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Neuropsychological Predictors of Socioemotional Disturbance in Young Reading-Impaired Children

by

Maureen E. Wass

B.A., University of Winnipeg, 1989

A Thesis
Submitted to the Faculty of Graduate Studies through the Department of Psychology in Partial Fulfilment of the Requirements for the Degree of Master of Arts at the University of Windsor

Windsor, Ontario, Canada

1991
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ABSTRACT

The purposes of the present investigation were to study the relationship between reading impairment and socioemotional functioning and to consider the predictive validity of neuropsychological tests of linguistic functioning for socioemotional subtype. The subjects consisted of 274 clinic-referred children. Two groups of these children were compared on a number of neuropsychological linguistic tests, the WISC, the WRAT, the PPVT and the Children's Word Finding Test, as well as on their characteristic profiles on the Personality Inventory for Children. One group was defined as reading-impaired (on the basis of WRAT scores for Reading and Spelling), and the remaining children served as controls. Children in the reading-impaired group were found to comprise a significant proportion of the Normal socioemotional subtype, while no group differences were noted for the six other subtypes identified. Neuropsychological linguistic measures of pure language functioning (Speech Sounds Perception, Auditory Closure, Sentence Memory, and Verbal Fluency) were found to be the best predictors of psychosocial subtype, and all linguistic tests were adequate predictors of group membership. It was concluded that, for young children, reading impairment is not necessarily associated with psychosocial dysfunction, and higher reading and spelling scores were more likely to be linked to more severe forms of psychopathology.
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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABSTRACT</td>
<td></td>
<td>iv</td>
</tr>
<tr>
<td>ACKNOWLEDGEMENTS</td>
<td></td>
<td>v</td>
</tr>
<tr>
<td>LIST OF TABLES</td>
<td></td>
<td>ix</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td></td>
<td>x</td>
</tr>
<tr>
<td>Chapter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Learning Disabilities and Socioemotional Disturbances</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Reading Disabilities and Socioemotional Disturbances</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Subtypes of Reading-Impaired Children and Socioemotional Disturbance</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Summary</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Neuropsychological Analysis</td>
<td>11</td>
</tr>
<tr>
<td></td>
<td>Neuropsychological Test Validity and Reliability</td>
<td>12</td>
</tr>
<tr>
<td></td>
<td>Social Competence</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Reading Impairment and Social Competence</td>
<td>17</td>
</tr>
<tr>
<td></td>
<td>Rationale for Present Study</td>
<td>19</td>
</tr>
<tr>
<td></td>
<td>Hypotheses</td>
<td>20</td>
</tr>
<tr>
<td>II</td>
<td>METHOD</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Subjects</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Measures and Procedure</td>
<td>23</td>
</tr>
</tbody>
</table>
III RESULTS

Overview

Mean Values for Neuropsychological Variables

Comparison to Known Subtypes

Rank Ordering of Subtype by Severity of Psychopathology

Examination of Possible Cohort Effect

Prediction of Reading Group by Neuropsychological Variables

Prediction of Socioemotional Subtype by Neuropsychological Variables

Multivariate Analysis of Variance

Group Differences on Neuropsychological Variables

Group Differences on PIC Scales

Subtype Differences on Neuropsychological Variables

Subtype Differences on the WRAT

IV DISCUSSION

Performance of Reading-Impaired Children and Controls on Neuropsychological Linguistic Variables

Socioemotional Characteristics of Reading-Impaired and Control Subjects

Use of the WRAT as a Criteria for Classification of Learning-Disabled Children

Predictive Accuracy of Neuropsychological Linguistic Variables for Socioemotional Subtype

Socioemotional Subtype Performance on
the WRAT

The Utility of the PIC "Cognitive Triad" in Differentiating Reading-Impaired Children from Non-Reading-Impaired Children

Implications of the Research Findings

Limitations of the Study

Recommendations for Future Research

REFERENCES

APPENDIX

A

STANDARD DEVIATIONS FOR MEAN VALUES OF NEUROPSYCHOLOGICAL VARIABLES

B

SEVEN PROTOTYPIC SOCIOEMOTIONAL PROFILES ON THE PERSONALITY INVENTORY FOR CHILDREN

C

PROFILE MATCHING ALGORITHM

VITA AUCTORIS
LIST OF TABLES

Table                      | Page
---------------------------|-----
1  Means for Neuropsychological Variables and Age by Group | 29  
2  Means for Neuropsychological Variables and Age by Subtype | 30-31 
3  Socioemotional Subtype Classification by Profile Matching | 33  
4  Mean Percentages of Reading-Impaired and Control Subjects Within Mild, Moderate, and Severe Groups of Psychopathology | 36  
5  Between-groups Canonical Loadings for the Canonical Function Predicting Socioemotional subtype and Group Membership Using Linguistic Variable Scores | 39  
6  ANOVA Summary for Significant Differences Between Groups (Reading-Impaired and Controls) for Neuropsychological Variables | 42  
7  ANOVA Summary for Significant Differences Between Groups on PIC Scales | 43  
8  Scheffe's Test Post-Hoc Comparisons for the Effect of Group Membership on PIC Scales | 45  
9  ANOVA Summary for Significant Differences Between Subtypes for Neuropsychological Variables | 46  
10 Bonferroni T-Test Post-Hoc Comparisons for the Effect of Subtype Membership on Neuropsychological Variables | 47  
11 Mean WRAT Reading and Spelling Centiles Within Mild, Moderate, and Severe Groups of Psychopathology | 51  

ix
<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Percentage of Reading-Impaired and Control Subjects Within Three Degrees of</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Severity of Psychosocial Dysfunction</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Mean WRAT Reading and Spelling Percentile Scores for All Socioemotional</td>
<td>49</td>
</tr>
<tr>
<td></td>
<td>Subtypes</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Mean WRAT Reading and Spelling Centile Scores for Mild, Moderate, and Severe</td>
<td>52</td>
</tr>
<tr>
<td></td>
<td>Forms of Psychopathology</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER I
INTRODUCTION

There is general agreement that language skills are critical for success in school, and that deficits or delays in these skills are commonly noted in children with reading and learning disabilities. Research on reading disabilities has an extensive history of confusing and conflicting results, as well as opposing views and theoretical orientations (Applebee, 1971). There are multiple explanations for this, but it may be concluded that a basic reason for the confusion is the lack of agreement regarding terminology and definitions of the reading-disabled child. Traditional research in the reading disabilities area has relied on vague taxonomic definitions such as that provided by the World Federation of Neurology for "specific developmental dyslexia:"

A disorder manifested by difficulties in learning to read despite conventional instruction, adequate intelligence, and socio-economic opportunity. It is dependent on fundamental cognitive disabilities which are frequently of constitutional origin (Critchly, 1970, p.11).

Additionally, reading-disabled and learning-disabled subjects vary along a wide variety of cognitive, social, behavioral, and academic dimensions (Morris, Blashfield, & Satz, 1986). Large within-group variance can obscure differences between groups, and may reflect different "subtypes" within a sample. The literature correlating emotional and behavioral functioning would suggest that learning-disabled (LD) children,
in general, interact interpersonally in a very different manner than their normally achieving peers. Compared to normally achieving children, children with learning-disabilities may be described as follows: They are (1) perceived as less pleasant and desirable by their parents, teachers, and peers; (2) the recipients of more negative communications from their parents, teachers, and peers; (3) ignored and rejected more often by their teachers; (4) treated in a more negative and punitive way by their parents; and (5) likely to reside in a family environment that resembles that of emotionally disturbed children (Rourke, 1988).

LEARNING DISABILITIES AND SOCIOEMOTIONAL DISTURBANCE

Several investigators have attempted to conduct controlled studies of the hypothesized relationship between learning disabilities and socioemotional disturbance. The assumption that learning-disabled children may be prone to developing a particular pattern of emotional dysfunction is necessarily tempered by the fact that recent neuropsychological evidence suggests that LD children are not homogeneous with regard to socioemotional abilities (Porter and Rourke, 1985). These authors chose to address this issue by applying a multivariate statistical subtyping technique, Q-factor analysis, to the Personality Inventory for Children (PIC; Wirt, Lachar, Klinedinst & Seat, 1977) scores of 100 learning-disabled children. The resulting factor pattern revealed four subtypes; these subtypes
were further analyzed in terms of the mean PIC profiles displayed by the subjects within each.

The first and largest subtype (37 subjects) was characterized by no elevations on the PIC scales reflecting socioemotional disturbance and could be regarded as a normal, well-adjusted profile. The parent-respondents of this group of children displayed primary concern with the cognitive development and academic functioning of these children. The PIC profile of the second subtype (20 subjects) was suggestive of seriously disturbed socioemotional functioning best characterized as "internalized" (e.g., symptoms indicating depression, withdrawal, and anxiety). The third subtype (18 subjects) had a mean PIC profile suggesting "externalized", hyperkinetic behavior dysfunction. The fourth and smallest subtype (10 subjects) was comprised of children with relatively normal psychosocial adjustment with evidence of a number of somatic complaints. From these data it was concluded that the personality characteristics of learning-disabled children are heterogeneous and that not all learning-disabled children exhibit emotional disorders.

Utilizing Q-factor analysis, four hierarchical-agglomerative clustering techniques, and one iterative partitioning technique, Fuerst, Fisk, and Rourke (1969) found excellent correspondence between the above subtypes, derived from all grouping methods. The subjects were a new sample of learning-disabled children, defined by the same criteria. Thus these subtypes can be reliably recovered from samples of learning-disabled children and
are replicable.

Speece, McKinney, and Applebaum (1985) also employed hierarchical cluster analysis to identify seven distinct behavioral subtypes of 63 school-identified learning-disabled children (approximately seven years of age). The Classroom Behavior Inventory (CBI; Schaeffer, Edgerton, & Aronson, 1977), a teacher rating instrument completed by classroom teachers, was the measure used for clustering. Speece et al. (1985) demonstrated that these seven behavioral subtypes differed from one another, as well as from those evident among normal achieving controls. It was also apparent that approximately one third of the learning-disabled children classified displayed profiles that were normal. More serious subtypes such as those characterized by withdrawal, conduct disorder, and other pervasive behavior problems were described. Both these normal and dysfunctional behavioral subtypes are similar to those described by Porter and Rourke (1985). A three-year longitudinal investigation of 47 of these children suggested some stability of the subtypes, with some degree of change in subtype membership over time (McKinney & Speece, 1986).

READING DISABILITIES AND SOCIOEMOTIONAL DISTURBANCE

It has been commonly reported that linguistic difficulties are accompanied by emotional and behavior problems (Kline, 1986). The precise nature of the relationship is unknown. One hypothesis is that the behavior problems arise as a consequence
of the child's reaction to self-perceived language inadequacies. A second hypothesis is that the behavior problems precede the language deficit and impact on the child's ability to benefit from instruction. An alternative possibility is that behavior problems and language impairment coexist due to commonalities in central processing patterns or other general factors such as a disadvantaged social environment. Additionally, none of these possibilities need act in isolation. All could be somewhat valid, and interacting to differing degrees (Jorm, Share, Matthews, & Maclean, 1986).

A number of investigations have attempted to clarify this relationship. Two primary methodological approaches have been employed. The first compares children exhibiting both reading difficulties and behavior problems with children who have reading difficulties only and with children who have behavior problems only. If children with both reading deficits and behavior problems are similar in background to those with reading difficulties alone, and not to those with behavior problems alone, it is likely that behavior problems arise somewhat as a consequence of reading failure. If, however, the children with combined problems are more similar in background to those with behavior problems, then it seems more likely that behavior problems are the primary disorder.

In the Rutter and Yule (1970) Isle of Wight study, there was evidence to suggest that boys with reading retardation and conduct problems were similar to those with reading deficits
only, and were unlike those with conduct disorder only. In this sample, a child with a conduct disorder was more likely to have come from a background of family conflict and parental separation, while both groups of reading retarded children came from larger families with a history of reading retardation, and were more likely to have poor attention and hyperactive behavior. The authors interpreted this finding as evidence that the behavior problems may have been a consequence of the reading deficits and associated with educational failure.

Sturge (1982) found a less clear relationship. She investigated similar groups of boys with corresponding patterns of reading and/or antisocial behavior. Results suggested that the group with both types of problems displayed "mixed" similarities to both "pure" groups. Only on the items of poor attention and motor restlessness did the group with combined difficulties resemble the reading deficit group. Sturge suggested that in light of this data, no one causal hypothesis could be favoured.

A second methodological approach attempted by researchers in this area is that of the longitudinal design. This may be the best method of establishing causal direction in the relationship between language dysfunction and emotional disorder. Silva, Williams, and McGee (1987) followed a large sample of Dunedin (New Zealand) children who were re-assessed at age three to identify those with language delay. These children were assessed at ages seven, nine, and eleven on measures of intelligence,
reading, and behavior. The Reynell (1969) Developmental Language Scales were used to define language delay at age three. On this measure, three subtypes of language delay were identified: comprehension delay, expressive delay, and general language delay. At ages seven, nine, and eleven, reading was assessed by the Burt Word Reading Test (Scottish Council for Research and Education, 1976), and behavior was evaluated by the Rutter Parent and Teacher Scales (Rutter, Tizard, & Whitmore, 1970). Those in all three language delay subtypes had significantly lower mean IQs and lower mean reading scores than did the remainder of the sample. They also more frequently displayed a low IQ or a lower reading score at ages seven and nine, as well as a lower Verbal and Full Scale IQ at eleven years of age. The groups with delayed verbal comprehension and general language delay had significantly more behavior problems than did the remainder of the sample, and had significantly higher scores on a family disadvantage index. This study not only emphasized the high risk of later behavioral disorder in children with early language delay, but provided evidence that different types of language deficit may have a specific impact on behavior.

SUBTYPES OF READING-IMPAIRED CHILDREN AND SOCIOEMOTIONAL DISTURBANCE

McGee, Williams, Share, Anderson, and Silva (1988) investigated a group of boys identified as either specific reading retarded or as general reading backward from ages five, seven, nine, and eleven. Children with specific reading
retardation were defined as those whose observed reading score was more than 1.5 standard errors below their reading score predicted from Performance IQ on the Wechsler Intelligence Scale for Children-Revised (WISC-R; Wechsler, 1974). General reading backward children were identified as having a reading score that was less than the average reading score of the entire sample, but was within 1.5 standard errors of their reading score as predicted by Performance IQ. While this classification system is subject to question in terms of reliability and validity issues, it is evident that different subgroups of reading-disabled children may be identified. This study was part of the previous investigation of reading and behavioral problems in New Zealand. The measures employed in the above described study, along with interviews using the Diagnostic Interview for Children (Costello, Edelbrock, Kalas, Kessler, & Klaric, 1982), served as the data base.

Both types of reading disability were associated with teacher reports of behavior problems at the time of school entry, these problems were related to hyperactive and aggressive behaviors rather than anxiety or depression. Similar to the Isle of Wight studies (Rutter et al., 1970), there was a significant association between specific reading retardation and problem behavior. These results suggest, however, that problem behaviors are not simply a direct consequence of reading failure, as both groups of boys revealed behavior problems at school entry. Both parent and teacher reports suggested that there was a relative
increase in behavior problems during early schooling. Teachers reported significant increases in hyperactive behaviors, indicating that the experience of reading failure may exacerbate already existing problems. Parents also reported a relative increase in aggressive behaviors for the specific reading retarded group between five and seven years.

The reading-disabled boys tended to show greater persistence of problems from five to eleven years, and by age eleven their self-reports indicated that they saw themselves as having more problems. They reported more inattentive, hyperactive, and antisocial behaviors than did their peers. Half of the reading-disabled boys were identified as having some form of behavioral or emotional disorder according to the Diagnostic and Statistical Manual of Mental Disorders III (American Psychiatric Association, 1983) criteria, a rate three times that of the remaining sample of boys. The most common disorder among the reading-disabled boys was attention deficit disorder followed by conduct or oppositional disorder. Disorders of anxiety or depression were less common.

SUMMARY

The results of these studies suggest that a significant number of reading-impaired children identified by common criteria show signs of significant emotional and behavioral disturbance. From a review of the literature, this disturbance appears to be primarily of the externalizing variety (eg.; hyperactivity,
aggression, conduct disorder). An important issue to be addressed is the determination of more specific linguistic and cognitive characteristics that differentiate children who develop adaptive coping skills from those who develop either internalized or externalized psychopathology. While the language evaluation instruments employed in previous investigations have provided overall scores representing linguistic functioning, other methods of measuring language functioning, such as neuropsychological assessment of specific language abilities, would more clearly define the nature of the language deficits that may be associated with socioemotional dysfunction.

With respect to cognitive functioning, the results of studies by Rourke and Finlayson (1978) and Strang and Rourke (1983) demonstrated that 9-year-old to 14-year-old learning-disabled children who exhibit a pattern of language impairment (impaired reading and spelling) relative to significantly better arithmetic skills differ markedly in their patterns of neuropsychological abilities and deficits from those who exhibit the opposite pattern. These differences comprise a wide range of abilities: the former group display mild to moderate difficulties in many areas of language functioning and pronounced difficulties in auditory-perceptual tasks that tax their capacities for speech-sounds detection, within a context of normal visual-spatial-organizational, psychomotor, tactile-perception, and non-verbal concept formation. The latter exhibit below-average performance on tasks requiring visual-spatial organization,
psychomotor, tactile-perceptual, and conceptual skills, within a context of normal performance on verbal tasks that require rote, overlearned verbal skills.

Paying closer attention to the performance of these two groups of children on specific neuropsychological tests, other less clear patterns emerge. The group of linguistically impaired children performed significantly below the mean on linguistic measures evaluating auditory-perceptual and visual-perceptual processes (Speech-Sounds Perception Test, Auditory Closure Test, Sentence Memory Test). On tests of verbal ability as measured by the WISC (Similarities, Information, Vocabulary and Digit Span) and the Peabody Picture Vocabulary Test, the language impaired children performed at less than one standard deviation below the mean, and were not significantly different from the visual-perceptually impaired group (Rourke, 1989). Thus, these subtests of the WISC and the PPVT may not prove accurate discriminators between these two groups of learning-disabled children. Speech-Sounds Perception, Auditory Closure, and Sentence Memory Tests would be more likely to discriminate between language impaired and non-language impaired children.

NEUROPSYCHOLOGICAL ANALYSIS

Employing neuropsychological variables as measures of language functioning has been useful in past investigations (Satz & Morris, 1981). These authors examined a sample of 236 elementary-age boys on achievement, defined by performance on the
Wide Range Achievement Test (WRAT; Jastak & Jastak, 1965) and, using cluster analytic techniques, found two of nine clusters to be predominantly disabled readers. Children in these two clusters were then given a battery of neuropsychological tests, and the results indicated five clusters, three of which (57% of the sample) were characterized by some form of language disorder. One subtype was defined as globally language impaired, the second was selectively impaired only on verbal fluency, and the third was deficient on all neuropsychological tests (language and perceptual), including the Peabody Picture Vocabulary Test (Dunn, 1965). This suggests that subgroups of verbally disordered children may be separated in terms of their performance on neuropsychological measures, indicating that there must be more precise definition of the linguistic deficits of these children for accurate subgrouping to be carried out.

NEUROPSYCHOLOGICAL TEST VALIDITY AND RELIABILITY

Brown, Rourke, and Cicchetti (1989) evaluated the reliability of tests and measures employed in the neuropsychological assessment of children, specifically those developed by Reitan and Davidson (1974), as well as related measures used in this investigation, over a 2.42 year period. Those measures relating to linguistic ability displayed good to excellent test-retest reliabilities, ranging from correlations of .82 for the Wechsler Full Scale IQ and Verbal IQ scores to .47 for the Speech-Sounds Perception Test. WRAT test-retest
correlations for Spelling and Reading were .57 and .56 respectively.

Satz and Morris (1981) point out that one must be aware of the limitations regarding the use of achievement measures such as the WRAT to classify learning-disabled children. This measure is notoriously restricted in the scope of the linguistic skills it assesses, but for the purposes of this study and those of many other investigators, the WRAT provides a pragmatic and valid method for subject selection (Petrauskas & Rourke, 1979; Porter & Rourke, 1985; Rourke & Finlayson, 1978; Strang & Rourke, 1983).

SOCIAL COMPETENCE

Social competence may be defined as the child's ability to satisfy interpersonal needs in ways that are both effective and socially acceptable to society. Social competence is difficult to define in more operational terms. Anderson and Messick (1974) have outlined a componential analysis of the skills required for social competence. These skills may be classified into three groups: (1) perceptual skills; (2) cognitive abilities (to discern cause-and-effect relationships in social events); (3) motor and language skills (to express social behavior). Competent social behavior can be seen as the result of the complex interaction and coordination of these and other variables such as self-esteem and self-concept.

Literature in the learning disabilities area reveals frequent claims that learning-disabled children experience
problems in their social relationships, and that these problems persist into adolescence and adulthood. LaCrecia (1981) reviewed a number of studies evaluating the social behavior and social comprehension skills of learning-disabled children in an effort to understand their low peer status. This review suggested that, although they appear to interact with peers as frequently as other children, learning-disabled children (a) are more likely to be involved in negative peer interactions and (b) tend to display less frequent and/or more inappropriate positive social behaviors. Evaluation of these studies also indicated several methodological issues which merit consideration. The first involved the variability of the subject populations. Across studies, subject groups have varied with respect to age, sex, and racial composition, peer status, as well as IQ and achievement. It is important for investigators to detail more clearly the characteristics of each subject sample so that cross-study comparisons can be made. Additionally, there is a need for more careful and detailed behavioral coding. Different behavioral categories have precluded consistent assessment of behavioral effects.

Wallander and Hubert (1987) have reviewed the literature regarding the peer functioning of children with mental retardation, learning disabilities, attention deficit disorder, and physical disabilities. These authors concluded that children with these developmental disorders are indeed at risk for experiencing problems in this area. It was noted that peer
problems may occur for different reasons in different children with different disorders, and that further research must be aimed at the clarification of the factors involved in the social isolation experienced by disabled children. Learning-disabled children have been reported to be less accurate in their perception of social interactions than are normal children (Goldman & Hardin, 1982), a factor that may impact adversely on the child's ability to interact with peers in a positive manner.

Attention has turned recently to the relationship between learning-disabled children's linguistic deficits and their social skills. The ability to use language in social contexts has become an important issue in light of the evidence presented that learning-disabled children are likely to be involved in negative peer and teacher social relations (Bryan, Donahue, & Pearl, 1981). Communicative competence, the understanding of the rules that govern socially appropriate speech, is critical to the child's ability to establish and maintain adequate and appropriate interpersonal relationships (Dudley-Marling, 1985). Investigations in this area indicate that learning-disabled children's competence as cooperative listeners and speakers varies with differences in task demands and conversational partners (Bryan et al., 1981). Learning-disabled children do not appear to differ from non-disabled children when given adequate messages, or in situations where there is no opportunity or obligation to provide feedback to partners. However, learning-disabled children are less adequate conversational partners than
normally achieving children in situations that demand formulating useful descriptions, repairing communicative breakdown, and taking a dominant, assertive position.

Other investigators have attempted to examine different patterns of social competence observed in different populations of learning-disabled children. Ozols and Rourke (1985) have provided data with respect to two specific subtypes of learning-disabled children. Children in one group are those who exhibit many relatively poor psycholinguistic skills in conjunction with very well developed abilities in visual-spatial-organizational, tactile-perceptual, psychomotor, and non-verbal problem-solving skills. Academically, their deficiencies appear on tests of reading and spelling. The other group exhibited the opposite pattern of clear strengths in the area of language skills but significant weakness in non-verbal, psychomotor, perceptual skills. These children experience their greatest academic difficulties in the area of mathematics. The performances of these two groups of children were compared on four measures of social competence and responsiveness. The results of this study were in accord with those of Bryan et al. (1981), in that children in the language-disorder group performed more effectively than did those in the visual-spatial disorder group on tasks requiring non-verbal responses. Those tasks requiring verbal responses yielded exactly the opposite pattern of performance between these two groups. These studies suggest that social awareness and responsiveness vary for both subtypes of
children, and tend to differ depending on their own patterns of processing as well as task demands.

READING IMPAIRMENT AND SOCIAL COMPETENCE

Strang and Rourke (1985) compared average PIC profiles of children chosen to approximate the characteristics of the two subtypes described by Ozols and Rourke (1985). The profile for the "non-verbal disability" group was similar to that exhibited by the "emotionally disturbed" group in the Porter and Rourke (1985) study, whereas the profile for the "verbally disabled" group was similar to the "normal" group in that study. The non-verbal disability group was more pathological on both the factors of "personality deviance" and "internalized psychopathology".

Fuerst and Rourke (1991) also compared groups of learning-disabled children on achievement measures and found that children with relatively well developed reading and spelling skills were more likely to appear in PIC subtypes designated as "severe" psychopathology, whether it be of the "internalizing" or "externalizing" variety. Children with less well developed reading and spelling skills demonstrated either mild somatization or conduct disorder problems, or were indistinguishable from normal children. Children with mild anxiety and depressive symptoms ranged between these two extremes, and were not clearly distinguishable on the basis of achievement measures.

These results would indicate that different patterns of central processing abilities may eventuate in (a) substantially
different subtypes of learning disabilities, and (b) significantly different patterns of socioemotional functioning. It would appear that, within samples of learning-disabled children, socioemotional disturbances in reading-impaired children are found at a much lower frequency than they are in non-verbally impaired children.

Reasons for the discrepancy between the studies discussed earlier that frequently identified emotional disturbances in verbally dysfunctional children and the investigations of Rourke and colleagues may be related to developmental considerations as well as sample characteristics. If socioemotional functioning varies with age, differences in research results could reflect the different ages of the subjects employed. Investigators may compensate for this by either restricting the age range of the subjects, as in this investigation, or by designing the study to account for developmental parameters. Differences in severity may also have had an impact on any observed group differences. It has been suggested that a continuum of severity can be observed within the learning-disabled population and that this continuum is functionally related to the ease with which learning-disabled individuals adapt to their environment (Weller, Strauser, & Buchanan, 1985). If this is so, new samples of verbally impaired children may display more pronounced emotional problems, as well as clearer patterns of behavioral dysfunction.

The series of studies by Rourke and colleagues does not imply that language deficient children do not experience
socioemotional disturbances (Rourke, 1988). Rather, these results suggest that there must be some other factor in addition to the deficits in language functioning that is necessary for disturbed socioemotional functioning to occur. These factors may include some of those mentioned earlier regarding the emotional dysfunction problem relationships (e.g., teacher-pupil personality conflicts, parent and teacher demands, and family social disadvantage). Other factors may include the presence of influential anti-social models, selective reinforcement of non-adaptive and socially maladaptive behaviors, and any number of social and environmental influences that have the potential for encouraging problems in the socioemotional functioning of even normally functioning children.

In summary, then, it may be said that several patterns emerge from the literature regarding children with both linguistic and non-linguistic learning disabilities.

1. Some learning-disabled children suffer from mild to severe forms of socioemotional disturbance.

2. There is no one pattern of emotional disturbance or social incompetence displayed by all learning-disabled children.

3. There appear to be distinct subtypes or "profiles" of socioemotional disturbance and behavior problems exhibited by subgroups of learning-disabled children.

4. Patterns of central processing abilities and deficits (e.g., non-verbal learning disability) appear to lead to both a specific style of academic achievement and to a particular form of
socioemotional disturbance (internalized psychopathology).
(5) Verbal deficits appear to be more often associated with externalized psychopathology, more specifically in the forms of conduct disorder, attentional difficulties, hyperactivity, and aggressiveness.

The purpose of the present investigation is to extend our understanding of socioemotional dysfunction in reading-impaired children by investigating the relationship between reading impairment and socioemotional subtype (as defined by the PIC). To further explore this relationship, this investigation will also assess the proficiency of different neuropsychological language tests to adequately predict socioemotional subtype. The instruments chosen were selected from past research by Rourke and colleagues, as well as other investigators, and all have been previously validated by these sources.

HYPOTHESES

The present study will assess the relationship between reading impairment and socioemotional disturbance, while considering the predictive value of neuropsychological linguistic measures for socioemotional subtype. Comparisons between two groups, one defined as reading-impaired and one defined as controls, will enable the testing of a number of hypotheses.

Hypothesis 1. Reading-impaired subjects and controls will perform differently on neuropsychological linguistic measures. The reading-impaired subjects are expected to perform more poorly
than the control group on the neuropsychological linguistic measures employed.

Hypothesis 2. Speech-Sounds Perception, Auditory Closure, and Sentence Memory Test scores will best predict group membership (reading-impaired or control group).

Hypothesis 3. It is expected that reading-impaired children will evidence characteristic elevations on scales of emotional disturbance that are distinct from those of non-impaired (or control) subjects.

Hypothesis 4. While a high number of reading-impaired children might be expected to appear "normal" on socioemotional measures of behavior, it is expected that the reading-impaired group will demonstrate elevations similar to the Conduct Disorder, Somatic Concern, Mild Hyperactivity and Mild Anxiety prototypic profiles.

Hypothesis 5. Of all the neuropsychological measures of language functioning employed, Speech-Sounds Perception, Auditory Closure, and Sentence Memory Test scores will best predict socioemotional subtype for reading-impaired children, as they are the best discriminators of learning disability subtypes.
CHAPTER II

METHOD

SUBJECTS

The 278 subjects employed in this investigation were
selected from a population of children referred to a large urban
clinic for neuropsychological assessment because of apparent
learning or "perceptual" problems. Two groups of children were
selected from this population: a reading-impaired group (n=168)
and a control group (n=108). The selection criterion for reading
impairment was defined as centile scores on the WRAT Reading
subtest that were 35 or below. The subjects in the reading-
impaired group, 127 males and 39 females, ranged from 5.70 to
9.79 years of age. Subjects in the control group displayed
normal achievement on the WRAT Reading and Spelling measures, and
also fell within this age range. Subjects in the control group
were screened to ensure that none displayed the pattern of "non-
verbal learning disability" described in detail by Rourke (1989).
Each subject had obtained a Wechsler Intelligence Scale for
Children Full Scale IQ of between 85 and 133 (inclusive). Mean
Full Scale IQ for the sample was 101.79. Defective hearing had
been ruled out in all subjects. No children suspected of
suffering from sociocultural or economic deprivation were
included in the study sample. Primary emotional disturbance was
also ruled out: Children in treatment for emotional disturbance,
or diagnosed as needing such treatment, were excluded from this
study. All subjects spoke English as their first language.

22
MEASURES AND PROCEDURE

The PIC was completed routinely by parents of children referred to the clinic for neuropsychological assessment. The inventories for this sample were generally completed by the subject's mothers.

The PIC is composed of 600 true-false questions regarding the child's behavior, attitudes, and interpersonal relations. It can be scored for three validity or response style scales (Lie, F, and Defensiveness), one general screening scale (Adjustment), 12 clinical scales (Achievement, Intellectual Screening, Development, Somatic Concern, Depression, Family Relations, Delinquency, Withdrawal, Anxiety, Psychosis, Hyperactivity and Social Skills). The PIC also provides general profiles of both "Internalized" (e.g.; anxiety, depression) and "Externalized" (e.g.; hyperactivity) psychopathology. Score elevations in the positive direction (e.g.; greater than 70 T) increase the likelihood of significant pathology for each of these scales. Alpha coefficients for internal consistency have been reported to range between .62 to .84 in a normative sample, and test-retest product-moment correlations have ranged from .68 to .97 on a normative sample (Porter & Rourke, 1985). The PIC has been subject to a great deal of analysis regarding its validity and reliability. Forbes (1987) found this measure to be a valid discriminator between learning-disabled children with emotional problems and emotionally disturbed children with learning disabilities. The PIC has been employed extensively in research
undertaken in the laboratory of Rourke and colleagues, and since this study builds on this data base, it was deemed appropriate to utilize the PIC as the measure of socioemotional functioning. All children were evaluated on a number of neuropsychological linguistic variables (these are outlined in detail in Rourke, Fisk, & Strang, 1986):

Verbal Fluency:

The child is required to name as many words as he/she can, within 60 seconds, that begin with the sound "P," as in "pig." This is repeated with the sound "C," as in "cake." The score is the mean number of correct words for the two trials.

Sentence Memory Test (Benton, 1965):

The child is required to repeat sentences of gradually increasing length (from 1 to 28 syllables). These are presented on a tape recorder. The score is the number of sentences correctly repeated.

Auditory Closure Test (Kass, 1964):

The child is required to blend into words 23 progressively longer chains of sound elements presented on a tape. The score is the number of words correctly identified.

Speech-Sounds Perception Test (Reitan & Davidson, 1974):

The child is required to attend to 30 tape-recorded nonsense syllables and to select the correct response alternative from among three printed choices. The
score is the number of sounds correctly identified.

Peabody Picture Vocabulary Test, Form A (Dunn, 1965):
One hundred fifty sets of four line drawings, with which 150 words of increasing difficulty are associated. The words are those of Form A of the Peabody Vocabulary Test. The score is the total number of correct picture-word associations. Oral IQ is the transformation of the raw score to an IQ score on the basis of test norms.

Children's Word Finding Test (Reitan, 1972; Pajurkova, Orr, Rourke & Finlayson, 1976; Rourke & Fisk, 1976):
The test consists of 13 items, each composed of five sentences. Each sentence contains a nonsense word, "Grobnick". The child is required to determine (10 seconds per sentence) the meaning of the nonsense word through the appreciation of its verbal context. The score is the total number correct. The task requirement is verbal problem solving, and appreciation of contextual cues. The response is a spoken answer.

Wide Range Achievement Test (WRAT; Jastak & Jastak, 1965):
Reading. Standardized test of oral word-reading achievement. Score. Centile score based on total number of words read correctly aloud. The task requirement is the association of printed letters to the spoken word.

Spelling. Standardized test of written spelling
achievement. **Score.** Centile score based on the total number of words correctly spelled. The task requirement is the written production of the spoken word.

**Wechsler Intelligence Scale for Children (WISC; Wechsler, 1949):**

**(VERBAL SUBTESTS)**

**Information.** Thirty questions involving elementary factual knowledge of history, geography, current events, literature, and general science. **Score.** Number of items correct. The task requirement is the retrieval of acquired verbal information.

**Comprehension.** Fourteen questions involving the ability to evaluate social and practical situations. **Score.** The number of items correct. The task requirement is the evaluation of verbally formulated problem situations.

**Similarities.** Sixteen pairs of words, in which the most essential semantically common feature of the word pairs must be stated. **Score.** Number correct. The task requirement is verbal abstraction.

**Vocabulary.** Forty words that need to be verbally defined. **Score.** Number correct.
CHAPTER III
RESULTS

Overview

The purpose of the present investigation was to extend our understanding of socioemotional dysfunction in reading-impaired children by investigating the relationship between reading impairment and socioemotional subtype (as defined by the PIC). To determine the characteristics of the socioemotional functioning of the study sample, a simple profile matching algorithm was implemented as outlined in previous research (Fuerst, 1991). This algorithm served to classify both the reading-impaired and control subjects into one of seven socioemotional subtypes. To further explore the relationship between language functioning and socioemotional subtype, one way multivariate analyses of variance (MANOVA) were carried out. MANOVAs for group as well as for socioemotional subtype were calculated, with all neuropsychological linguistic test scores as dependent variables. Multivariate effects found to be significant were further evaluated utilizing univariate analyses of variance to determine the nature and direction of the effects.

This investigation also assessed the proficiency of different neuropsychological language tests to adequately predict socioemotional subtype. Canonical discriminant analysis, with socioemotional subtype membership as the criterion, was carried out with all neuropsychological measures as predictors.
Mean Values for Neuropsychological Variables

The mean values for the twelve neuropsychological linguistic variables and for age are presented in Table 1. These values are reported for both the reading-impaired group and the control group. These statistics are also reported in Table 2 for the seven socioemotional subtypes outlined in detail in the following section. Standard deviations are presented in Appendix A.

Comparisons to Known Subtypes

The results of previous research (Fuerst et al., 1989; Porter & Rourke, 1985) were used to classify subjects into prototypic socioemotional subtypes. This research has produced seven psychosocial subtypes (Normal, Somatic Concern, Mild Anxiety, Mild Hyperactivity, Conduct Disorder, Internalized Psychopathology, and Externalized Psychopathology) based on PIC scores. Examples of these seven subtypes are presented in Appendix B. Through computation of the mean PIC scores for these seven subtypes, "prototypic" PIC profiles were derived (Fuerst, 1991). Correlations between each subject's PIC profile and the seven prototypes were calculated, utilizing a simple profile matching algorithm employed in previous studies (Fuerst, 1991). Subjects were assigned to the subtype displaying the highest correlation with their own. The profile matching algorithm is presented in Appendix C. This statistical calculation and all others employed in this investigation were effected using SAS statistical packages.
Table 1
Means for Neuropsychological Variables and Age by Group

<table>
<thead>
<tr>
<th>Variable</th>
<th>Reading-Impaired</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Fluency *</td>
<td>4.87</td>
<td>6.09</td>
</tr>
<tr>
<td>Sentence Memory *</td>
<td>9.96</td>
<td>10.70</td>
</tr>
<tr>
<td>Auditory Closure *</td>
<td>9.72</td>
<td>11.51</td>
</tr>
<tr>
<td>Speech-Sounds *</td>
<td>15.42</td>
<td>18.45</td>
</tr>
<tr>
<td>PPVT ***</td>
<td>100.26</td>
<td>105.50</td>
</tr>
<tr>
<td>CWFT *</td>
<td>19.80</td>
<td>23.14</td>
</tr>
<tr>
<td>WRAT Reading **</td>
<td>16.51</td>
<td>60.58</td>
</tr>
<tr>
<td>WRAT Spelling **</td>
<td>17.34</td>
<td>46.36</td>
</tr>
<tr>
<td>WISC Information ****</td>
<td>7.86</td>
<td>9.10</td>
</tr>
<tr>
<td>WISC Comprehension ****</td>
<td>10.04</td>
<td>9.72</td>
</tr>
<tr>
<td>WISC Similarities ****</td>
<td>10.65</td>
<td>12.07</td>
</tr>
<tr>
<td>WISC Vocabulary ****</td>
<td>10.79</td>
<td>11.78</td>
</tr>
<tr>
<td>Chronological Age (years)</td>
<td>8.15</td>
<td>7.88</td>
</tr>
</tbody>
</table>

Note. * Raw Scores (number correct)
** Centile Scores
*** Standard Score (Mean = 100; Standard Deviation = 15)
**** Scaled Scores (Mean = 10; Standard Deviation = 3)
Table 2

Means for Neuropsychological Variables and Age by Subtype

<table>
<thead>
<tr>
<th>Variable</th>
<th>Socioemotional subtype</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>Verbal Fluency</td>
<td>4.94</td>
</tr>
<tr>
<td>Sentence Memory</td>
<td>10.16</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>10.33</td>
</tr>
<tr>
<td>Speech-Sounds</td>
<td>16.51</td>
</tr>
<tr>
<td>PPVT ***</td>
<td>101.84</td>
</tr>
<tr>
<td>CWFT *</td>
<td>20.84</td>
</tr>
<tr>
<td>WRAT Reading **</td>
<td>25.88</td>
</tr>
<tr>
<td>WRAT Spelling **</td>
<td>22.08</td>
</tr>
<tr>
<td>WISC Information ****</td>
<td>7.76</td>
</tr>
<tr>
<td>WISC Comprehension ****</td>
<td>9.87</td>
</tr>
<tr>
<td>WISC Similarities ****</td>
<td>11.16</td>
</tr>
<tr>
<td>WISC Vocabulary ****</td>
<td>10.95</td>
</tr>
<tr>
<td>Chronological Age (years)</td>
<td>8.26</td>
</tr>
</tbody>
</table>

Note 1.  * Raw Scores (number correct)  
** Centile Scores  
*** Standard Score (Mean = 100; Standard Deviation = 15)  
**** Scaled Scores (Mean = 10; Standard Deviation = 3)

Note 2. Subtype 1 = Normal; Subtype 2 = Externalized; Subtype 3 = Internalized; Subtype 4 = Somatic Concerns.
Table 2 (continued)

Means for Neuropsychological Variables and Age by Subtype

<table>
<thead>
<tr>
<th>Variable</th>
<th>Socioemotional subtype</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
</tr>
<tr>
<td>Verbal Fluency *</td>
<td>6.20</td>
</tr>
<tr>
<td>Sentence Memory *</td>
<td>10.80</td>
</tr>
<tr>
<td>Auditory Closure *</td>
<td>10.67</td>
</tr>
<tr>
<td>Speech-Sounds *</td>
<td>17.40</td>
</tr>
<tr>
<td>PPVT ***</td>
<td>100.63</td>
</tr>
<tr>
<td>CWFT *</td>
<td>22.1</td>
</tr>
<tr>
<td>WRAT Reading **</td>
<td>38.30</td>
</tr>
<tr>
<td>WRAT Spelling **</td>
<td>33.03</td>
</tr>
<tr>
<td>WISC Information ****</td>
<td>8.20</td>
</tr>
<tr>
<td>WISC Comprehension ****</td>
<td>10.27</td>
</tr>
<tr>
<td>WISC Similarities ****</td>
<td>11.53</td>
</tr>
<tr>
<td>WISC Vocabulary ****</td>
<td>11.16</td>
</tr>
<tr>
<td>Chronological Age (years)</td>
<td>8.05</td>
</tr>
</tbody>
</table>

Note 1. * Raw Scores (number correct)
** Centile Scores
*** Standard Score (Mean = 100; Standard Deviation = 15)
**** Scaled Scores (Mean = 10; Standard Deviation = 3)

Note 2. Subtype 5 = Mild Anxiety; Subtype 6 = Mild Hyperactivity; Subtype 7 = Conduct Disorder.
The number and percentages of the subjects classified to each of the seven prototypes are presented in Table 3. Each subject was classified into the prototype most similar to their mean PIC scores, and a total of 247 subjects could be classified into one of the seven subtypes. Due to the presence of missing values for some subjects, 29 of the original sample could not be classified. Table 3 also provides the number and percentages of reading-impaired and control children assigned to each prototype.

To evaluate the significance of the frequencies of subject classification to each prototype, Chi-square tests were calculated for the matrix in Table 3. The overall Chi-square for the matrix was significant ($\chi^2 = 14.78; p < .05$), but further analysis of individual 1 x 2 matrices for all seven socioemotional subtypes revealed that only for the Normal subtype were there significant differences between the number of cases classified within that subtype and the number that would be expected by chance ($\chi^2 = 16.00; p < .01$). Thus, a large proportion of the subject sample were most similar to the Normal prototype on the PIC. Additionally, a significant number of the group classified as Normal were from the reading-impaired group (75%), while there were no significant group differences for the other six subtypes.
Table 3

Socioclonal Subtype Classification By Profile Matching

<table>
<thead>
<tr>
<th>Subtype</th>
<th>Group</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reading-Impaired</td>
<td>Controls</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Number</td>
<td>Percentage</td>
<td>Number</td>
</tr>
<tr>
<td>Normal</td>
<td>48</td>
<td>75.00</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>(33 %)</td>
<td></td>
<td>(16 %)</td>
</tr>
<tr>
<td>Somatic</td>
<td>15</td>
<td>60.00</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(10 %)</td>
<td></td>
<td>(10 %)</td>
</tr>
<tr>
<td>Mild Hyperactive</td>
<td>13</td>
<td>56.52</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>(9 %)</td>
<td></td>
<td>(10 %)</td>
</tr>
<tr>
<td>Conduct Disorder</td>
<td>11</td>
<td>61.11</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>(8 %)</td>
<td></td>
<td>(7 %)</td>
</tr>
<tr>
<td>Mild Anxiety</td>
<td>18</td>
<td>54.55</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>(13 %)</td>
<td></td>
<td>(15 %)</td>
</tr>
<tr>
<td>Internalizing</td>
<td>18</td>
<td>56.25</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>(13 %)</td>
<td></td>
<td>(14 %)</td>
</tr>
<tr>
<td>Externalizing</td>
<td>21</td>
<td>40.38</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>(15 %)</td>
<td></td>
<td>(30 %)</td>
</tr>
</tbody>
</table>

Note 1. "Percentage" indicates the percent of each subtype comprised by either group.

Note 2. Total number of subjects classified as reading-impaired = 144. Total Number of subjects classified as controls = 103.

Note 3. Values in parentheses are number of subjects expressed as a percentage of the total number of subjects in that group (ie.: out of 144 or 103).
Rank Ordering of Subtype by Severity of Psychopathology

The data presented in Table 3 revealed different patterns of socioemotional profiles for the two groups of subjects. It was apparent that the rank ordering of these subtypes was different for the reading-impaired children than it was for the control subjects. In the reading-impaired group, the most prevalent subtype was the Normal subtype, followed by Externalizing, Mild Anxiety and Internalizing, Somatic Concern, Mild Hyperactivity, and Conduct Disorder. For the control group this ordering was, from highest frequency to lowest, Externalizing, Normal, Mild Anxiety, Internalizing, Somatic Concern and Mild Anxiety, and Conduct Disorder. To evaluate whether these differences in ranking were significant between groups, Spearman's Rho Coefficient was calculated for the correlation between the two sets of ranks. This value was significant at the 0.01 level ($\rho = 0.999; p < .01$). From this analysis it was evident that the rank ordering of socioemotional subtypes for the reading-impaired subjects was highly correlated with the ordering of those subtypes for the control group. In fact, these orderings were identical with the exception of the Normal and Externalizing subtypes.

There were other trends noted for the frequency data given in Table 3. Examination of the seven prototypic profiles in Appendix B indicated that the Normal, Somatic Concern, Mild Hyperactive, and Conduct Disorder subtypes could be grouped
together as representing mild forms of psychopathology. These four profiles were characterized by, at most, a single elevated clinical scale and elevated PIC "Cognitive Triad" scales (Achievement, Intellectual Screening, and Development) that contributed to a high Adjustment score. The Mild Anxiety profile could be considered as representative of moderate psychosocial dysfunction, as it was comprised of two clinical scale elevations and an elevated "Cognitive Triad". Finally, the Internalizing and Externalizing profiles represent the most severe forms of socioemotional dysfunction, as they exhibit elevations on three or more clinical scales as well as extremely high Adjustment scores.

To assess whether reading-impaired children and control children were equally represented in the mild, moderate and severe psychopathology groupings, mean percentages for each of these three groups were calculated from the values in Table 3. These values are displayed in Table 4. It is evident that the percentage of reading-impaired subjects is higher than the percentage of controls in the mild psychopathology grouping, while the opposite pattern occurs for the moderate and severe psychopathology groupings. This relationship is illustrated in Figure 1. Thus it appears that reading-impaired children may be more likely to evidence mild forms of psychosocial dysfunction than controls, and would be less likely to display the severe forms such as Anxiety, Externalizing and Internalizing psychopathology.
<table>
<thead>
<tr>
<th>Group</th>
<th>Subtype</th>
<th>Reading-Impaired</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>Normal</td>
<td>33 %</td>
<td>16 %</td>
</tr>
<tr>
<td></td>
<td>Somatic</td>
<td>10 %</td>
<td>10 %</td>
</tr>
<tr>
<td></td>
<td>Hyperactive</td>
<td>9 %</td>
<td>10 %</td>
</tr>
<tr>
<td></td>
<td>Conduct Disorder</td>
<td>8 %</td>
<td>7 %</td>
</tr>
<tr>
<td></td>
<td><strong>MEAN (MILD)</strong></td>
<td><strong>60 %</strong></td>
<td><strong>43 %</strong></td>
</tr>
<tr>
<td>Moderate</td>
<td>Mild Anxiety</td>
<td>13 %</td>
<td>15 %</td>
</tr>
<tr>
<td></td>
<td><strong>MEAN (MEDIUM)</strong></td>
<td><strong>13 %</strong></td>
<td><strong>15 %</strong></td>
</tr>
<tr>
<td>Severe</td>
<td>Internalizing</td>
<td>13 %</td>
<td>14 %</td>
</tr>
<tr>
<td></td>
<td>Externalizing</td>
<td>15 %</td>
<td>30 %</td>
</tr>
<tr>
<td></td>
<td><strong>MEAN (SEVERE)</strong></td>
<td><strong>28 %</strong></td>
<td><strong>44 %</strong></td>
</tr>
</tbody>
</table>

**Note 1.** Values expressed as a percentage of either the reading-impaired group or the control group out of the total number of subjects in that group (144 or 103, respectively).
Figure 1. Percentage of Reading-Impaired and Control Subjects Within Three Degrees of Severity of Psychosocial Dysfunction
Examination of Possible Cohort Effect

It is essential to consider that the control group employed in this investigation might not be considered "normal". These children were drawn from the same clinic-referred population as the reading-impaired subjects, and reasons for referral were not known to the investigator. It was known that there was a greater likelihood of more severely impaired children being referred and evaluated later in the history of the clinic, as more selective criteria was employed. This fact necessitated testing for a cohort effect, to ensure that the control group was not more severely impaired than the reading-impaired subjects. T-test statistics comparing the average chronological case numbers of the two groups of children revealed no significant differences between groups (t = 0.58; p < .001). Thus the control group appeared to be no more likely to be impaired on neuropsychological or socioemotional measures than the reading-impaired group solely on the basis of a cohort effect.

Prediction of Reading Group by Neuropsychological Variables

A canonical discriminant analysis was carried out with group membership (reading-impaired group and controls) as the criterion. The between-groups canonical loadings are presented in Table 5. All linguistic variables with the exception of WISC Comprehension were found to be positively predictive of group membership.
Table 5

**Between-Groups Canonical Loadings for the Canonical Function Predicting Socioemotional Subtype and Group Membership Using Linguistic Variable Scores**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Subtype</td>
</tr>
<tr>
<td>Verbal Fluency</td>
<td>0.95</td>
</tr>
<tr>
<td>Sentence Memory</td>
<td>0.76</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>0.81</td>
</tr>
<tr>
<td>Speech-Sounds</td>
<td>0.89</td>
</tr>
<tr>
<td>PPVT</td>
<td>-0.07</td>
</tr>
<tr>
<td>CWFT</td>
<td>0.69</td>
</tr>
<tr>
<td>WRAT Reading</td>
<td>0.83</td>
</tr>
<tr>
<td>WRAT Spelling</td>
<td>0.80</td>
</tr>
<tr>
<td>WISC Information</td>
<td>0.62</td>
</tr>
<tr>
<td>WISC Comprehension</td>
<td>-0.20</td>
</tr>
<tr>
<td>WISC Similarities</td>
<td>0.76</td>
</tr>
<tr>
<td>WISC Vocabulary</td>
<td>0.76</td>
</tr>
</tbody>
</table>
**Prediction of Socioemotional Subtype by Neuropsychological Variables**

A canonical discriminant function analysis was carried out, with socioemotional subtype as the criterion. All twelve neuropsychological linguistic variables were used as predictors. The results of this analysis revealed which of the linguistic tests are of highest predictive value for each of the seven socioemotional subtypes in question. The between-groups canonical loadings for the first canonical function are also displayed in Table 5. Examination of Table 5 indicated that the Verbal Fluency, Sentence Memory, Auditory Closure, Speech-Sounds Perception, WRAT Reading, WRAT Spelling, WISC Similarities, and WISC Vocabulary tests were the most important predictors for distinguishing between these subtypes.

**Multivariate Analysis of Variance**

Multivariate Analysis of Variance (MANOVA) was carried out to verify the results of the canonical discriminant analysis. In this study it was also of interest to test whether there were significant differences between both groups of subjects (i.e.: reading-impaired and controls) as well as between the seven socioemotional subtypes for each of the linguistic variables. MANOVA was employed as a first step in this analysis, and subsequent ANOVA's were carried out only if significant multivariate effects were revealed. This minimized the possibility of Type 1 error.
Group Differences on Neuropsychological Variables

MANOVA results across group membership revealed significant differences between the reading-impaired subjects and controls ($F(13, 215) = 45.50; p < .001$). MANOVA results will be reported based on Wilk's Criterion for significance. Univariate ANOVA's revealed significant differences between groups on all neuropsychological variables except on the WISC Comprehension subtest. Significance values are reported in Table 6.

Examination of group means on these variables indicated that reading-impaired children scored significantly below the control group on all the neuropsychological linguistic variables except for WISC Comprehension. On the WISC Comprehension subtest the control group performed more poorly than the reading-impaired group, although not significantly so.

Group Differences on PIC Scales

To test whether there were differences between the reading-impaired group and the control group with respect to the 16 clinical scales of the PIC, univariate analyses were carried out across groups for these 16 scales. Three scales demonstrated statistical significance. Scores on PACH (Achievement), PIS (Intellectual Screening), and PDVL (Development) were significantly different for the reading-impaired subjects than for the controls. The results of this analysis are presented in Table 7.
Table 6

ANOVA Summary for Significant Differences Between Groups (Reading-Impaired and Controls) for Neuropsychological Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Fluency</td>
<td>11.40</td>
<td>** 0.0009</td>
</tr>
<tr>
<td>Sentence Memory</td>
<td>5.44</td>
<td>* 0.0206</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>11.63</td>
<td>** 0.0006</td>
</tr>
<tr>
<td>Speech-Sounds</td>
<td>19.21</td>
<td>** 0.0001</td>
</tr>
<tr>
<td>PPVT</td>
<td>7.71</td>
<td>** 0.0060</td>
</tr>
<tr>
<td>CWBT</td>
<td>9.48</td>
<td>** 0.0023</td>
</tr>
<tr>
<td>WRAT Reading</td>
<td>576.71</td>
<td>** 0.0001</td>
</tr>
<tr>
<td>WRAT Spelling</td>
<td>162.94</td>
<td>** 0.0001</td>
</tr>
<tr>
<td>WISC Information</td>
<td>14.42</td>
<td>** 0.0002</td>
</tr>
<tr>
<td>WISC Comprehension</td>
<td>0.91</td>
<td>0.3421</td>
</tr>
<tr>
<td>WISC Similarities</td>
<td>16.07</td>
<td>** 0.0001</td>
</tr>
<tr>
<td>WISC Vocabulary</td>
<td>11.01</td>
<td>** 0.0011</td>
</tr>
</tbody>
</table>

Note 1. * = p < .05.
** = p < .01.

Note 2. df = (1,227)
Table 7

ANOV A Summary for Significant Differences Between Groups on PIC Scales

<table>
<thead>
<tr>
<th>PIC Scale</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lie</td>
<td>0.83</td>
<td>0.3642</td>
</tr>
<tr>
<td>F</td>
<td>0.97</td>
<td>0.3256</td>
</tr>
<tr>
<td>Defensiveness</td>
<td>0.47</td>
<td>0.4944</td>
</tr>
<tr>
<td>Adjustment</td>
<td>0.03</td>
<td>0.8715</td>
</tr>
<tr>
<td>Achievement</td>
<td>8.07</td>
<td>0.0049</td>
</tr>
<tr>
<td>Intellectual Screening</td>
<td>25.28</td>
<td>0.0001</td>
</tr>
<tr>
<td>Development</td>
<td>12.57</td>
<td>0.0005</td>
</tr>
<tr>
<td>Somatic Concern</td>
<td>0.32</td>
<td>0.5725</td>
</tr>
<tr>
<td>Depression</td>
<td>0.18</td>
<td>0.6675</td>
</tr>
<tr>
<td>Family Relations</td>
<td>1.26</td>
<td>0.2620</td>
</tr>
<tr>
<td>Delinquency</td>
<td>0.05</td>
<td>0.8299</td>
</tr>
<tr>
<td>Withdrawal</td>
<td>0.36</td>
<td>0.5499</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.05</td>
<td>0.8155</td>
</tr>
<tr>
<td>Psychosis</td>
<td>0.12</td>
<td>0.7283</td>
</tr>
<tr>
<td>Hyperactivity</td>
<td>0.10</td>
<td>0.7561</td>
</tr>
<tr>
<td>Social Skills</td>
<td>0.79</td>
<td>0.3739</td>
</tr>
</tbody>
</table>

Note 1. * = p < .01.

Note 2. df = (1, 245).
A Scheffe's Test post-hoc comparison was conducted to determine the direction of the relationship revealed in the above analysis. The results of the Scheffe's Tests are presented in Table 8. From these statistics it was evident that the reading-impaired group scored significantly higher than the control group on the PACH, PIS and PDVL scales of the PIC.

Subtype Differences on Neuropsychological Variables

MANOVA results across PIC subtype revealed significant differences between the seven socioemotional subtypes ($F(78, 1163.97) = 1.46; p < .01$). Univariate ANOVA's revealed significant differences between subtypes on Sentence Memory, Auditory Closure, Verbal Fluency, Speech-Sounds Perception, WRAT Reading, WRAT Spelling, and WISC Information subtests. Significance values are reported in Table 9.

A Bonferroni (Dunn) T-Test post-hoc comparison was conducted to determine the direction of the relationship revealed in the above analysis. The results of these tests are presented in Table 10. From these results it was apparent that on the Verbal Fluency subtest, subjects classified within the Mild Anxiety and the Internalizing subtypes scored significantly higher than did those subjects within the Somatic Concern subtype. Children classified within the Mild Anxiety subtype also scored significantly higher than did those children classified within the Somatic Concern subtype. Subjects within the Externalizing and Mild Anxiety socioemotional subtypes scored significantly
Table 8

Scheffe's Test Post-Hoc Comparisons for the Effect of Group Membership on PIC Scales

<table>
<thead>
<tr>
<th>PIC SUBSCALE</th>
<th>Reading-Impaired</th>
<th>Controls</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PACH</td>
<td>63.44</td>
<td>65.56</td>
<td>*</td>
</tr>
<tr>
<td>PIS</td>
<td>77.52</td>
<td>64.67</td>
<td>*</td>
</tr>
<tr>
<td>PDVL</td>
<td>69.70</td>
<td>64.58</td>
<td>*</td>
</tr>
</tbody>
</table>

Note 1. * indicates pairs of comparisons significantly different at the 0.05 level.

Note 2. df = 245.
Table 9

ANOVA Summary for Significant Differences Between Subtypes for Neuropsychological Variables

<table>
<thead>
<tr>
<th>Variables</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Fluency</td>
<td>3.07</td>
<td>**</td>
</tr>
<tr>
<td>Sentence Memory</td>
<td>2.63</td>
<td>*</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>2.98</td>
<td>**</td>
</tr>
<tr>
<td>Speech-Sounds</td>
<td>4.24</td>
<td>**</td>
</tr>
<tr>
<td>PPVT</td>
<td>1.10</td>
<td></td>
</tr>
<tr>
<td>CWFT</td>
<td>1.70</td>
<td></td>
</tr>
<tr>
<td>WRAT Reading</td>
<td>3.38</td>
<td>**</td>
</tr>
<tr>
<td>WRAT Spelling</td>
<td>2.67</td>
<td>*</td>
</tr>
<tr>
<td>WISC Information</td>
<td>2.20</td>
<td>*</td>
</tr>
<tr>
<td>WISC Comprehension</td>
<td>1.16</td>
<td></td>
</tr>
<tr>
<td>WISC Similarities</td>
<td>1.14</td>
<td></td>
</tr>
<tr>
<td>WISC Vocabulary</td>
<td>1.27</td>
<td></td>
</tr>
</tbody>
</table>

Note 1.  * = p < .05.
        ** = p < .01.

Note 2.  df = (6, 222)
<table>
<thead>
<tr>
<th>Neuropsychological Variables</th>
<th>Subtypes</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Fluency</td>
<td>Mild Anxiety (higher) x Somatic</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Internalizing (higher) x Somatic</td>
<td>*</td>
</tr>
<tr>
<td>Sentence Memory</td>
<td>Mild Anxiety (higher) x Somatic</td>
<td>*</td>
</tr>
<tr>
<td>Auditory Closure</td>
<td>Externalizing (higher) x Somatic</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Mild Anxiety (higher) x Somatic</td>
<td>*</td>
</tr>
<tr>
<td>Speech-Sounds</td>
<td>Internalizing (higher) x Somatic</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Externalizing (higher) x Somatic</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Mild Anxiety (higher) x Somatic</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Normal (higher) x Somatic</td>
<td>*</td>
</tr>
<tr>
<td>WISC Information</td>
<td>Externalizing (higher) x Normal</td>
<td>*</td>
</tr>
<tr>
<td>WRAT Reading</td>
<td>Externalizing (higher) x Normal</td>
<td>*</td>
</tr>
<tr>
<td>WRAT Spelling</td>
<td>Internalizing (higher) x Normal</td>
<td>*</td>
</tr>
<tr>
<td></td>
<td>Externalizing (higher) x Normal</td>
<td>*</td>
</tr>
</tbody>
</table>

Note 1. * indicates comparisons significantly different at the 0.05 level.
higher on the Auditory Closure test than did subjects within the Somatic Concern subtype. On the Speech-Sounds Perception test, subjects in the Internalizing and Externalizing subtypes scored significantly higher than subjects classified within the Somatic Concern subtype on the PIC, as did subjects within the Normal and Mild Anxiety profiles. Finally, those subjects within the Externalizing subtype performed significantly better on the WISC Information subtest than did subjects classified as Normal. Differences between socioemotional subtypes on performance on the WRAT subtests will be discussed in the following section.

**Subtype Differences on the WRAT**

Mean WRAT scores on WRAT Reading and Spelling subtests were calculated and employed to plot Figure 2 (see Table 2). Examination of Figure 2 indicated that both WRAT Reading and Spelling performances differed between subtypes. As univariate ANOVA's across subtype reached significance on these variables (refer to Table 9), post-hoc planned comparisons using Bonferroni T-Tests were conducted to determine which of the seven subtypes were significantly different on WRAT Reading and Spelling subtests (refer to Table 10).

The results of this analysis indicated that, with alpha set at .05, significant differences between subtypes were evident between the "Normal" socioemotional subtype and the "Externalizing" subtype on the WRAT Reading subtest. No other comparisons reached significance for the WRAT Reading subtest.
Figure 2. Mean WRAT Reading and Spelling Centile Scores for All Socioemotional Subtypes.
Thus, subjects classified within the Externalizing subtype displayed significantly higher WRAT Reading scores than did subjects classified within the Normal subtype. For WRAT Spelling, children within both the Internalizing and Externalizing subtypes demonstrated significantly better performance than did children within the Normal subtype.

To evaluate whether WRAT Reading and WRAT Spelling performances were related to severity of psychosocial dysfunction, mean WRAT Reading and Spelling centile scores were calculated for each of the mild, moderate, and severe forms of psychosocial dysfunction that were outlined previously. These values are presented in Table 11. Examination of the means of Reading and Spelling centiles for these three forms of psychosocial severity indicated that for both WRAT subtests there was a trend towards higher scores with increasing severity of psychosocial dysfunction. Children with lower scores were more likely to exhibit the milder forms. Linear trend analysis revealed a significant linear trend towards increasing WRAT Reading ($E(2, 241) = 9.60; p < .01$) and Spelling ($E(2, 241) = 7.62; p < .01$) means over these three levels of psychosocial dysfunction. Quadratic trends were not significant. This relationship is demonstrated graphically in Figure 3.
Table 11

**Mean WRAT Reading and Spelling Centiles Within Mild, Moderate, and Severe Groups of Psychopathology**

<table>
<thead>
<tr>
<th>Group</th>
<th>Subtype</th>
<th>WRAT Reading</th>
<th>WRAT Spelling</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild</td>
<td>Normal</td>
<td>25.88</td>
<td>22.08</td>
</tr>
<tr>
<td></td>
<td>Somatic</td>
<td>33.69</td>
<td>28.70</td>
</tr>
<tr>
<td></td>
<td>Hyperactive</td>
<td>38.30</td>
<td>33.08</td>
</tr>
<tr>
<td></td>
<td>Conduct Disorder</td>
<td>29.53</td>
<td>28.53</td>
</tr>
<tr>
<td></td>
<td><strong>MEAN (MILD)</strong></td>
<td><strong>31.85</strong></td>
<td><strong>27.80</strong></td>
</tr>
<tr>
<td>Moderate</td>
<td>Mild Anxiety</td>
<td>33.13</td>
<td>29.95</td>
</tr>
<tr>
<td></td>
<td><strong>MEAN (MODERATE)</strong></td>
<td><strong>33.13</strong></td>
<td><strong>28.95</strong></td>
</tr>
<tr>
<td>Severe</td>
<td>Internalizing</td>
<td>42.32</td>
<td>39.64</td>
</tr>
<tr>
<td></td>
<td>Externalizing</td>
<td>45.38</td>
<td>34.21</td>
</tr>
<tr>
<td></td>
<td><strong>MEAN (SEVERE)</strong></td>
<td><strong>43.85</strong></td>
<td><strong>36.93</strong></td>
</tr>
</tbody>
</table>
Figure 3. Mean WRAT Reading and Spelling Centile Scores for Mild, Moderate, and Severe Forms of Psychopathology
CHAPTER IV
DISCUSSION

The purpose of the present investigation was to evaluate the relationship between reading disability and socioemotional subtype in children. More specifically, this study was directed at the evaluation of the neuropsychological linguistic performances of these two groups of children, and how these patterns of performance differed between socioemotional subtypes. Subjects were grouped into two groups according to their performance on a test of academic achievement in reading (word recognition), and their scores on various neuropsychological psycholinguistic measures were analyzed to assess differences between the two groups. Subjects' scores on a measure of adaptive or psychosocial functioning were also analyzed to reveal group differences on these psychosocial scales. Finally, scores on both the psycholinguistic measures and the psychosocial scales were analyzed to evaluate the degree of predictive accuracy of the psycholinguistic measures in classifying subjects into reading group and socioemotional subtype. The results of these analyses are discussed below in relation to the research hypotheses presented in the first chapter. The implications of these findings, limitations of the research, and avenues of future study will be outlined here.
Performance of Reading-Impaired Children and Controls on Neuropsychological Linguistic Variables

As explained previously, the results of studies by Rourke and Finlayson (1978) and Strang and Rourke (1983) demonstrated that 5-year-old to 14-year-old language-impaired children (impaired on reading and spelling) differ markedly in their patterns of neuropsychological abilities and deficits from those who do not exhibit these linguistic deficits. The first research hypothesis predicted that the reading-impaired subjects would perform more poorly on the neuropsychological linguistic measures employed in this investigation. The results of the present study support the acceptance of this hypothesis and the findings of these earlier investigations. The reading-impaired group displayed difficulties in many areas of language functioning measured by the WISC, and significant difficulties in auditory-perceptual tasks as well as on tests of verbal fluency.

With reference to the second research hypothesis, it was not expected that the more rote, overlearned language tests (PPVT and WISC subtests) and the more linguistically complex language tests (CWFT) would also be significantly different between reading-impaired and control subjects. The age of the subjects may have played a role in the group differences on these measures. The average age of these children was approximately eight years, and this is substantially different from the earlier reported sample of nine- and fourteen-year-olds. Ozols and Rourke (1981) provide data evaluating younger children (seven- and eight-year-olds) on some of the same auditory-linguistic measures as have been used
in this investigation, including the subtests of the WISC. The WISC Similarities subtest was the only measure in this study on which group differences did not reach significance. These authors suggest that "complex linguistic skills may not be a prerequisite for successful performance on this task (Similarities)" (p. 105). It is also possible that the performance on the WISC Comprehension subtest exhibited by the sample of children in the present study may indicate reliance on other skills to correctly answer questions. Many of the responses to the "Comprehension" questions may be rote, overlearned social behaviors and thus may not tap verbal comprehension skills for this sample of children.

The fact that the children in this study were of approximately seven to eight years of age should not be overlooked when evaluating the differences between reading disability subtypes and neurocognitive performance. A previous study of younger learning-disabled children (five- to eight-year-olds) was not able to demonstrate significant differences between subtypes of children who were classified using the WISC (Rourke, Dietrich & Young, 1973). These differences, relatively more clear for older children (Rourke & Telegedy, 1971; Rourke, Young, & Flewelling, 1971), were not apparent in these samples of a younger age group. Ozols and Rourke (1991) hypothesize that "the absence of significant group differences for young children is related to the relative unreliability of the psychological tests at these ages and/or the relatively undifferentiated ability
structures of young children" (pp. 99-100). These authors evaluated a sample of seven- and eight-year-old learning-disabled children on their patterns of cognitive functioning when classified on the basis of their performance on academic achievement measures. Group 1 children in the Ozols and Rourke (1981) investigation displayed deficient performance on all three of the WRAT Reading, Spelling, and Arithmetic subtests. Group 2 obtained severely impaired WRAT Reading and Spelling centile scores and average Arithmetic scores. Group 3 performed from the average range to the above average range on the WRAT Reading and Spelling tests, but exhibited deficient Arithmetic scores. The auditory-linguistic measures were equivalent to those employed in the present investigation. Statistically significant differences between groups were found on nine of the ten neuropsychological linguistic variables. The above mentioned study, and the results of the present investigation appear to support the hypothesis that, for younger children, performance on almost all auditory-linguistic measures may be significantly different between subtypes of learning-disabled children.

Socioemotional Characteristics of Reading-Impaired and Control Subjects

As stated in the third research hypothesis, the results of the profile matching analysis revealed that reading-impaired children do display different socioemotional patterns than non-reading-impaired children. The psychosocial compositions of the two groups of children in this investigation corresponded well
with those of previous studies derived from factor analytic
techniques (Porter and Rourke, 1985). It was evident that both
the reading-impaired and control subjects displayed elevations on
the clinical scales of the PIC, and that some of each group were
most similar to the Normal subtype. The first and largest
subtype (64 subjects in total) was characterized by no elevations
on the PIC scales reflecting socioemotional disturbance (Normal).
The parent-respondents of this group of children were primarily
concerned with the cognitive development and academic functioning
of these children. This subtype was composed of primarily
reading-impaired children (75%). The PIC profile of the second
largest subtype (52 subjects in total) was suggestive of
"externalized", hyperkinetic behavior dysfunction, and both
groups of children were equally represented in this subtype. The
other five socioemotional subtypes all displayed no significant
differences in composition between reading-impaired children and
control subjects, and were not substantially different in number
from what may be estimated by chance. Recall that Strang and
Rourke (1985) found that average PIC profiles for children in the
"verbally disabled" group were similar to the "normal" group in
the Porter and Rourke (1985) study. Although the fourth research
hypothesis predicted that a greater proportion of the reading-
impaired children would display some psychopathology on the PIC,
it would appear that in this study the reading-impaired subjects
displayed a number of different socioemotional profiles, but the
majority of these children comprised either the Normal subtype or
those subtypes characterizing mild forms of psychopathology. Trends in the data indicated that well developed reading and spelling ability may be associated with more severe forms of psychopathology, rather than the reverse.

**Use of the WRAT Subtests as Criteria for Classification of Learning-Disabled Children**

Many authors have suggested the use of caution when employing achievement measures such as the WRAT to classify learning-disabled children (Satz & Morris, 1981). While this measure is somewhat restricted in the scope of the linguistic skills it evaluates, the WRAT has been validated as an accurate method of subject selection for subgrouping learning-disabled children (Petrauskas & Rourke, 1979; Porter & Rourke, 1985; Rourke & Finlayson, 1978; Strang & Rourke, 1983). This conclusion was supported in the present investigation. The reading-impaired and control subjects were classified into these groups as accurately by these achievement measures as they were categorized by the widely accepted, standardized linguistic subtests of the WISC and the normed measures of the neuropsychological tests of language functioning employed. Thus the WRAT may be used with some confidence as a subgrouping criterion for future studies.

**Predictive Accuracy of Neuropsychological Linguistic Variables for Socioemotional Subtype**

Consistent with the fifth research hypothesis, the results
here would indicate that neuropsychological measures of language abilities (Verbal Fluency, Auditory Closure, Speech-Sounds Perception, and the WRAT Reading and Spelling subtests) may serve as the best predictors for maximally separating subtypes. WISC Information and WISC Comprehension subtests appear to be very poor in their discriminative power for socioemotional subtype. Tests such as WISC Similarities, WISC Vocabulary, and Sentence Memory tend to be moderately good in their prediction of subtype membership. Previous research has found that linguistically impaired children perform significantly below the mean on linguistic measures evaluating auditory-perceptual processes (Speech-Sounds Perception Test, Auditory Closure Test, Sentence Memory Test) (Rourke, 1989).

Rourke (1989) also found that on tests of verbal ability as measured by the WISC (Similarities, Information, Vocabulary and Digit Span) and the Peabody Picture Vocabulary Test, the group of verbally impaired children were not as significantly different from comparison group (visual-perceptually impaired). Thus, these subtests of the WISC and the PPVT may not prove accurate discriminators between these two groups of learning-disabled children, and would not be expected to accurately discriminate between socioemotional subtypes of learning-disabled children either. It is of interest here that subjects' performance on the WRAT Reading and Spelling tests of academic achievement are among the most important predictors for distinguishing between socioemotional subtype. This issue will be dealt with in the
following section. The nature of the relationship between psychosocial functioning and academic achievement has been the focus of a great deal of research in the recent past (Rourke & Fuerst, 1991). Further research relating to patterns of central processing deficits that may lead to patterns of academic achievement is necessary to clarify their relationships to the incidence and characteristics of psychopathology.

**Socioemotional Subtype Performance on the WRAT**

Reading-impaired and control children in this study also performed differently on the measures of academic achievement by which they were classified. These patterns of performance differed with respect to their respective socioemotional subtype classification. The results of analyses with respect to these differences revealed that those children within the Externalizing Psychopathology subtype scored significantly higher on the WRAT reading subtest than did children in any other subtype. Children within the Internalizing Psychopathology subtype scored almost as high on the WRAT Reading subtest, although the relationship did not quite reach statistical significance. Fuerst and Rourke (1991) also compared groups of learning-disabled children on achievement measures and found that children with relatively well developed reading and spelling skills were more likely to appear in PIC subtypes designated as "severe" psychopathology, whether it be of the "internalizing" or "externalizing" variety. Children with less well developed reading and spelling skills
demonstrated either mild somatization or conduct disorder problems, or were indistinguishable from normal children. These results are consistent with the data from the present study, as children in this sample who scored the lowest on the WRAT reading test comprised the Normal, Conduct Disorder, Mild Hyperactivity, Mild Anxiety and Somatic Concerns subtypes.

The Utility of The PIC "Cognitive Triad" in Differentiating Reading-Impaired Children From Non-Reading-Impaired Children

The finding that only three of the 16 PIC subscales were significantly different between reading-impaired and control subjects was also of interest. The Achievement, Intellectual Screening, and Development subscales were both clinically elevated (i.e.; > 70 T score) and significantly elevated for the reading-impaired subjects as compared to the control group. These scales have been identified as the "Cognitive Triad" (Kline, Lachar, & Sprague, 1985), and have been found to clearly discriminate learning-disabled children from behavior-disordered children (Goh, Cody, & Dollinger, 1984). Kline et al. (1985) describes the construction of these scales:

The ACH and IS scales were constructed from items that discriminated, respectively, reading-disabled from normal children, and retarded from normal non-retarded disturbed, and psychotic children. The DVL scale comprises items suggestive of delayed development and deficient judgment skills (p. 146).

Kline et al. (1985) utilized a multiple regression procedure to evaluate all the scales of the PIC. This study was done to determine whether these scales adequately predicted performance
on cognitive and academic measures (i.e.; the WISC-R, PPVT, and Peabody Individual Achievement Test [PIAT]; Dunn & Markwardt, 1970). All three scales were significantly correlated with the criterion measures, and these correlations were larger than those found for the other scales. These authors point out that the three scales together were good predictors of academic and intellectual functioning, but that each scale individually did not differentially predict cognitive and academic test results. In this study, WISC-R, PIAT and PPVT measures related only to the PIC cognitive triad scales and not to the other subscales of the PIC. The results of the present study support these observations, in that only ACH, IS, and DVL were significantly elevated for the reading-impaired group as compared to the control group.

Implications of the Research Findings

The results of the present investigation have both clinical and research implications. The finding of primarily normal levels of psychopathology for the reading-impaired subjects indicates that inferring a causal relationship between reading-disability and psychosocial dysfunction may not be entirely accurate. The suggestion by Rourke (1988) that these children may experience some forms of socioemotional disturbance, but that these are a result of environmental and family social disadvantage may have some support. It is difficult to make developmental conclusions while employing a cross-sectional
research design, but the results of Fuerst (1991) would suggest that both patterns and incidence of psychosocial functioning with increasing age for learning-disabled children are generally stable. Thus it would not be expected that these patterns observed for reading-impaired children would change substantially over time.

The finding that there were some indications of psychosocial subtype differences on the WRAT is of interest for those investigators focused on the relationship between academic performance and socioemotional functioning. If one accepts the premise that there are specific patterns of central processing assets and deficits that lead to both subtypes of learning disabilities as well as characteristic forms of socioemotional dysfunction, then relationships such as those observed between performance on measures of academic achievement and profiles on psychosocial measures are clinically significant. The results of this study and those of Fuerst and Rourke (1991) would indicate that children with higher linguistic skills are the individuals more likely to exhibit more severe psychosocial dysfunction. Children with reading and spelling deficits would be more likely to present with milder psychosocial difficulties or none at all. These results are similar enough to warrant replication, as they were found for two distinctly different samples of learning-disabled children.

The finding that neuropsychological tests of language functioning are good predictors of both reading-impairment and
somewhat accurate in predicting psychosocial functioning has implications for assessment and evaluation of learning-disabled children, but the interpretation of these results must be tempered with some caution. Previous studies have validated these linguistic tests as accurate discriminators of reading-disabled children, but there exists little support for the use of these tests to predict socioemotional subtype, especially in a sample of reading-impaired children. As measures such as the PIC already exist for such a purpose, it would seem more prudent to utilize them in this manner.

Limitations of the Study

A number of methodological limitations within this research call for cautious interpretation of the results. Most obviously, the use of a larger sample size would considerably strengthen the results. Non-significant experimental findings may in fact prove significant with an increase in the sample size. It would be advisable to balance the reading-impaired group with the control group with respect to sample sizes, as a statistical correction factor for unbalanced groups would not then be necessary.

A second limitation of this study may lie in the lack of what might be considered a truly "normal" control group. While there were two comparison groups, the "control" subjects as described in this investigation were drawn from the same population of clinic-referred children as the reading-impaired group, and therefore cannot be considered a completely normative
sample. The addition of a third group of children who had not
been previously identified as in need of assessment for any
reason may serve to clarify any differences observed between
reading-impaired and non-reading-impaired children. It is also
important to keep in mind that the PIC is a normed and
standardized measure of psychosocial functioning, and for this
reason a third "normal" group of children was not deemed
necessary for this investigation.

The findings of this study may only be generalized to the
age group in question, or those children ranging in age from six
to nine. Because of the cross-sectional nature of the design,
developmental considerations may not be adequately dealt with.
Further investigations employing two or three age levels may
clarify whether these children were simply at an immature age to
display psychosocial deficits, or if increasing age would have
little impact at all on the socioemotional constitution of the
reading-impaired child.

Recommendations for Future Research

Future research involving socioemotional functioning and
reading impairment should focus on more accurate definition of
the groups involved, so that direct inferences may be made
concerning the impact of reading failure on psychosocial status.
It may be important to utilize groups more disparate on measures
of reading and spelling to better separate children with severe
reading deficits from children with only slight impairment.
Risk factors also need to be well defined when dealing with early language impairment and socioemotional dysfunction. Future studies employing longitudinal designs may be valuable additions to the research on developmental changes in psychosocial functioning of the reading-impaired child. Moreover, the use of indices of family disadvantage, as was suggested by Silva, Williams, and McGee (1987), would control for environmental and familial risk factors not in evidence when research is directed solely at current psychosocial status.

Finally, replication of these results is necessary to ensure the reliability of the patterns outlined in previous pages.
REFERENCES


APPENDIX A

STANDARD DEVIATIONS
<table>
<thead>
<tr>
<th>Variable</th>
<th>Standard Deviations (Total Sample)</th>
</tr>
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<tbody>
<tr>
<td>Verbal Fluency</td>
<td>2.64</td>
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<tr>
<td>Sentence Memory</td>
<td>2.41</td>
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<tr>
<td>Auditory Closure</td>
<td>3.99</td>
</tr>
<tr>
<td>Speech-Sounds</td>
<td>5.37</td>
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<tr>
<td>PPVT</td>
<td>14.31</td>
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<tr>
<td>CWFT</td>
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<td>WRAT Spelling</td>
<td>22.37</td>
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<tr>
<td>WISC Comprehension</td>
<td>2.48</td>
</tr>
<tr>
<td>WISC Similarities</td>
<td>2.74</td>
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<tr>
<td>WISC Vocabulary</td>
<td>2.29</td>
</tr>
<tr>
<td>Age</td>
<td>0.73</td>
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</table>
APPENDIX B

SEVEN PROTYPIC SOCIOEMOTIONAL PROFILES
ON THE PERSONALITY INVENTORY FOR CHILDREN
Figure 1. Prototypical mean PIC profile for the Normal subtype.
Figure 2. Prototypical mean PIC profile for the Mild Hyperactive subtype.
Figure 3. Prototypical mean PIC profile for the Mild Anxiety subtype.
Figure 4. Prototypical mean PIC profile for the Somatic Concern subtype.
Figure 5. Prototypical mean PIC profile for the Conduct Disorder subtype.
Figure 6. Prototypical mean PIC profile for the Internalized Psychopathology subtype.
Figure 7. Prototypical mean PIC profile for the Externalized Psychopathology subtype.
APPENDIX C

PROFILE MATCHING ALGORITHM
Macro For Performing Simple Matching

/*------------------------------------ PROFMAT ------------------------------------*/
/* THE PROFMAT MACRO IMPLEMENTS THE SIMPLE PROFILE MATCHING */
/* ALGORITHM USED IN THIS STUDY. THE PARAMETERS ARE THE */
/* NAME OF THE DATASET CONTAINING THE OBSERVATIONS TO BE */
/* ASSIGNED TO SUBTYPES, THE NAME OF THE DATASET CONTAINING */
/* THE PROTotypical (OR SEED) PROFILES, THE MINIMUM */
/* ACCEPTABLE LEVEL OF SIMILARITY FOR ASSIGNMENT TO OCCUR, */
/* THE NUMBER OF PROTOTYPES, THE NUMBER OF VARIABLES TO USE */
/* IN CALCULATING SIMILARITIES, AND A LIST OF THE VARIABLE */
/* NAMES, EACH SEPARATED BY A '+' . NOTE THAT, AS WRITTEN, */
/* THIS MACRO USES CORRELATION COEFFICIENTS AS THE */
/* SIMILARITY MEASURE; HOWEVER, THIS COULD BE EASILY CHANGED*/
/* TO ANY SUITABLE SIMILARITY/DISSIMILARITY MEASURE. */
/*------------------------------------*/
%MACRO PROFMAT(INSET,SEEDSET,MINSIM,NSED,NPVars,PVARS);
DATA PMTMP;
/*THE FOLLOWING VECTOR IS REALLY A NSEEDxNPVARS MATRIX USED */
/*TO HOLD THE PROTotypical PROFILES - NO 2D ARRAYS IN CMS */
/*SAS!*/
ARRAY X($EVAL(&NSED*&NPVARS)) X1-X%EVAL(&NSED*&NPVARS);
/*THE FOLLOWING VECTOR IS FOR TEMP STORAGE OF THE PVAR */
/*VALUES*/
ARRAY Y($NPVARS)
%DO I=1 %TO &NPVARS;
  %SCAN(&PVARS,&I,+)
%END;
;/*VECTOR CR HOLDS THE NSEED SIMILARITIES FOR AN */
/*OBSERVATION*/
ARRAY CR(&NSED) CR&NSED;
PT=1;
SET &SEEDSET POINT=PT NOBS=NO;
IF _ERROR_=1 THEN ABORT;
DO I=1 TO NO;
  PT=1;
  SET &SEEDSET POINT=PT; /*Y() IS NOW LOADED WITH PROTO VALS */
  IF _ERROR_=1 THEN ABORT;
  DO J=1 TO &NPVARS; /*COPY THEM TO SEMIFERM STORAGE IN */
    /*X()*/
    X((I-1)*&NPVARS+J)=Y(J);
  END;
END;
PT=1;
SET &INSET POINT=PT NOBS=NO;
IF _ERROR_=1 THEN ABORT;
DO I=1 TO NO;         /*FOR EVERY SUBJECT... */
   PT=I;
   SET &INSET POINT=PT;
   IF _ERROR_=1 THEN ABORT;
   SY=0;                /*CALCULATE CORRS WITH Prototypes */
   SYQ=0;
   DO K=1 TO &NPVARS;   /*CALC THE Y VALUES ONLY ONCE */
      SY=SY+Y(K);
      SYQ=SYQ+(Y(K)**2);
   END;
   DO J=1 TO &NSEED;
      SX=0;
      SXQ=0;
      SXY=0;
      DO K=1 TO &NPVARS; /*/CALC X AND XY VALUES /*
         SX= SX+X(((J-1)*&NPVARS)+K);
         SXQ= SXQ+X(((J-1)*&NPVARS)+K)**2);
         SXY= SXY+Y(K)*X(((J-1)*&NPVARS)+K);
      END; /*K*/
      CR(J)=((&NPVARS*SXY)-(SX*SY))/
            SQRT(((&NPVARS*SXQ)-(SX**2))**2))*((&NPVARS*SYQ)-(SY**2));
   END; /*J*/
   PROTO=0;
   MAXCORR=-2;
   DO J=1 TO &NSEED;   /*GOT ALL CORRS SO DO THE ASSIGNMENT */
      IF (CR(J) >= &MINSIM) AND (CR(J) > MAXCORR) THEN DO;
         PROTO=J;
         MAXCORR=CR(J);
      END;
   END;
   DROP X1-X%EVAL(&NSEED*&NPVARS) MAXCORR SX SY SXY SXQ SYQ;
   OUTPUT;
   END; /*I*/
STOP;
;
PROC DATASETS NOLIST;
DELETE &INSET;
;
PROC DATASETS NOLIST;
CHANGE PNTMP=&INSET;
%MEND;
VITA AUCTORIS

Maureen Elizabeth Wess was born on October 26, 1963 in Winnipeg, Manitoba. She graduated from Windsor Park Collegiate in June, 1981. She received her Honours Bachelor of Arts degree from the University of Winnipeg, Manitoba in May, 1989. Currently, she is enrolled in the doctoral program in Clinical Neuropsychology at the University of Windsor, Ontario.