ability in Focal Attention while Field Articulation was underdeveloped. As in the case of the other boys, the Passive Phase of the APP remedial training enhanced Focal Attention and Leveling-Sharpener but the Active Phase of training did not rectify the difficulties in Field Articulation. Brian appeared to be over alert to the environment and was not able to develop new strategies to control this activity. According to APP theory he did not reach a successful integration of the vestibular and cochlear systems. The writer feels therefore that even this case supports the trend expressed in the presently

discussed research expectation. That is, the pattern of improved active and extensive scanning as well as a better ability to articulate present from past information were achieved but the necessary ability to differentiate relevant from irrelevant material as well as to develop more mature strategies for memory was achieved neither auditorially (as in the training tasks) nor visually (as in the cognitive control tasks). One could argue that perhaps Brian's particular pattern of cognitive control functioning cannot be remediated by APP remedial training. However, as the second or Active Phase of training was not successfully completed one cannot discount the possibility that a prolonged remedial training might have eventually produced the same pattern of results evidenced in the results of the other four boys.

Santostefano (1978) in discussing the various patterns of cognitive control functioning suggests that some children, due to negative and lengthy life experiences, have learned to be very attentive and aware in their environments while shutting out their own inner feelings. Others have learned to shut out the exterior environment. These methods of adaptation force the child to perceive his environment in a very unique fashion. This unique fashion of perception is what hinders him when he comes face to face with formal academic tasks such as reading.

Tomatis (1978) suggests that it is a child's early rejection of communication that prevents adequate language development and hence leaves one unprepared to learn to attack the written word. Both Santostefano and Tomatis see school failure as the result of poor adaptation in the pre school years. Both also seem to agree that a successful remedial program must attack these preschool tasks. The APP remedial program

appears to have achieved this for four out of five of the boys in this research project.

Second Research Expectation. The second research expectation spelled out in Chapter I deals with the use of syntactical structures in spontaneous speech. It was stated thus: Immature use of syntactical structures in spontaneous speech samples should develop in the direction of mature syntactical structures in accordance with age expectations.

Again this research expectation was met by the four boys whose APP remedial training program was considered to have been successful. Of interest is the fact that all four lads demonstrated an initial spurt in quantity of verbal output followed later by an increase of more qualitative syntactical structures. This difference was not always assessed accurately by the DSS due to the peculiarity of the scoring system. That is, children could use a long compound sentence and attain a slightly higher score than if the same ideas were expressed in an imbedded complex type sentences. Compound sentences were frequent during the early part of the remedial training when the boys simply increased their verbal output. Hence when the boys later used shorter sentences, but expressed their thoughts more succinctly through the embedding of ideas in phrases and clauses, they tended to obtain a lower DSS score. The more mature expression of ideas was confirmed by the observations of teachers and parents who observed the children's spontaneous speech within their everyday environment. Two of the boys demonstrated quantitative improvement during the Passive Phase of training while the other two demonstrated such change early in the Active Phase. However in all four cases quantitative output preceded qualitative change. This suggests a developmental

sequence that coincides with native language development. The work of such people as Roger Brown (1974), Laura Lee (1974) and David McNeill (1966) demonstrates the use of compound sentences (where a simple conjunction is used to join two simple sentences) prior to the use of a more complex type sentences where the ideas are imbedded in subordinate phrases and clauses.

The one boy whose APP training was not completely successful continued to use syntactical structures below his level of expectancy although even he showed a general trend toward a positive change.

The passive listening to filtered sounds according to APP theory breaks down barriers to linguistic communication and drives the individual to exteriorize himself (Tomatis, 1978). This may well account for the early increases of verbal output which were noted in all five boys, even Brian. The gradual lateralization process of the Active Phase of training tunes the individual's ear to the differentiated sounds of his native language thereby permitting him to listen, to attend, and to hear the differences in sounds and structures of that language.

It is true that syntactical development is not complete when a child enters formal schooling (Loban, 1976; Carol Chomsky, 1971) but he must be at a level commensurate with the reading material of his grade if he wishes to obtain information via the written word. Vellutino (1979) has pointed out that the discovery of pronounced linguistic deficits in children at the beginning stages of reading speaks for the possibility that language disabilities may be the cause of reader disability and not the result of reading problems. Loban's 1976 longitudinal studies confirm this by demonstrating that the poor readers in grade one demonstrated

lower language development than the good readers and were still lower in grade twelve.

Third Research Expectation. In this particular research expectation it was stated that: Vague and undetermined expression of ideas in spontaneous speech samples should demonstrate change in the direction of vivacious and clear expression of ideas. This was assessed by the average number of words used by the child in a unit of communication.

All five boys could be considered as showing improvement in the direction of this research expectation but such positive changes occurred at different phases of the APP remedial training program and were not dramatic. Four of the five boys were functioning below expectancy at the termination of training as they had been at the outset. Andrew came into the program using longer than expected units of communication, improved during training and, of course, was the one lad who functioned well above expectancy at the termination of remedial training. Charles did make very positive progress in APP training but was incapable of maintaining this higher level of functioning within the random or average group for his age.

Generally it would seem that the ability to express one's ideas in a clear and vivacious fashion is a "late to develop" language ability. That is, syntax and certain aspects of language style must exist in the child's bag of language tools to enable him to formulate his ideas effectively. This parallel of increased reading skill and comprehension with an increase in the average number of words used in a unit of communication tends to suggest that beyond a certain level of efficiency in both fields reading and language begin to have influence on the development of each

other. One needs a certain fluency of language to comprehend more advanced reading material; but, on the other hand one's language flexibility and fluency is surely influenced by a varied use of literature. (Chomsky, 1971)

The four boys whose average number of words in a unit of communication was small for the grade expectancy all showed a positive trend at the termination of the training programs as language was becoming lateralized. Their reading scores also began to improve at this time.

Charles was the one exception. Despite early indications of a positive APP remedial training program his performance on this test of language fluency was too varied. This boy's fluctuating test performance will be discussed in more detail in the following section of this chapter.

In conclusion one must say that overall there was very little change in the average number of words used by four out of five of the boys in their units of communication. Logically one might expect vivaciousness and self expression (used here as fluency) to improve during the fourth or "training" subphase of the APP program when the subject has become lateralized for self-listening and accordingly begins to project himself as a person with experiences on his social environment (Tomatis, 1978).

Ideally Charles and Ernest should have shown the greatest increase as their fourth or training subphases had been of considerable duration (six and four and a half months respectively). Charles would have fitted the ideal picture but all his test performances appeared to have been influenced by negative aspects of the family environment. Ernest did show excellent improvement toward the end of his APP training but it was not maintained during follow-up. Brian and Darryl had just entered the final phase of

training late in the remedial phase of this research project and both did show some improvement on the WPU test.

Loban (1978) claims that the average number of words in a unit of communication is a measure of fluency or vivacious and self expression in speech. As well his longitudinal studies indicate a significant difference between children considered to be low language achievers, by their teachers, and those considered to be high language achievers. Hence this test does measure something developmentally important during the first thirteen years of schooling. This researcher is left with the question: Could it be that APP training does not have an effect on fluency of speech; or, are the late positive trends an indication that time and experience are essential to develop fluency of self expression whereas syntax is learned and generalized once an individual attends effectively to his language medium?

Tomatis theory would suggest that such ease of expression would result when language laterality has been completely established. As only Andrew could be considered as having reached this goal by the termination of the remedial phase of the research project, the other four could not be expected to have achieved their ideal level.

The writer also questions the use of Loban's WPU as the best measure for fluency or vivaciousness of self expression. First it does not appear to distinguish between imitative and original expression which is considered important in APP remediation as well as an important back drop for reading comprehension. Secondly, there is some indication in the literature (Jansky, 1980) that children might demonstrate flexibility of expression in pure spontaneous speech before it can be detected in a testing

situation. The spontaneous speech samples for the WPU analysis were elicited in a structured fashion. While these results did not demonstrate the changes expected, teachers had reported better and even excellent improvement of self expression in all of the children.

Fourth Research Expectation. The fourth research expectation, that dealing with hesitations in speech, was formulated thus in Chapter 1: The use of language tangles and hesitations in spontaneous speech samples should decrease in accordance with the percentage expected of fluent speakers. This particular expectation was not fulfilled in any of the five cases. Of particular interest here is the relationship that appears to exist between the introduction of the various phases and subphases of the APP remedial training program and changes in the percentage of language tangles and hesitations in each of the boy's spontaneous speech samples.

Although the assessment results did not follow the trend suggested by the Research Expectation laid out in Chapter 1 there were some common and interesting occurrences. First there were dramatic increases in the percentage of language tangles and hesitations used in the spontaneous speech samples in four out of five of the boys at the time of the "letting go" of the initial auditory defenses. For Andrew, Brian and Ernest this occurred with the opening of selectivity; for Darryl it occurred when the flat non analytic air curve began to take on an ascending slope thus permitting the boy to begin analyzing the sounds of speech. The fifth boy, Charles, indicated a good hearing curve during the diagnostic period. He showed no increase in the use of language tangles but rather a decrease with the introduction of the language training phase of the program.

Three of the five cases, Andrew, Brian and Charles, showed an increase in the percentage of language tangles used at the time of the introduction of the final phase of training.

Three of the five boys (Andrew, Brian and Darryl) showed positive change of such language behavior after the termination of the remedial training program while one, Charles, showed a dramatic negative change. The boys who were considered the most successful according to APP theory (Andrew and Ernest) showed a larger percentage of language tangles and hesitations in their spontaneous speech at the termination of the training program than they had at the onset of the program. Brian, the least successful case according to the APP theory, showed the same pattern. Charles and Darryl end with virtually the same percentage they had started.

Language tangles and hesitations did not indicate change in the manner expected during the APP remedial training program. Rather changes in such behavior appeared to occur with the changes caused in awareness to the outside world of social language and self language and with increased tension suggested by a higher bone threshold on the Tomatis Listening Test.

Loban, in his studies, found that the use of language tangles tended to be very variable during the latency years. He himself wondered if such speech behavior could be related to personality more than age and level of development. The present writer wonders if speech tangles, hesitations, false starts etc. might not be the end result of a variety of underlying factors. Logically it seems that speech could be hesitant when one is momentarily distracted in the organized presentation of his/her ideas. Secondly such stumbling over words could be the result of tension-- positively this could be heightened attention produced by self consciousness

or self awareness. Such hesitations then one might expect at the introduction of a new phase in the remedial training program. Also, such language tangles could result from the very positive attitude of learning to self-correct ones speech or of self-monitoring ones errors as he becomes more conscious of trying to more explicitly express himself linguistically. Certainly this might have been what was happening with Andrew, Brian and Ernest toward the end of the remedial training phase when both teachers and parents noted that the boys spoke their ideas more deliberately and in a more organized fashion correcting themselves when necessary. Charles, on the other hand, became more disorganized in his presentation of ideas with the increased tension from the home environment. Hence his increase in tangled speech has a more negative connotation.

Fifth Research Expectation. This research expectation was formulated in Chapter I as follows: Those aspects of Language Style considered to be immature in the spontaneous speech samples should develop in accordance with expected performance. The first part of this analysis deals with the story content and the expectation was stated as: Concrete, unorganized and unrealistic story content should become more dynamic, organized and realistic.

The four boys (Andrew, Charles, Darryl and Ernest) who were considered to have been successfully remediated, according to results on the diagnostic tests, showed change in accordance with the research expectation. This change occurred, for all four boys, during the Active Phase of the remedial training program. Since APP theory claims that during this Active Phase of training a person works on those aspects of his/her native language expression which permit a better and clearer expression of

thought, the above findings were not unexpected. The profiles further suggest that while the changes in organization of thoughts came about in a gradual manner, the more personalized approach demonstrated in the dynamism of the stories, evolved rather abruptly toward the end of the training. It is of interest that two of the boys, Andrew and Charles, showed a decrease in the use of realistic themes in their stories at the same time that they became more organized in their thoughts and dynamic in content. For Andrew, this stage of extreme or fantasy type stories was short lived and he returned to a more realistic level without reverting to the super realistic concrete stories which characterized his earlier stories. Charles, on the other hand, became more and more unrealistic in his story content. He began to use his story content in an attention seeking manner and at times became self absorbed in his own stories drawing away from the realities of the picture.

The second part of the Language Style analysis deals with the interpersonal or social context of a story telling situation. The expectation is stated as: Ego-centric and structured dependency in the interpersonal aspects of story telling should move toward social and self directed relationships.

The four boys who had been considered as successfully remediated showed development in the expected direction on those measures of the interpersonal aspects of story telling which had suggested immature performance in the pretraining phase. The fifth boy, Brian, showed little change. All results suggest that he was sociable in the testing situation but unable to organize his own responses so as to fulfill the test requirements.

In general the "ego centric-social" dimension improved first with the introduction of the Active Phase, sometimes called the social phase, of the training program. This would tend to support APP theory which suggests that awareness of socialization evokes the desire to communicate. The gradual processes of establishing language laterality then assists one in organizing one's ideas. This concept of language as an organizer of thought and expression is certainly not novel to APP theory but has also been expressed in the works of Piaget, Vygotsky and Luria.

The final section of Language Style analyses deals with voice quality and was formulated as follows: A halting, monotonous, mumbled voice should become more fluent, expressive and distinct. All five subjects demonstrated change in the direction suggested by the research expectation. Brian was the only lad who did not demonstrate a preference for the right ear in the monitoring of speech by the close of the remedial training phase of the research project. Two boys, Andrew and Darryl, demonstrated immediate change but, while Andrew maintained this higher level throughout the research project, Darryl reverted to his lower level gradually recuperating again over the duration of the Active Phase.

Generally Language Style changes occurred during the Active Phase of training. Social, as versus ego-centric interpersonal action, changes occurred first followed by a more gradual ability to organize ideas and the task in general. The more personal involvement of dynamic story telling and voice expression etc. showed their most positive changes toward the end of APP training. This pattern closely ties in with the developmental theory of APP language development presented in Chapter I.

In summary, poorly organized levels of cognitive control functioning and immature use of language skills in spontaneous speech appear to have

been remediated in the four boys who experienced a successful APP remedial training program. During this period of change the theoretical approaches of both Sebastiano Santostefano and Alfred Tomatis appear to have been upheld. That is, successful treatment did establish a proper biodevelopmental hierarchy and with the establishment of language laterality poorly developed language skills demonstrated a gradual change toward expected levels of maturity. More precisely the passive listening to filtered sounds (Passive Phase) made the individuals more attentive to their environment and appears to have increased memory skills by assisting the child in formulating discrete images of information. Tomatis (1978) would suggest that the high frequency sounds, which supply energy to the cortex, allowed the children to focus their attention without becoming easily fatigued. The auditory and visual ability to discriminate relevant from irrelevant material, as well as the establishment of other language skills occurred during the active part of the training program which actually focuses on listening and speaking so as to establish the Right auditory-vocal language loop.

The literature review in Chapter I demonstrated that proper cognitive control functioning and a certain developmental level of language skills were essential for a successful reading experience at the formal academic level. The findings in this research project, demonstrate that once cognitive control functioning was properly established in accordance with Santostefano's biodevelopmental framework and language skills such as syntactical development and certain aspects of language style had reached grade expectancy, the boys could no longer be defined as dyslexic according to the criteria used in this research. It would appear therefore that

a successful APP remedial training program does assist in the maturation of perceptual and language skills deemed as pre-requisites to reading.

The writer feels that the individual nature of each boy's treatment program adds strength to the above findings. That is, since changes occurred in relation to training phase rather than in relation to number of months in training, they were less likely to be influenced by exterior factors as time of year, teacher mood; weather, holidays etc.

Individual Subject Profiles

While the Research Expectations spelled out in Chapter I were met in the case of the four boys who had experienced a positive remedial training program, it is of interest that the individual initial profile of cognitive control functioning and spontaneous speech was different for each of the boys despite the fact that all were diagnosed "dyslexic" by the diagnostic criteria. Likewise their patterns and rate of change during the period of the remedial training program were quite different although all four did achieve much the same goal in the end. A review of each boy's individual pattern of change would help attest to the uniqueness of a dyslexic's problem and the need for his individualized pace of remediation.

Andrew. In the diagnostic or preremedial training period this lad demonstrated immature development in the earliest to develop of the cognitive controls with adequate functioning in the other levels. Measures of spontaneous speech were efficient for the boy's age although teachers noted that his language was not personalized. That is, Andrew did not express his own ideas but rather repeated ideas he had heard from parents, teachers and other significant adults in his everyday life. This was reflected in the super realism of his story content and the lack of dynamic

interpretation of pictures. It was also reflected by his halting, monotonous and mumbled voice. During the Passive Phase of training levels of cognitive control functioning were reorganized in a positive manner in relation to the Biodevelopmental Framework and the Voice Qualities became fluent, expressive and distinct. With the opening of selectivity and the introduction of the Active Phase of the training program Andrew seemed free to produce in a positive manner on all measures of spontaneous speech. For this lad, it was as if a great deal of skill learning had taken place prior to training but was being blocked from efficient usage by the boy's resistance to intake of the environment both visually and auditorially. Dr. Tomatis had described Andrew as a severe dyslexic whose problem was rooted in his lack of motor laterality. According to APP theory (Tomatis, 1978) motor laterality is the primary laterality which needs to be developed before auditory-vocal laterality is superimposed to form a functional harmonization as language becomes the expression of thought. While Andrew had well developed language skills they were not lateralized in a hierarchical function. As he became lateralized, first motorically and then auditorially, during the remedial training program, he could use his skills in a useful manner. For this boy then remediation of the earliest level was important and required a proportionately lengthier program. Once the basis was there he moved quickly and positively.

Brian. In the pretraining phase of this research project Brian's pattern of cognitive control functioning indicated excellent maturity on the primary level, variability on the second, immaturity on the third and fourth. He appeared to be stuck at the primary level. Language development, at this time was extremely poor--both weak and limited.

Brian did show positive changes during the Passive Phase of the training program but he never felt at ease with the Active Phase of training. His pattern continued to be one of partial progress followed by a short period of discouragement or, at best, a plateau of behavior. The positive gains in cognitive control functioning and voice quality obtained during the Passive Phase of training were lost during the Active Phase. Although the program assistant, teachers and parents all noted many positive changes in the boy's attitude toward himself and others as well as in self expression these were only weakly reflected in the measures used for this research project. However such observations suggest that Brian was becoming more social and ready to use language for the expression and reception of thought. This boy seemed relieved when the Remedial Training Phase was terminated as he had been frequently depressed by the effort involved. He made many gains during the follow-up period.

Brian's problem appears to be of a deep set familial nature where the father himself was dyslexic and did not or could not supply an adequate language atmosphere for his children. In cases such as this Dr. Tomatis would recommend that the whole family enter treatment together so as to remediate the entire language setting of the home.

Charles. This boy was initially presented as the least dyslexic of the five boys according to Dr. Tomatis' assessment. He appeared to have a good secure basis for language learning but required lateralization on an auditory-vocal level. His test profiles show adequate cognitive control functioning but immaturity in the areas of language. During the early part of the training he progressed rapidly and positively. However once parental interference began to occur the boy began to regress. From then

on his performance in the therapy sessions, in the classroom, with his peers, and in the testing situations was unpredictable and tended to parallel the parents' attitude to the program.

APP theory continuously emphasizes the need for total family support and encouragement for the adequate maturation of auditory-vocal laterality as a vehicle for the expression of thought through language. Charles' case appears to support this theory. Overall his APP training was moderately successful although slower and less complete than originally predicted by Dr. Tomatis. In the early part of training cooperation was adequate and the boy's training indicated positive and steady changes. Later when the parents' lack of support left the lad in an insecure position and with the need to retreat to his own private world, progress was slower and at times the test results indicated regression.

Darryl. In the pretraining phase Darryl's test profiles show immaturity of the first or primary level of cognitive control functioning. Linguistically he had a knowledge of syntactical structures but had difficulty expressing thoughts of his own. His voice qualities were also poor.

This boy was functioning at a pre language level. That is, he was demonstrating a resistance to language as a mode of communication and social participation on a verbal level and consequently had not and could not use language as communication in a written/reading sense. He was the most immature linguistically of all the children. His APP progress and test profiles show a gradual developmental sequence from the beginning to the end of treatment. During the Passive Phase, which for Darryl was very lengthy, we note the development of the first level of cognitive control functioning. In the Active Phase there is an early increase in syntax

with a slower and more gradual growth in the ability to communicate ideas fluently. At the same time the social aspects of story telling precede a more gradual organization of thought which is eventually followed by personalization of content. This had needed time to develop and mature at every level of language development. At the termination of training he was ready to approach the written word:

Darryl's pattern of successful remedial training also indicates the important role parents play in auditory-vocal education. Darryl's Passive Phase of training had been somewhat lengthened by the mother's negative interference as was explained in Chapter III. With her renewed co-operation APP training progressed in a positive manner.

Ernest. Initially this boy was very reactive. His motivation could be keen in the face of something new, even a test situation; but, he quickly lost interest, motivation and concentration. His test behavior was also very effected by his "mood of the moment" which itself was unpredictable.

In the pretraining phase of this research project Ernest's cognitive control profiles indicate immature development of the first or primary level. In the language tests syntactical structures were weak although he could state an idea. The boy was sociable in his language although often in an attention seeking, rather than information giving, manner. Other measures of Language Style were unstable. As the Passive Phase, with its filtered sounds, built up the higher frequencies in Ernie's listening attitude he became less fatigued and capable of concentrating for longer periods of time. This in turn helped motivate him. Although he did not appear to use language to communicate, he apparently had a

knowledge of its structures. The positive support of the Passive Phase built up the lad's security so that he could use the strengths and skills he possessed. During this Passive Phase we note the reorganization of the cognitive control hierarchy, improved use of syntactical structures, an attempt at organization of thoughts and improved voice qualities. The introduction of the Active Phase (each new subphase for that matter) coincides with a reorganization in Ernie's behaviors. That is, he becomes temporarily lost, so to speak, at the same time that a new phase is introduced. His overall improvement was then gradual but steady during the lateralization process.

The variety of patterns seen in the cognitive control and spontaneous speech functioning of these boys emphasizes the heterogeneity of the problem of dyslexia. It also demonstrates the need for individual diagnosis and treatment. The boy, his family and his school all interact effecting his individual rate of progress. These various programs illustrated the importance of this delicate interplay. APP remedial training demands the co-operation of the school and the home to allow the natural process of language laterality to occur once the "blocks" have been removed.

Strengths and Weaknesses of Present Research

The Single Case Time Series design used for the present study had definite advantages. In doing the assessments of cognitive control functioning and spontaneous speech at regular two month intervals the researcher was able to note when, in the Remedial Training Program, specific changes took place. In a simple Pre-Post design one could not have noted that the cognitive control reorganization took place during the Passive Phase of training whereas qualitative language changes occurred during the Active

Phase of training. Likewise the researcher was able to note that, in general, cognitive control reorganization occurred prior to language changes. The regular assessments enhanced the differences of profile patterns among each of the five children. These short term assessments also helped to demonstrate that Brian, who according to a Pre-Post design would have shown no definite pattern of change, did make some definite strides particularly during the Passive Phase of training, even though his overall APP remedial training could not be considered successful from the diagnostic standpoint. The Single Case approach pointed out most clearly the differences between the lengths of the various remedial phases for each of the boys.

However, there were definite weaknesses in the present design which should be taken into consideration in planning future research of a similar nature. First, the baseline measures were too short. Children, with problems of any nature, tend to be variable in their test performances. In order to obtain a trend of achievement one would need to have at least three and preferably more sets of results taken during the baseline phase. Other designs should be tried to assist in teasing out to what degree the changes noted in this study could be credited to the APP remedial training as opposed to the attention paid to children in a one-to-one relationship and/or the maturational factor which is bound to take place during such a lengthy treatment program. For instance, in the present study it might have been most helpful to have had control subjects who were in the Child Study Centre program, defined as dyslexic, but not receiving the APP remedial training. Another study might use control subjects who would receive the same individualized attention with pleasant music through a similar looking apparatus while the experimental dyslexics

receive the four phases of the APP training program. Failing this, dyslexic children may be placed on two or three different remedial programs and the results compared with those of the dyslexic children on an APP remedial training program. The lack of a control group in the present study has greatly diminished the interpretative impact of the positive changes noted in cognitive control functioning and spontaneous speech during the various phases of the APP remedial training program.

The present research design called for a considerable amount of testing which was carried out every two months. This was hard on the children involved in the study. The literature discusses the Practice Effect of test taking between short intervals. However, with the present testing regime the researchers became more concerned with the boredom effect produced by familiarity and repetition of the tests. It would seem, at least to this writer, that observational type tests would help to reduce these massive testing schedules at least for the subjects in the study.

Possibilities for Future Research

One of the purposes of the present exploratory type research, which uses five in depth case analyses, was to tease out areas for further research based on the trends suggested by these five cases.

According to the diagnostic measures used, all five boys were considered dyslexic at the commencement of this project while only one, Brian, could still be defined as dyslexic at the termination of the Remedial Training Program. That is, four out of five of the cases could no longer be considered "dyslexic". This strongly suggests that the Audio-Psycho-Phonological (APP) language remediation program had a definite influence on the skills considered necessary for success in reading and would

appear to confirm Dr. Tomatis' claim that auditory-vocal laterality must precede reading.

One case was not successfully remediated either according to the auditory-vocal assessments used by Tomatis or the academic and social measures used in the test battery. If all five boys had have been included in a Group type study Brian's definite lack of progress would not have been apparent since Mean Scores tend to erradicate a single failure. More single case studies of a similar nature using measures of cognitive control functioning and spontaneous speech would add to the statistical strength of the effect of APP training on these two important prereading areas. The detailed and careful recording of the process of change which occurs in cases considered as unsuccessful would yield clues for individualizing the training programs in greater detail. That is, in the case of the five children used for the present study the same remedial process was used for each although the individual need for difference lengths of time on each of the four subphases of the program was taken into consideration. This in itself confirmed the need for an individualized remedial program. However more recent experimentation by Dr. Tomatis has led to further refinements in APP training and the use of the Electronic Ear equipment. Individual problem cases, such as Brian, may be assisted with a more refined use of the EE. Dr. Tomatis has now made available an apparatus which assists in the remediation of listening via bone conduction. He has also found that a more intensive schedule of training is most helpful with these more difficult cases. During the present research project these refinements of the program were not used. Intensive studies

of such individual difficult cases are necessary to better understand and work out effective individualized programs of remediation.

There is much room for further research in the stimulation and focusing of attention. The present study would tend to lend support to the previously mentioned work Douglas (1976); Harris (1976); and Meichenbaum (1976) who noted and suggested the need for self monitoring through the use of language. It would appear that sustained attention and activity are important prerequisites of directed or focused perception so one does not necessarily want to cut out stimulation but rather to help the subject learn to focus that activity on relevant material. Of the five cases Brian was originally the most alert visually yet he did not learn to focus his attention and he did not achieve auditory-vocal lateralization. A more refined use of APP treatment in cases such as Brian's could help in understanding the process involved in learning to focus one's attention.

The test results from this present research project indicate that while all children had some difficulty, at one time or another, with geographical distractions all scored better than expected on contextual distractions. It seems one needs to better differentiate the cognitive processes involved in these two different types of distractions.

This writer does not feel that the measures used to assess spontaneous speech, in the present research project, were sensitive enough to tease out the refinements in fluency, self expression and voice qualities eluded to in APP theory. More refined measures need to be worked out. The communication of ideas appears to be an important issue in the auditory-vocal lateralization process but was not tapped by the tests used in this research. Teachers' ratings of taped samples of spontaneous speech

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are fairly adequate but there are also more refined electronic measures available at this time. For example, voice characteristics could be analyzed from spectrographs of children's voices etc.

The role of hesitations and false starts in spontaneous speech requires further investigation. It seems that these might be interpreted in a positive as well as a negative manner. Further research might successfully distinguish the two.

Another area of much needed research is in the standardization of the Tomatis Assessment tools themselves particularly The Tomatis Listening Test (TLT) and the test of Audiolaterometry (ALM). Here normative studies might be useful to answer such questions as: What is the normal or typical listening profile of Canadian preschool and school age children? At what age does Selectivity open in the normally developing Canadian child? Is this a gradual or sudden process? Does visual activity and scanning precede the opening of auditory selectivity? How do normally developing children respond to the test of Audiolaterometry? How does the gradual process of auditory-vocal laterality show itself on the ALM results of preschool and school aged children?

The results of the present research project lend some support to the suggestion that in remediating auditory vocal control of language the APP remedial training program remediates pre academic or reading skills as well. This suggests that auditory-vocal language development is a prerequisite to successful reading experience at the academic level.

REFERENCES

- Bannatyne, A. Language, reading and learning disabilities. Springfield: Thomas, 1971.
- Bannatyne, A. Reading: an auditory vocal process. San Rafael Calif: Acad. Therapy Publications, 1973.
- Bender, L. Specific reading disability as a maturational lag. Bulletin Orton Society, 1957, 7, 9-18.
- Bever, T. G. & Chiarello, R. J. Cerebral dominance in musicians and non musicians. Science, 1974, 185, 537-539.
- Blishen, B. R. A socio-economic index for occupations in Canada. Canadian Review of Sociology and Anthropology, 1967, 4(1), 41-53.
- Braine, M. The ontogeny of English phrase structure: the first phase. Language, 1963, 39, 1-13.
- Brown, R. A first language: the early stages. Cambridge, Mass: Harvard Univ. Press, 1973.
- Brown, R., & Fraser, C. The acquisition of syntax. In C. Cofer & B. Musgrave (Eds.), Verbal behavior and learning: problems and processes. New York: McGraw Hill, 1963.
- Bryan, T. S., & Cooper, R. Perception of the learning disabled child: the eye of the observer. In Journal of Learning Disabilities, 1972, 5 (8), 486.
- Bryan, T. S. & McGrady, J. Use of a teacher rating scale. In Journal of Learning Disabilities, 1972, 5(4), 199-206.
- Bryden, M. P. Ear preference in auditory perception. Journal of Experimental Psychology, 1963, 65, 103-105.
- Campbell, S. B., Douglas, V. I., & Morgenstein, G. Cognitive styles in hyperactive children and the effect of methylphenidate. Journal of Child Psychology and Psychiatry, 1971, 12, 55-67.
- Campbell, D. T., & Stanley, J. C. Experimental and quasi-experimental designs for research. Chicago: McNally, 1963.
- CELDIC. One million children. Toronto: Crainford, 1970.
- Chomsky, C. The acquisition of syntax in children from 5 to 10. Cambridge: MIT Press, Res. Mono. 57, 1969.

- Chomsky, C. Linguistic development in children from 6 to 10. Cambridge, Mass: Radcliffe Institute, 1971. (ERIC Document Reproduction Service No. ED 059 196)
- Chomsky, N. Aspects of the theory of syntax. Cambridge, Mass: MIT Press, 1965.
- Critchley, M. The dyslexic child. London: Heinemann Medical Books, 1970.
- Davis, W. Q. A study of test score comparability among five widely used reading survey tests. Unpublished doctoral dissertation, Southern Ill. Univ., 1968.
- DeLong, A. R. Diagnosis and treatment of speech and reading problems. Springfield, Ill: Charles C. Thomas, 1964.
- Denny, D. R. Relationship of three cognitive style dimensions to elementary reading abilities. Journal of Educational Psychology, 1974, 66, 702-709.
- Dukes, W. F. N=1. Psychological Bulletin, 1965, 64(1), 74-79.
- Eisenberg, L. Reading retardation: psychiatric and sociological aspects. Pediatrics, 1966, 37, 352-365.
- Forness, S. R., & Esveldt, K. C. Classroom observation of children with learning and behavior problems. Journal of Learning Disabilities, 1975, 8(6), 383.
- Freud, S. The disposition to obsessional neurosis (1913). The Standard Edition of the Complete Psychological Works of Sigmund Freud, 1958, 12, 311-326.
- Fries, C. C. Linguistics and reading. Toronto: Holt, Rinehart & Winston, 1962.
- Gates, A. I., & MacGinitie, W. H. Gates-MacGinitie reading tests. New York: Columbia Univ. Teachers College Press, 1972.
- Geschwind, N. & Levitsky, W. Human brain: right left asymmetries in the temporal speech region. Science, 1968, 161, 186.
- Gibson, E. Reading for some purpose. In J. Kavanagh & I. Mattingly (Eds.), Language by ear and by eye. Cambridge: MIT Press, 1972.
- Gibson, R. J., & Levin, H. The psychology of reading. Cambridge: MIT Press, 1975.
- Goldberg, H. K. Vision, perceptions and related facts in dyslexia. In A. Keeney & V. Keeney (Eds.), Dyslexia-diagnosis and treatment of reading disorders. St. Louis, Missouri: Mosby, 1968.

- Goodman, K. The psycholinguistic nature of the reading process. Detroit: Wayne State Univ. Press, 1968.
- Goodman, K. S. Reading: the key is in children's language. The Reading Teacher, 1972, 25(6), 505-508.
- Guthrie, G. D. Changes in cognitive functioning under stress: a study of plasticity in cognitive controls (Doctoral dissertation, Clark University Worcester, Mass., 1967).
- Hebb, D. O., Lambert, W. E., & Tucker, G. R. A DMZ in the language war. Psychology Today, 1973, 6, 55-62.
- Husson, R. Etude expérimentale des modifications éventuelles de la fourniture vocalique sous l'influence de fournitures auditive stimulatrices concomitantes. Annales de l'Académie des Sciences, March 15, 1957. (Note by P. P. Grasse)
- Jastak, J. F. & Jastak, S. R. The wide range achievement test. Wilmington: Guidance Assoc., 1965.
- Jayarathne, S. Analytic procedures for single-subject designs. Social Work Research and Abstracts, 1978, 14(3), 30-40.
- Johnson, D., & Myklebust, H. Learning disabilities educational principles and practices. New York: Grune & Stratton, 1967.
- Kagan, J., & Kogan, N. Individual variation in cognitive process. In P. H. Mussen (Ed.), Carmichael's manual of child psychology (Vol. 1, 3rd ed.). New York: Wiley, 1970.
- Kephart, N. C. Let's not misunderstand dyslexia. The Instructor, 1968, 78 (Aug/Sept), 62-63.
- Kimura, D. Cerebral dominance and the perception of verbal stimuli. Canadian Journal of Psychology, 1961, 15, 166-171.
- Kimura, D. Left-right differences in the perception of melodies. Quarterly Journal of Experimental Psychology, 1964, 14, 355-358.
- Kinsbourne, M. The minor cerebral hemisphere. Archives of Neurology, 1971, 25, 302-306.
- Kinsbourne, M., & Caplan, P. Children's learning and attention problems. Boston: Little, Brown & Co., 1979.
- Kirk, S. A. Teaching reading to slow learning children. New York: Houghton Mifflin, 1940.
- Kirk, S. A. Behavioral diagnosis and remediation of learning disabilities. Proceedings of the Annual Meeting of the Conference on Exploration into the Problems of the Perceptually Handicapped Child, Vol. 1, 1963.

- Kirk, S. A. Is learning disability another name for educational retardation? Paper presented at the First National Conference on Learning Disabilities, Ottawa, October 1977.
- Klassen, E. The syndrome of specific dyslexia. Baltimore: Univ. Park Press, 1972.
- Klein, G. S. Cognitive control and motivation. In G. Lindzey (Ed.), Assessment of human motives. New York: Holt, Rinehart & Winston, 1958.
- Klein, G. S. Perception, motives, and personality. New York: Knopf, 1970.
- Klein, G. S., & Schlesinger, H. J. Where is the perceiver in perceptual theory? Journal of Personality, 1949, 18, 32-47.
- Lee, L. L. Developmental sentence analysis. Evanston: Northwestern Univ. Press, 1974.
- Lee, L. L., & Canter, S. M. Developmental sentence scoring: a clinical procedure for estimating syntactic development in children's spontaneous speech. Journal of Speech and Hearing Disorders, 1971, 36, 315-340.
- Lenneberg, E. H. Biological foundations of language. New York: Wiley, 1967.
- Loban, W. Language development: kindergarten through grade twelve. Urbana, Ill: NCTE, 18, 1976.
- Meacham, J. A. The development of memory abilities in the individual and society. Human Development, 1972, 15, 205-228.
- McGlannan, F. K. Familial characteristics of genetic dyslexia: preliminary report from a pilot study. Journal of Learning Disabilities, 1968, 1(3), 185-191.
- McNeill, D. Developmental psycholinguistics. In F. Smith & G. Miller (Eds.), The genesis of language. Cambridge, Mass: MIT Press, 1966.
- Michael, J. Statistical inference for individual organism research: mixed blessing or curse? Journal of Applied Behavior Analysis, 1974, 7, 647-653.
- Miller, W. R., & S. M. Ervin. The development of grammar in child language. In U. Bellugi & R. Brown (Eds.), The acquisition of language. Monographs of the Society for Research in Child Development, 1964, 29(1), 9-33.
- Milner, B. Laterality effects in audition. In V. B. Mountcastle (Ed.), Interhemispheric relations and cerebral dominance. Baltimore: John Hopkins Press, 1962.

- Money, John. Reading disability: progress and research needs in dyslexia. Baltimore: The Johns Hopkins Press, 1962.
- Myklebust, H. R. Auditory disorders in children. New York: Grune & Stratton, 1954.
- Myklebust, H. R. The psychology of deafness. New York: Grune & Stratton, 1960.
- Myklebust, H. R. (Ed.). Progress in learning disabilities (Vol. 1). New York: Grune & Stratton, 1968.
- Myklebust, H. R. The pupil rating scale: screening for learning disabilities. New York: Grune & Stratton, 1971.
- Orton, S. T. Reading, writing and speech problems in children (The Salmon Lectures). New York: W. W. Norton, 1937.
- Osgood, C. E. Method and theory in experimental psychology. New York: Oxford University Press, 1953.
- Osgood, C. E. Motivational dynamics of language behavior. In M. R. Jones (Ed.), Nebraska symposium on motivation. Lincoln: University of Nebraska Press, 1957.
- Osgood, C. E., & Miron, M. S. Approaches to the study of aphasia. Urbana: University of Illinois Press, 1963.
- Palermo, D., & Molfese, D. Language acquisition from age five onward. Psychological Bulletin, 1972, 78(6), 409-428.
- Parsons, T. The father symbol: an appraisal in the light of psychoanalytic and sociological theory. Conference on Science, Philosophy and Religion in their relation to the Democratic Way of Life. Symbols and values, an initial study. New York: Harper, 1954.
- Peller, L. E. Language and its prestiges. Bulletin of the Philadelphia Association for Psychoanalysis, 1964, 14, 55-76.
- Penfield, W. & Roberts, L. Speech and Brain-Mechanisms. Princeton: University Press, 1959.
- Proger, B. B. Review of the Pupil Rating Scale: Journal of Special Education, 1975, 7(3), 311-317.
- Rabinovitch, R. D.. Reading problems in children: definitions and classifications. In A. Keeney & V. Keeney (Eds.), Dyslexia-Diagnosis and Treatment of Reading Disorders, St. Louis, Missouri: Mosby, 1968, 1-10.

- Reeves, J. E., & Perkins, M. L. The pupil rating scale: a second look. Journal of Special Education, 1976, 10(4), 437-439.
- Ricks, N. L. Sustained attention and other effects of distraction in underachieving second grade children. Unpublished doctoral dissertation, Boston University, 1974.
- Rutter, M., & Yule, W. The concept of specific reading retardation. Journal of Child Psychology and Psychiatry, 1975, 16, 181-197.
- Santostefano, S. A biodevelopmental approach to clinical child psychology--cognitive controls and cognitive control therapy. Toronto: Wiley & Sons, 1978.
- Santostefano, S., Rutledge, L., & Randall, D. Cognitive styles and reading disability. Psychology in the Schools, 1965, 2, 57-62.
- Sapir, S., & Nitzburg, A. (Eds.). Children with learning problems. New York: Brunner/Mazel, 1973.
- Satz, P. E., Friel, J., & Boebel, R. Some predictive antecedents of specific learning disability: a three year follow up. Bulletin of the Orton Society, 1957, 25, 91-110.
- Schilder, P. Congenital alexia and its relation to optic perception. Journal of Genetic Psychology, 1944, 65, 67-88.
- Shankweiler, D. Developmental dyslexia--a critique and review of recent evidence. Cortex, 1964, 1, 53-62.
- Shapiro, I. F. Cognitive controls and adaptation in children. Unpublished doctoral dissertation, Boston College, 1972.
- Strauss, A. A., & Kephart, N. C. Psychopathology and education of the brain injured child. New York: Grune & Stratton, 1955.
- Strauss, A. A., & Werner, H. Disorders of conceptual thinking in the brain injured child. Journal of Nervous and Mental Diseases, 1942, 96, 153-172.
- Thompson, L. Reading disability: developmental dyslexia. Springfield, Ill: Thomas, 1966.
- Tomatis, A. A. Vers l'écoute humaine (Tome 2). Paris: Les Editions ESF, 1974.
- Tomatis, A. A. Education and dyslexia (Louise Guiney, trans.). Fribourg, Switzerland: AIAPP, 1978. (Originally published in French, 1972.)
- Tomatis, A. A. Audio-psycho-phonology: a new challenge (Teri Brown, trans.). Paper presented during the Symposium of Audio-Psycho-Phonology, Potchefstroom University, April 1980.

- Tomatis, L. A. The assimilation of modern languages (Elizabeth Brooks, trans.). Hastings, England: Battle Instant Print, 1978. (Originally published in French, 1970.)
- Torgesen, J. Problems and prospects in the study of learning disabilities. In E. Hetherington (Ed.), Review of child development research (Vol. 5). Chicago: Univ. Chicago Press, 1975.
- Vogel, S. Syntactic abilities in normal and dyslexic children. Baltimore: Univ. Park Press, 1975.
- Wechsler, D. Wechsler intelligence scale for children--revised. New York: Psychological Corporation, 1974.
- Wepman, J. M., Jones, L. V., Bock, R. D., & Van Pelt, D. Studies in aphasia: background and theoretical formulations. Journal of Speech and Hearing Disorders, 1960, 25, 323-332.
- Wiederholt, J. L. Historical perspectives on the education of the learning disabled. In L. Mann & D. A. Sabatino (Eds.), The second review of special education. Philadelphia: JSE Press, 1974.
- Wiener, W., & Cromer, W. Reading and reading difficulty: a conceptual analysis. Harvard Educational Review, 1967, 37(4), 620-643.
- Witkin, H. A. The perception of the upright. Scientific American, 1959, 200, 50-70.
- Witkin, H. A. Psychological differentiation and forms of pathology. Journal of Abnormal Psychology, 1965, 70, 317-336.
- Woodward, C. A., Santa-Barbara, J., & Roberts, R. Test-Retest reliability of the wide range achievement test. Journal of Clinical Psychology, 1975, 31(11), 81-84.
- Zangwill, O. L. Dyslexia in relation to cerebral dominance. In J. Money (Ed.), Reading Disability. Baltimore: John Hopkins Press, 1962.

Appendix A
PERSONAL CORRESPONDENCE

MCLEAN HOSPITAL

301:

A division of the MASSACHUSETTS GENERAL HOSPITAL

FRANCIS DE MARNEFFE, M.D., DIRECTOR 855-2101
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HENRY J. LANGEVIN, ADMINISTRATOR 855-2104

BELMONT, MASSACHUSETTS 02178
855-2000

December 18, 1975

Ms. Joan M. Roy
University of Ottawa
Child Study Centre
265 Rue Nicholas Street
Ottawa, Canada
K1N 6N5

Dear Ms. Roy:

I will respond in sequence to the various questions you raise in your letter of November 25. I was pleased to learn that you received the materials and have been able to examine them and try them.

We have found that it is appropriate to readminister the tests at different stages during a treatment program. We have done this ourselves on several occasions and the tests have been effective in assessing change in cognitive control functioning. You should expect some learning to take place from one administration to the next. Therefore, you would need to use a different score. That is, you would take the child's pre-treatment measure as the base line and use the change observed following treatment from that base line. Of course, you could also handle the issue of a child's original status before treatment by using the statistic of covariance.

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After you examine these comments and the materials I send you please don't hesitate to be in touch with me. I would like to be as helpful as the distance between us permits in enabling you to use these procedures effectively in your work. Your study sounds very interesting and I will be more than eager to hear about its outcome.

Sincerely,



Sebastiano Santostefano, Ph.D.
Director, Department of Child Psychology,
and Associate Professor,
Harvard Medical School

Appendix B

ASSESSMENT MATERIALS NOT AVAILABLE FROM PUBLISHED SOURCES:

1. The Audiometer
2. Description of Cognitive Control Tests
3. Spontaneous Speech Materials
4. Language Style Scale
5. Age-Grade conversion table of Ottawa
Separate School Board

Audiolaterometer

The audiolaterometer is an electronically balanced device which permits the examiner to control the intensity of the sound fed into each ear. It is used in conjunction with the Electronic Ear which is itself a two channel amplifier matched to feed the two inputs of the audiolaterometer. When the subject speaks into a microphone attached to the Electronic Ear the energy is distributed through to the two earphones of the Audiolaterometer by identically controlled potentiometers, one to each of the ear phones. The amount of energy received in each ear can be controlled by manipulating the openings of the potentiometers. The face of the audiolaterometer contains two controls: one operating input to the left ear; the other for the right ear (Figure 63). If both controls are set at "5" then each ear will receive fifty decibels of feed back when the subject speaks into the microphone. Each control knob has a twelve point scale balanced in such a way that one full step on the scale increases the sound input by ten decibels.

To test for Leading Ear or Auditory Laterality, as it is frequently referred to in APP theory, the subject is seated in front of, and facing the examiner. He is then fitted with a pair of headphones and the microphone, attached to the Electronic Ear is placed in front of him (Figure 64). Microphone input level and volume are adjusted to suit the subject.

Since only the amplification system of the Electronic Ear is being used, all other input or modification systems must be turned down completely. That is:

- Tape Recorder input: 0
- Gating switch: 0
- Delay switch: 0
- Upper channel base: 0
- Upper channel treble: 0
- Lower channel base: 0
- Upper channel treble: 0

Next, the examiner sets both the controls on the audiolaterometer at "5" thereby allowing the subject to hear his own voice at a comfortable conversational level. The examiner then gradually decreases the input to

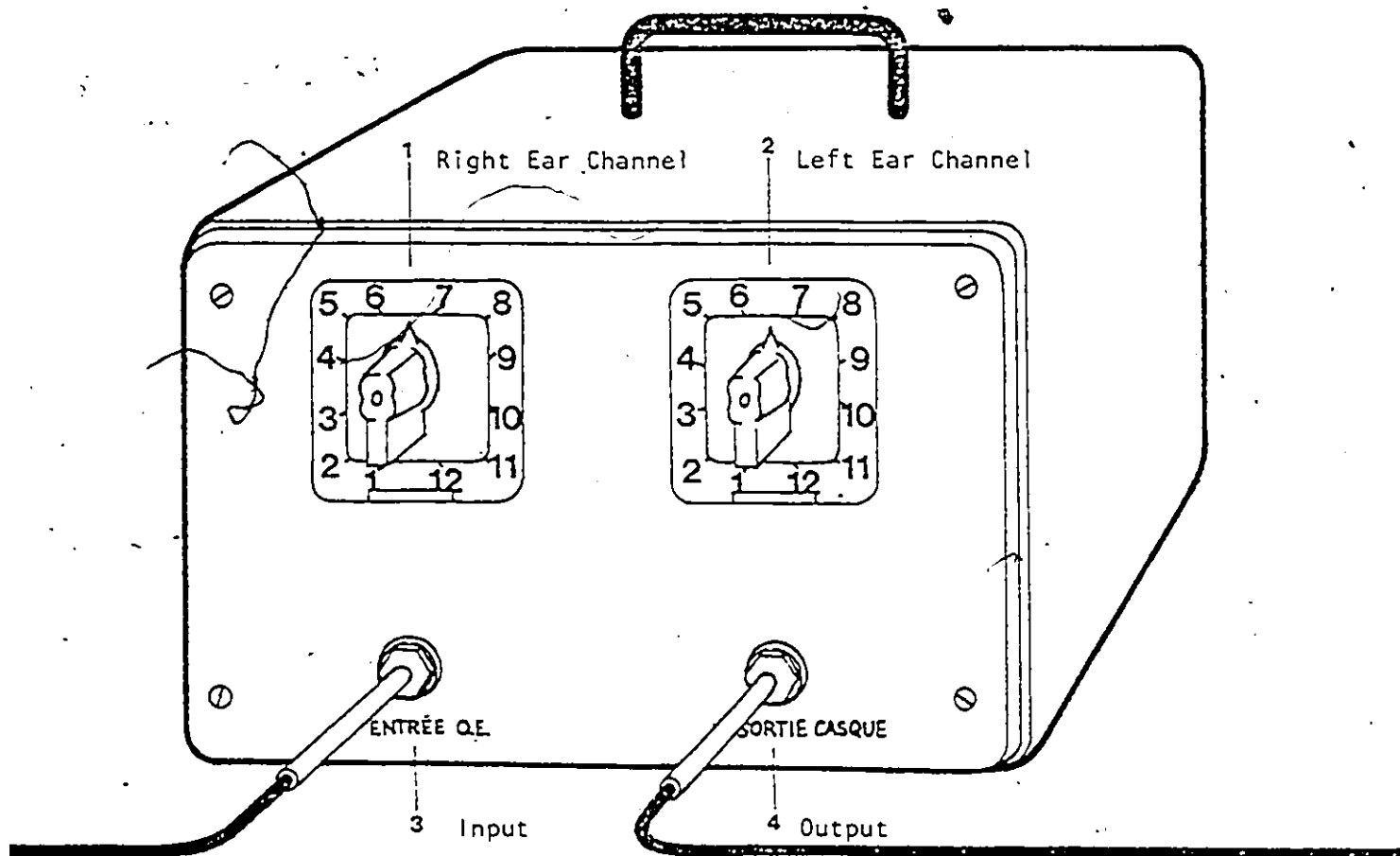


Figure 63. The Audiometer

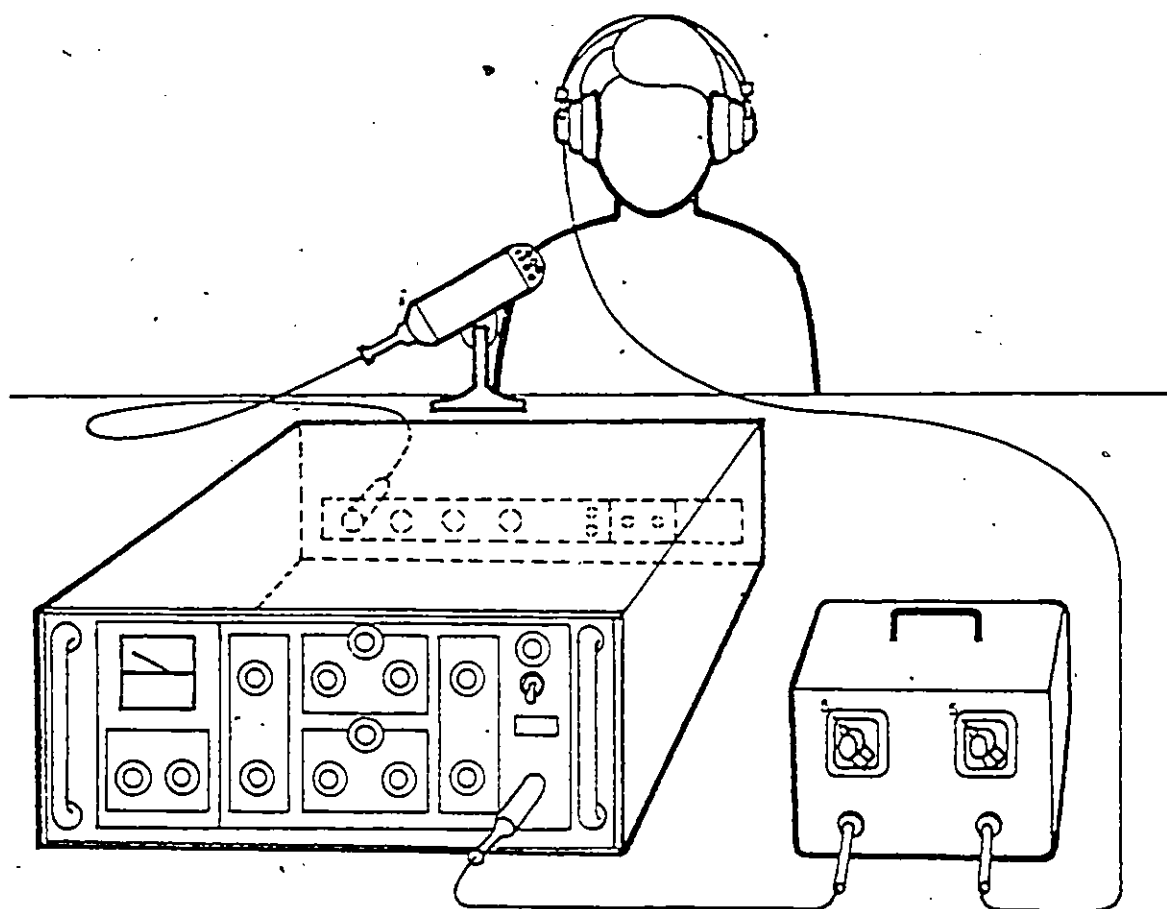


Figure 64. The Audiolaterometer used in conjunction with the Electronic Ear to assess Laterality of Language

the Left ear until such time that the subject gives physical indications of Right ear control. These include such signs as livelier facial expression; subject smiles and appears more relaxed; voice becomes light and modulated; general body posture becomes more erect; respiration is deeper. The difference between the original setting of "5" and the setting at which the Right ear is in control (be that "4", "3", "2", or "1") is a measure of how much the subject is controlling his voice or listening through the Left ear. Therefore we say the subject is -1 in Auditory Laterality if the reporting was at "4"; -2 if it was at "3"; -3 if it was at "2" etc. One never completely removes sound from the Left ear. This is also an indication of how much re-education is necessary before the Right ear will take over the task of monitoring auditory-vocal input and output.

If the subject gives the physical indications of hearing via the Right ear when both ears are initially set at "5", the examiner knows that he/she already has Right control and therefore tries to establish how strong this control is by increasing the input in the Left ear (that is "6"; "7", "8" etc.) until such time as the subject gives evidence of listening with the Left ear by demonstrating such physical signs as: loss of facial expression; voice becomes dull, flat and monotone; posture stoops etc. The difference between the original setting of "5" and the point at which the switch to Left occurs indicates the strength of the Right control. Hence if the change occurs at a setting of "7.5" we say he has +2.5 in Auditory Laterality.

This test takes much observational skill and practice to administer correctly. In this research project it was consistently administered by one of the researchers who had been trained to do so by Dr. Tomatis.

The results of the Audiolaterometry Test are shown in the designated boxes on the Listening Test, a sample of which is shown in Figure 65.

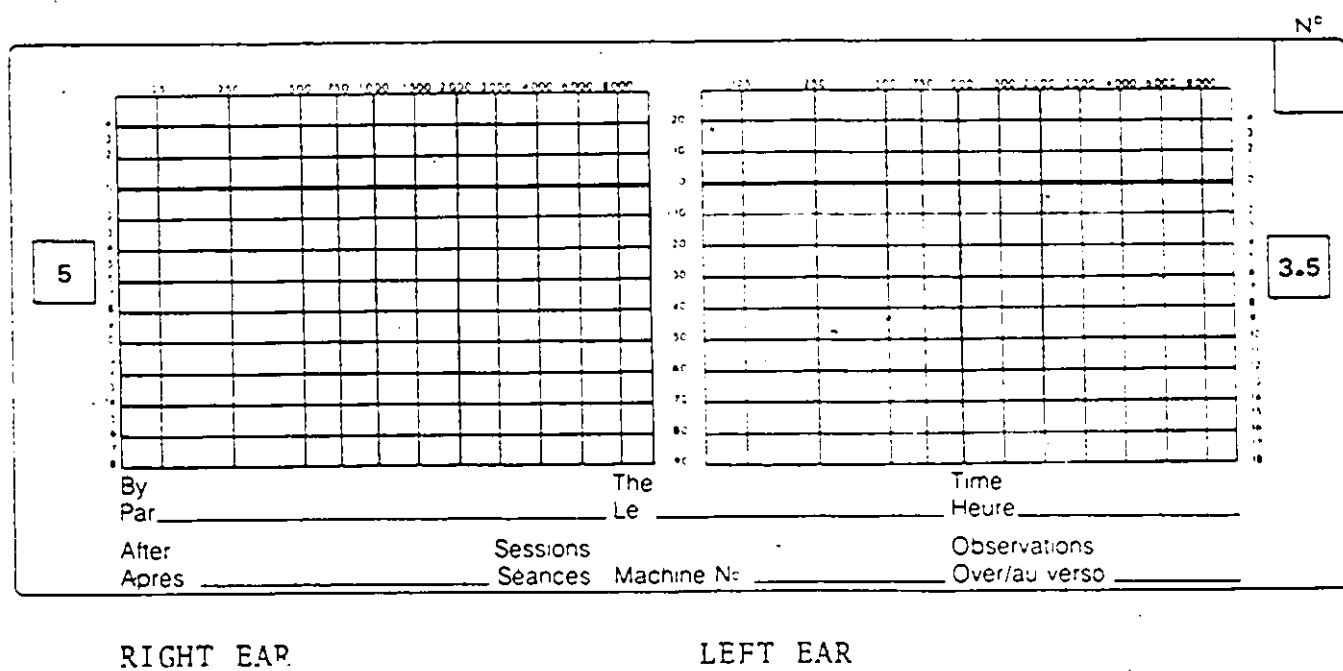


Figure 65. Tomatis Listening Test indicating
a -1.5 in Auditory Laterality

Cognitive Control Tests

The actual tests, together with rules for administration and scoring, are available in Santostefano's 1978 text, pages 421-477. Below is a general description of each of the tests.

Scattered Scanning Test

In this task the child is asked to scan a sheet of paper randomly scattered with geometric shapes and to mark only the circles and crosses. It is assumed that location of the shapes marked will reveal the manner, narrow or broad, in which the child scans. Two scores are derived from the raw data: the number of correct figures marked; and, the total distance traversed, defined by connecting the shapes marked in succession of marking them. The child whose markings are spread over the surface of the page, thereby giving a large distance score, is said to be characterized by active and extensive scanning whereas the child who marks only a few shapes and close together is characterized by passive narrow scanning.

Fruit Distraction Test

This test consists of four ten by fourteen and a half inch cards. Card I has ten rows each of five rectangular colored bars. Card II has ten rows each of five commonly known fruits. The fruits are colored in their natural colors and are the same as the bars on Card I. Card III is identical to Card II except that pictures of common food and non-food items have been placed around the fruits. Card IV has the fruits in the same place as Cards II and III but the colors of the fruit are in contradiction to the regular colors. On three of the four cards the child is asked to name the colors of the items as quickly as he can. On Card III he is cautioned to ignore the distracting pictures and on Card IV he is warned that the fruits are the wrong colors and he is to give the correct color for each. The child is coached with practice cards to ensure that he readily knows the primary colors, the names of the fruits, and the color typical of each. On each card total time to perform the task is recorded. Cards II, III and IV are seen as supplying a certain amount of

distracting information; Card II by formulating the colors into specific shapes; Card III by supplying geographical distractions (distractions in close vicinity to the expected pictures); and Card IV by content distractions (natural content is changed by false coloring of the fruit). Amount of distractibility is calculated by the difference in seconds between Card I and Cards II, III and IV and also between Card II and Cards III and IV when Card II is taken as the basic fruit card.

Leveling-Sharpening House Test

This test consists of sixty two-dimensional line drawings of a house each printed on a separate card. The cards are presented one at a time and are visible by the subject for five seconds before the next presentation is given. Elements of the house scene are omitted every fourth picture until nineteen items have been omitted. The child is asked to examine each card as carefully as possible and to tell the examiner to stop the display whenever the picture changes or looks different in any way. When the child requests that the presentation be stopped, the examiner conducts an enquiry to discover what about the picture looked different. The child's response is recorded and the presentation continues until all sixty pictures have been dealt with. Children who detect changes early in the series, report many changes, and report the change immediately or soon after it is presented are said to be maintaining stable differentiated images in memory over time. They are also keeping present information articulated from past information. Such children are referred to as Sharpeners. Levelers are those who detect few changes and usually long after they have been introduced. They are said to have global, fluid images in memory over time. They are also keeping present information articulated from past information. Such children are referred to as Sharpeners. Levelers are those who detect few changes and usually long after they have been introduced. They are said to have global, fluid images in memory over time and they tend to fuse present with past information. The important scores recorded for this test are: a) the number of the card on which the child first reports a change; b) the number of changes observed; c) the Leveling-Sharpening Ratio; and d) any incorrect changes.

Object Sort Test

Forty six items are placed on the table in front of the child. The instructions emphasize that there are no right or wrong answers; that the child may form many or few groups; that he may place as many or as few objects as he wishes in each group; that he should try to find a place for each object; and, that some objects may be left out of groups. To evaluate the child's performance Santostefano (1978) has evolved a scoring system to distinguish between typical and atypical groups in terms of content of the groups in combination with the reason for the group as stated by the child. The system then distinguishes between levels of abstraction represented by the typical groups.

Spontaneous Speech Materials

The five children in this study were basically of two different age groups. The younger group (Andrew, Francis and Hugh) were in grade two at the commencement of this research project. Darryl and Ernest, the two older boys, were in grade three. At times it was considered expedient to use different materials for the two age groups. In testing sessions, where this was deemed necessary, the materials have been headed "Younger Group" and "Older Group". The materials used in the various testing sessions are listed below.

December 1975

Pictures

1. Young boy bent over observing bird tracks in the mud.
2. Winter valley scene where three young children are playing with sleds on a snow covered road.
3. Summer scene of children happily playing in and around a swimming pool.
4. Two young lads attempting to repair a bicycle on a desolate road.
5. A solitary boy playing with toy dinosaurs on a rocky surface.

Problem Situations

Younger Group:

Bowling Game. You have brought two friends home from school with you to play with your new bowling game. The three of you get all the pins arranged and are ready to start playing but you cannot find the little bowling ball. What will you do?

Christmas Shopping. You were Christmas shopping with your family, at the Shopping Center. You were all walking around the Shopping Center together when you stopped for a few seconds to look in a store window. When you turned back you could not see the family. What would you do?

Babysitter. You and your little sister are being looked after by a babysitter because your mom and dad have gone out to a Christmas Party. Your sister is supposed to go to bed at 7:30 but when the babysitter tells her it is bedtime she starts to

cry and says she wants your mom and dad. She seems very unhappy. How could you help the babysitter?

Older Group:

Christmas Lights. Many people put fancy colored lights on their windows and Christmas trees at this time of the year. This makes the streets and homes look cheerful and happy but at the same time we know that we use too much electricity and that in the future we will not have the resources for the electricity we need. What could we do now to save electricity and still have cheerful happy looking homes at Christmas?

Bicycle Hike. You and your friend planned a bicycle hike for Saturday. At a small roadside park you stopped to cook your hot dogs and to have a nice restful lunch break. Just as the fire was ready for cooking the weiners, it started to pour rain. What would you do?

Overnight Camping. You and a friend went on an overnight camping trip. You packed everything you thought you might need for supper, breakfast and to sleep overnight then your friend's dad drove you out to the campsite. After his dad left, you got supper organized and while it was cooking you both worked at putting up your small pup tent but to your great surprise you discovered that you had forgotten the poles for the tent. What would you do?

Toys

A selection of small table top toy vehicles.

February 1976

Pictures

Younger Group:

1. A group of young boys involved in a baseball game.
2. The picture implies a family scene of a mother and three children ranging from approximately three to eight years. The mother is helping the older boy read while she folds the laundry. A second child is looking on, while the third seems more self absorbed.

3. A group of children playing on a Jungle Gym in a park or school yard.

4. A group of children involved in a class discussion with the teacher.

5. Two children peering out of the window on a very rainy day.

Older Group:

1. A baseball scene taken at home base where one lad is attempting to arrive ahead of the "catch". The umpire is obviously very intent.

2. (same as 2 above)

3. (same as 3 above)

4. A classroom scene in which the students appear to be planning a party with their teacher.

5. A boy and a girl standing outside of a large vehicle obviously very deeply absorbed in a discussion.

Problem Situations

Younger Group:

Building a Model. You received a Model as one of your Christmas presents. It is Sunday afternoon and you have nothing to do so you invite your friend to your house to help you build the Model. Before it is finished you run out of glue. What would you do?

Skating Rink. You have two friends who live just a couple of blocks from your house. You planned to meet these friends at the skating rink near your house. They wanted to stop at the store to buy a candy bar on their way to the rink so you said you would meet them on the rink. You have been skating around for quite awhile and your friends have not come yet. What will you do?

Bicycle Purchase. There is a fifty dollar bicycle in the catalogue that you would like to get this Spring but your parents have said they will not pay more than thirty five dollars for a bicycle. How could you earn the extra fifteen dollars between now and April?

Older Group:

Skating on the Canal. You were skating on the canal one Saturday afternoon with a friend. Your dad was to pick you up at the shack near the Chateau Laurier at 3:30. You and your friend were ten minutes late getting to the shack. When you finally got there your dad was not around. What would you do?

Skating Party. You would like to have a skating party with some friends. Your mom and dad said that this would be fine as long as you plan your party carefully and discuss your plans with them. How would you plan your party?

Bicycle Purchase. There is a special bicycle that you want for this summer but it costs eighty five dollars and your parents have said they will not pay more than fifty or fifty five dollars for a bicycle. How could you get the extra thirty or thirty five dollars for a bicycle between now and April?

Toys

A selection of toy cars, airplanes and other vehicles.

April 1976

Pictures

Younger Group:

1. A man and a boy talking to a dog in a kennel.
2. Three children and a dog romping on a sofa as a woman sits at one end.
3. A young lad leaning up against a post looking rather forlorn. The weather appears wet and dreary.
4. A baseball scene involving young children.
5. Two boys walking along the railroad tracks which are traversing a body of water.

Older Group:

1. (same as 1 above)
2. (same as 2 above)
3. (same as 3 above)

4. Two men perched on the edge of the Grand Canyon gazing and pointing into the distance.

5. (same as 5 above)

Problem Situations

Younger Group:

Lost Money. Your mom gave you three quarters to go to the store for a quart of milk. On the way you stopped to play with a friend for a few moments on the Monkey Bars. When you finally got to the store you discovered that you had only two quarters in your pocket. What would you do?

The Game. You have three friends who live close to you. Every week end the four of you play together. Today you get together to play; you want to play hockey but the other three want to play baseball. What would you do?

The Birdhouse. You saw a really nice bird house for ten dollars which you would like to have for the backyard. Your parents do not want to spend money on a bird house and you have only four dollars. How could you get a birdhouse?

Older Group:

Lost Money. Your mom gave you a dollar bill and two quarters to go to the store for a loaf of bread and a quart of milk. On the way you met a friend and stopped to play with him for a few moments on the Tumbling Bars in the park. When you finally got to the store you discovered that you had only the dollar bill in your pocket. What would you do?

The Birdhouse. (see above)

The Movie. Your parents gave you permission to go downtown to a special movie on Saturday afternoon because they knew you were going with two friends so together you could find your way and help each other if anything should happen. You were to meet your two friends at 2:15 at the bus stop. It is now 2:30 and your friends have not arrived. What will you do now, because the movie starts at 3:00 p.m. and it takes twenty minutes to get there?

Toys

A selection of soldiers and Indians with their appropriate equipment and vehicles.

June 1976

Pictures

1. A family like scene involving two adults, six children and a dog. All are involved in dragging along a large fir tree.
2. A living room scene, in a very elegant Victorian type house, of an elderly woman reading a story to two small children.
3. A small girl sitting on a chair with two stuffed toys in her arms.
4. A rodeo scene where a rather elderly cowboy is demonstrating the use of a lasso to eight young children.
5. A baseball player ready to hit the ball.

Problem Situations

Television Conflict. You and two friends had planned to have a picnic lunch out in the field but it started to rain so your mom said you and your friends could eat lunch and play at your house. The three of you wanted to watch television but you each wanted to watch different programs. What would you do?

Bicycle. You were out riding your bicycle and were several blocks from home when suddenly your bicycle chain broke. What would you do?

Fort. You and a friend made a fort in the field near your home.

Two days later when you and your friend went to play in the fort you found two other boys, whom you did not know, playing in the fort. What would you do?

Toys

A second selection of toy soldiers and Indians.

August 1976

Pictures

1. Two young children very obviously having fun playing with two stuffed animals on a large bed.

2. Lady and two children shopping in a grocery store. They have stopped to look at film--all three are intently involved.

3. A young boy, rather dressed up, standing on some kind of a construction much like a boat pier.

4. Three boys, on a home made raft, going down river in a thickly swamped area.

5. Two Olympic runners participating in a race.

Problem Situations

Homesick Boy. One boy in your group at camp is new. He is often in tears and complains that he wants to go home. How could you help him?

Cheating Friend. You were invited to your friend's house to play and stay for supper. You were playing a card game with him (a game like Fish) but he kept on cheating. What would you do?

Overnight Hike. Your group would like to go on an overnight hike. Your senior counsellor said that it would be fine as long as you made good plans and told him about them first. How would you plan your hike?

Toys

Emergency vehicles; small soldiers and Indians; RCMP and cowboys.

October 1976

Pictures

1. Family type scene where two adults and two children are camping by a lake. It appears to be a beautiful day. The table is laden with food and the father is busy cooking hamburgers.

2. A kitchen where a woman is working at the sink while a young lad helps a much younger boy organize his cereal. There's a variety of food in the kitchen.

3. A small boy and girl are sitting together in an armchair made of natural rough wood. The chair appears to be on a sandy beach. Both children are clutching stuffed toys.

4. A canoe carrying a boy, a man and some luggage, is passing through very rough water. The countryside appears to be dense woods.

5. A downhill skier lifting up into the air at the edge of a rocky precipice.

Problem Situations

Team Spirit. There is one boy on your Soccer Team who does not seem to have very much team spirit. When he is in the game he never kicks the ball when it comes near him and he does not seem to care whether your team wins or loses. How could you help this boy learn to be a better team member?

Shopping with Dad. You are out shopping with your dad one Saturday and you see a model racing car that you would love to have. You know your dad will not just buy the model for you, so what could you do to get that model?

Lost on Bike. You and a friend went for a bike ride one Saturday afternoon. You had been driving along for an hour or so and decided it was time to head back for home. You then realized that you were lost; you didn't know which way you had come. What would you do?

Toys

A selection of city type buildings and scenery; cavalry soldiers; RCMP; and extra vehicles.

December 1976

Pictures \

1. Family type scene where the mother, father and daughter are lugging a large tree planted in a wicker basket. The basket is broken. A young boy is carrying another plant. All are laughing heartily.

2. A young boy is being aided by an older girl as he prepares to brush his teeth.

3. Two children horseback riding at the edge of a field on a beautifully clear autumn day.

4. A young girl and a man are downhill skiing on a lovely winter day. All of the surroundings are covered with snow.

5. A Rodeo scene in which a cowboy has just managed to get a lasso over a young bull's head.

Problem Situations

Mom's Christmas Present. It is one week before Christmas. You see a lovely necklace in a store which you know your mother would like. You want to get it for her for Christmas but it costs \$6.95 and you only have \$3.00 left in your Christmas money. What would you do?

The Forts. You and three other friends are outside playing in the snow. You all agree that it would be fun to divide into two groups; each group build a snow fort and have a war. Everything starts off very friendly throwing snowballs at each other's fort. Then suddenly your two friends in the other fort get very rough and start breaking your fort and really trying to hurt you. What would you do?

Shopping Center. Your dad took you and a friend Christmas shopping. When you got to the Shopping Center you and your friend left your dad and went to do your own shopping. You agreed to meet your dad at the main door of the Shopping Center at three o'clock. You didn't get to the door until ten after three. You couldn't see your dad anywhere. What would you do?

Toys

{ Barn, farm animals and tractors together with various houses and city buildings; small cars, police and average people; general country and city scenery.

March 1977

Pictures

1. A scene depicting a family moving. The two adults are looking eagerly at a letter held by the woman. The gentleman is carrying an armful of items. Two children and a dog appear to be having a discussion in the background. Two men are attempting to move a piano off the truck.

2. A young lad is standing in front of an open screen door. He has an arm full of books and is carrying a lunch pail.

3. Four children and a man (all in pyjamas) are playing on a large bed. All appear to be having a good time.

4. A man, dressed in leather jacket and a cowboy hat, is standing there holding several pieces of harness.

5. An elderly man is sitting with a young boy on the edge of a boat pier. A dog is eating at their feet. The background has a large fishing boat and an old house built on stilts over the water.

Problem Situations

Wedding Anniversary. It is your parents' Wedding Anniversary in two weeks and you would like to do something very special for it. What could you plan to do?

Museum Trip. Your dad has promised to take you and three friends to a museum one day during the School Break. Two of you want to go to The Museum of Science and the other two want to go to The Museum of Man. What would you do?

Accident on Ice. You and a friend went skating on the canal. You had skated half way down the canal when your friend fell and hurt his leg. What would you do?

Toys

A selection of Cavalry soldiers; RCMP; army equipment; plus, vehicles and buildings.

Scale used for the Assessment of Language Style

CONTENT:

DESCRIPTIVE (names or lists of objects and persons present in the picture)	1 2 3 4 5 _____	DYNAMIC (formulates a dynamic imaginative story which encompasses the main items in the picture)
DISORGANIZED (hazy, disconnected or poorly organized thoughts; global ideas; overuse of pronouns and vague action words)	1 2 3 4 5 _____	ORGANIZED (coherent, deliberate, organized thoughts; states an opinion with ideas carefully spelled out)
UNREALISTIC (unconventional, unusual in story content)	1 2 3 4 5 _____	REALISTIC (conventional and plausible)

PERSONAL:

EGO CENTRIC (very subjective; goes ahead with own thoughts without consideration for listener, the task or picture content)	1 2 3 4 5 _____	SOCIAL (gives the impression of being part of a two-way conversation; integrates his experience with the picture and the examiner's statements)
OTHER DIRECTED (examiner must use many directing questions before child completes the task)	1 2 3 4 5 _____	SELF DIRECTED (completes task without need of guidance from examiner)

VOICE QUALITY:

HALTING (slow in response; hesitant in statements)	1 2 3 4 5 _____	FLUENT (ready with response; story flows easily and smoothly)
MONOTONE (dull, flat, lifeless, expressionless)	1 2 3 4 5 _____	EXPRESSIVE (lively, energetic, vivid, rhythmic)
MUMBLED (blurred, muffled)	1 2 3 4 5 _____	DISTINCT (clearly articulated)

The Approximate Mean Age-Grade Table
Stated in Years and Months

	SEPT.	OCT.	NOV.	DEC.	JAN.	FEB.	MARCH	APR.	MAY	JUNE
GRADE	1	2	3	4	5	6	7	8	9	10
K	5-3	5-4	5-5	5-6	5-7	5-8	5-9	5-10	5-11	6-0
1	6-4	6-5	6-6	6-7	6-8	6-9	6-10	6-11	7-0	7-1
2	7-4	7-5	7-6	7-7	7-8	7-9	7-10	7-11	8-0	8-1
3	8-5	8-6	8-7	8-8	8-9	8-10	8-11	9-0	9-1	9-2
4	9-5	9-6	9-7	9-8	9-9	9-10	9-11	10-0	10-1	10-2
5	10-6	10-7	10-8	10-9	10-10	10-11	11-0	11-1	11-2	11-3
6	11-5	11-6	11-7	11-8	11-9	11-10	11-11	12-0	12-1	12-2
7	12-5	12-6	12-7	12-8	12-9	12-10	12-11	13-0	13-1	13-2
8	13-5	13-6	13-7	13-8	13-9	13-10	13-11	14-0	14-1	14-2
9	14-4	14-5	14-6	14-7	14-8	14-9	14-10	14-11	15-0	15-1
10	15-4	15-5	15-6	15-7	15-8	15-9	15-10	15-11	16-0	16-1

Form A.C. 7
Auxiliary Education Services Division
Special Educational Services Branch.

Appendix C

TRAINING INSTRUMENT:

The Electronic Ear

The Electronic Ear

The Electronic Ear (EE) is an electrical apparatus, built by Dr. Alfred Tomatis, to facilitate listening and the development of language laterality. It basically consists of two channels, joined by an electronic relay and a set of electronic gates, used to open up and stimulate the Right ear. Microphone, earphones and amplifiers work on both channels. The sound source for the EE is either a specific high quality tape played on an equally high quality tape recorder or, in some parts of the training, the subject's own voice.

While the machine itself is fully automatic it must be programmed by a qualified person trained to operate the EE in accordance with the various psycho-physiological stages that occur in any specific individual's APP training program.

The purpose of APP training via the EE is to modify a person's way of hearing and consequently his way of speaking. It is an audio-vocal conditioning that forces the ear to accommodate so that the subject will hear in a way that is typical of a specific language and produce corresponding vocal patterns. Such alterations in listening are accomplished by using filters which can be made to effect bass and/or treble sounds. The bass filter can heighten or lessen the relative intensity of frequencies from 50 to 800 Hz along a continuum. The treble filter effects frequencies from 2,000 to 16,000 Hz. Frequencies between 800 and 2,000 Hz are only slightly modified by the EE system.

A schematic drawing of the process that the voice goes through as it travels from mouth or tape, through the EE and back to the ears is presented in Figure 66a. A microphone (M) feeds an amplifier from which two different circuits flow. These circuits provide two channels which do not function simultaneously. When the EE is switched on, Channel 1 (the lower channel) alone is open and the subject is exposed to the high bass low treble curve which puts the ear in a state of complete relaxation. When a sound is emitted either by the subject or from a recorded tape, as soon as it adds complementary intensity to the pre existing ambient noise, Channel 1 closes and Channel 2 is opened. This second electronic channel forces the ear into the low bass high treble listening curve. The opening

of Channel 2 is done by a gate system so that it is possible to change automatically from ones ordinary or habitual way of hearing to the way of hearing imposed by the settings of the EE set to produce the curve of the subject's native language.

When the sound emission terminates the consequent reduced intensity switches the system over the other way and Channel 1 opens while Channel 2 cuts out. The cycle restarts everytime the subject speaks. For most of our therapeutic purposes, although there are some exceptions, the bottom channel is set at maximum bass and minimum treble while the top channel, Channel 2, is set at minimum bass and maximum treble.

With the aim of afterwards modifying the rhythm and intonation of the native language, the operating times of the gate are chosen to correspond with the characteristic latency time of the language being studied. That is, each language has its own average emission time per syllable: 0.15 for French; 0.20 for English and so on.

The equilibrium control (see Figure 66b) reduces, by decrements of 20%, the intensity of input arriving at the Left ear. In therapy the intensity is gradually reduced (but never completely omitted) so that the subject gradually builds up control of speaking and listening through the Right ear.

While Figure 66a schematically depicts the process involved in using the EE, Figure 66B shows the equipment ready for use.

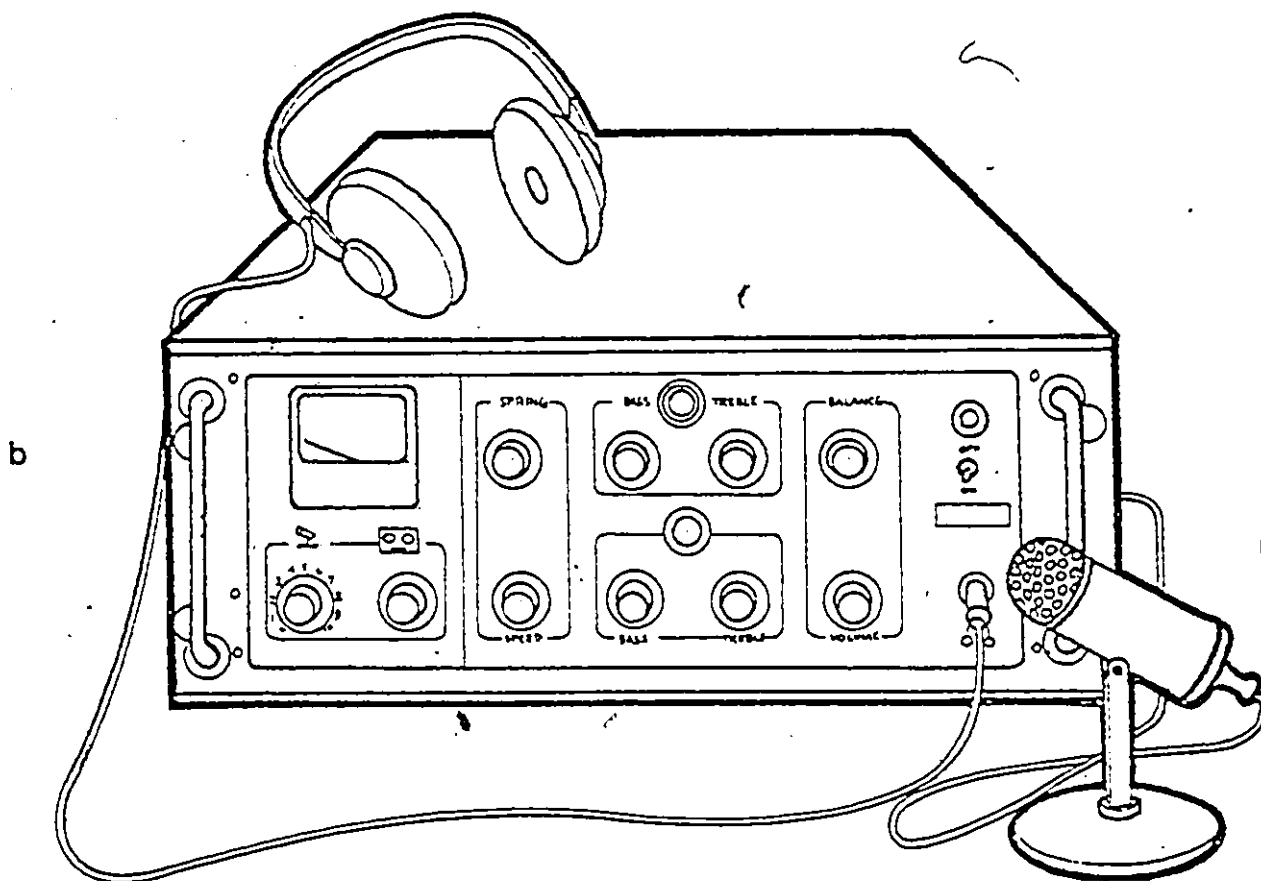
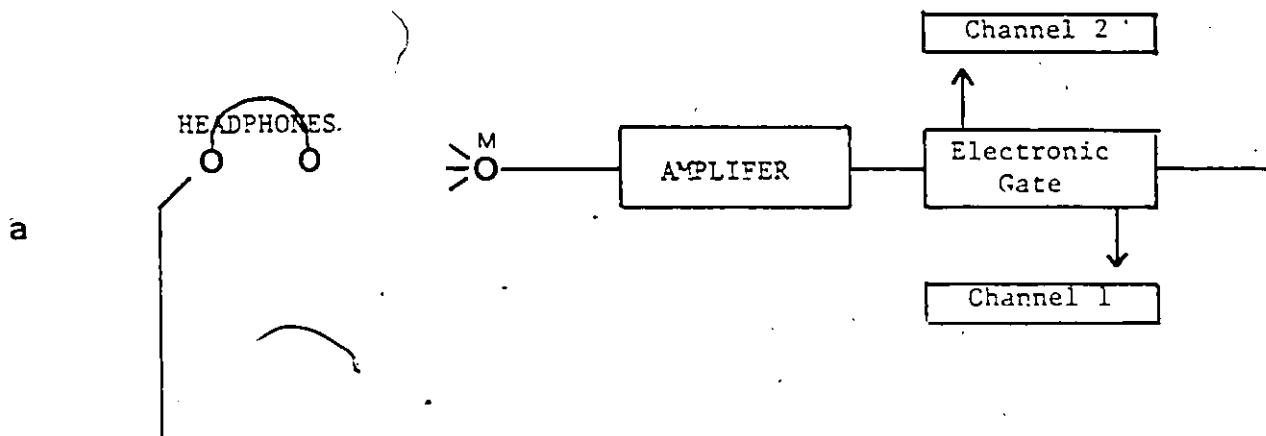


Figure 66. The Tomatis Electronic Ear
 a. Schematic drawing of its operation
 b. The instrument itself