

**LANGUAGE SKILLS OF
ADOLESCENTS WITH TOURETTE SYNDROME**

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DECLARATION

I declare that this research project is my own work and that it has not been submitted to any other University.

Carol Legg

Carol Frances Legg

29th March 1999

Date

DEDICATION

This research report is dedicated to children and adolescents with Tourette Syndrome and related disorders. I hope it will raise an awareness of the condition within the profession of speech and language pathology and guide further management.

To those individuals who participated in this study,

"I will note you in my book of memoirs"

Shakespeare, *King Henry VI*

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ABSTRACT

A multiple single-case study investigated language characteristics in adolescents with Tourette Syndrome (TS). The initial impetus for this study was a lack of unanimity in the literature on language features in TS and the limited role of the speech and language therapist in a neurological condition associated with educational and social impairment. Ten adolescent subjects with diagnosed TS were evaluated on a test battery sensitive to high level language and subtle discourse impairment. Results were compared to established norms, or where no norms have been established, with results obtained by five non-neurologically impaired adolescent subjects.

Intact communicative functioning was demonstrated by six of the ten subjects within the group, however certain tasks within the battery posed particular difficulty for two subjects whose performance was otherwise judged to be within normal limits. Four subjects were differentiated from normal communicative performance by their test results. Disorganized output, concreteness of language and poor formulation abilities were apparent. This symptomatology may reflect prefrontal disturbance and can be explained by the pathogenesis of the disorder.

The results gleaned from this investigation indicate that disordered language may be an integral feature of the syndrome. This finding adds to the literature regarding subcortical and frontal cortex involvement in language and places importance on the role of the speech and language therapist in the clinical and educational management of the TS population.

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"Unlocking the mysteries of Tourette Syndrome will not only provide new insight into the function of the human brain, but it will open a window into our understanding of the most basic aspects of human behavior."

Joseph Jankovic, 1997a, p. xvi

1. INTRODUCTORY PERSPECTIVE

This study investigates language skills in the adolescent Tourette Syndrome (TS) population and explores the relationship between language symptoms, the pathogenesis of TS and associated problems of the disorder.

The rationale for this study arose from recent reconceptualizations regarding TS. Once considered a rare disorder, characterized by motor and vocal tics and associated psychopathologies, TS is now regarded as a broadly-based behavioural disorder of high prevalence. Cognitive concomitants of TS have been recognised and may be an important contributor to academic problems in the school-age population.

In view of the intricate relationship between language and cognition, it is unlikely that communication remains unimpaired in TS. Yet, surprisingly little is known about the language features of the disorder. There is scant reference to language in the TS literature and reports of language impairment are anecdotal and conflicting. In referring to language abilities in individuals with TS, terms such as *speech* and *expression* are used loosely and interchangeably with *language*, *verbal fluency* and *verbal IQ* (Bornstein, King & Carroll, 1983; Brookshire, Butler, Ewing-Cobbs & Fletcher, 1994; Ludlow, Polinsky, Caine, Bassich, & Ebert, 1982).

There is thus a need to document language characteristics in TS to improve educational and therapeutic practice and to add to the general knowledge of a well-described condition,

Furthermore, the study of TS offers the opportunity to investigate the functional role of the basal ganglia and frontal lobe interconnections in language processing.

1.1. TOURETTE SYNDROME: DEFINITION AND DESCRIPTION

"It is a good scientific principle to begin by defining and limiting the field which is to be examined."

(James, 1970, p. 19)

1.1.6. Diagnostic Criteria of Tourette Syndrome

Tourette Syndrome (TS) is a hereditary neurobehavioural disorder associated with abnormalities in synaptic neurotransmission and subsequent damage to basal ganglia structures and related subcortical-cortical circuitry (Devinsky, 1983; Kurlan, 1989; Robertson, 1989; Singer & Walkup, 1990). Recent theory regarding the pathogenesis of TS suggests that an excess of sex hormones which mediate developmental brain processes cause abnormal development within the basal ganglia and limbic systems resulting in disrupted neurochemical activation (Kurlan, 1994; Kurlan, 1997a).

TS is characterised by a spectrum of motor and co-morbid behavioural problems. The disturbance in neurotransmitter systems manifests principally in motor and vocal tics, which are involuntary, repetitive movements or vocalizations. Although briefly suppressible, these tics form the essential diagnostic criteria for TS. Motor tics most often affect the face and neck muscles, but the extremities may also be involved. These tics may be simple, such as an eye blink, or complex, such as bending over and touching the ground. The vocal tics are usually unintelligible sounds, such as sniffing or grunting, but interesting

complex vocal phenomena occur in few cases. These features are perhaps the most celebrated signs of the syndrome and include coprolalia, which is involuntary inappropriate swearing, echoialia, the repetition of the speech of others, and pallilalia, the involuntary repetition of one's own speech. These actions may co-occur with the involuntary use of obscene gestures, referred to as copropraxia.

Tics are therefore classified as motor or phonic, simple or complex (Jankovic, 1997b). They may be exacerbated by increased emotional stress and the anatomical location, frequency and complexity of tics change over time. Comprehensive diagnostic criteria for the condition are documented in the Diagnostic and Statistical Manual of Mental Disorders, fourth edition (DSM-IV) of the American Psychiatric Association (1994) and presented in Table 1.

Table 1. DSM IV Diagnostic Criteria for Tourette Syndrome

- Both multiple motor and one or more vocal tics are to be present at some time during the illness, and not necessarily concurrently.
- The tics occur many times a day (usually in bouts), nearly every day or intermittently throughout a period of more than one year, and during this period there was never a tic-free period of more than three consecutive months.
- The disturbance causes marked distress or significant impairment in social, occupational, or other important areas of functioning.
- The onset is before 18 years of age.
- Symptoms do not occur exclusively during psychoactive intoxication or known central nervous system disease, such as Huntington's Chorea and post-viral encephalitis.

From: *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition* (American Psychiatric Association, 1994)

1.1.2. Historical and Epidemiological Perspectives

TS was first described in a case report by Itard in 1825. It was 60 years later however, that Charcot named the syndrome Gilles de la Tourette Syndrome after his scholar who described the diagnostic criteria and associated conditions of the syndrome based on nine case studies (Lajonchere, Nortz & Finger, 1996). Gilles de la Tourette's 1885 report created an awareness of this previously neglected syndrome in the neurological sciences and famous ticquers like Samuel Johnson, Amadeus Mozart and Napoleon Bonaparte were recognised.

Many of the syndrome's features described by Gilles de la Tourette remain valid today, however suggestions that TS is of a psychopathologic origin have been replaced by theories of genetic transmission. Research findings obtained from familial and twin studies support a sex-influenced, autosomal dominant mode of inheritance (Alsobrook & Pauls, 1997; Devor, 1990; Singer & Walkup, 1991; van de Wetering & Heutink, 1993). Some researchers propose that environmental factors interact with genetics to determine the heterogenous phenotypic expression of the syndrome in each individual, such as severity and occurrence of associated problems (Robertson, 1989).

In a recent review of epidemiologic studies, Tanner and Goldman (1997) demonstrated that the approximation of the prevalence of TS is variable across studies and is dependent on the definition of the disorder adopted for the study. It is suggested that the prevalence of TS has been underestimated (Cairze, McBride, Chiverton et al., 1988; Comings, Himes & Comings, 1990; Mason, Banerjee, Eapen et al., 1998) and results of recent epidemiologic studies demonstrate that TS is more common than the generally accepted

prevalence figure of five per 10 000 individuals. Comings et al. (1990) estimated the prevalence of TS to be 105 per 10 000 for males and 13 per 10 000 for females following a survey of a Californian school district. Using the same school survey methodology, Mason et al. (1998) identified five pupils within a mainstream secondary school with TS and yielded a prevalence figure of 299 per 10 000. The disorder manifests across all social and racial classes, but is far more prevalent in males than females.

1.1.3. Management of Tourette Syndrome

Pharmacologic therapy is the primary treatment approach in TS. The medication is symptomatic and thus variable. Dopaminergic drugs, which imitate the action of dopamine neurotransmission, have been found to be effective in suppressing tics and are administered to individuals whose tics are chronic and debilitating. Halperidol, sulpiride and pimozide are widely used drugs in the treatment of TS (Kurlan, 1997b; Robertson and Stern, 1997), however side effects include sedation, depression, poor school performance and motor dysfunction (Bornstein & Yang, 1991; Freeman, 1997; Singer, Schuerholz & Denckla, 1995). In the TS population, it may often be the associated conditions of obsessive compulsive disorders, attentional deficits and behavioural difficulties that present the greatest handicap. In these cases, drug selection targets the associated problems and psychostimulants and anti-depressants are frequently prescribed (Robertson, 1989; Singer & Walkup, 1991).

1.2. THE SPECTRUM OF TOURETTE SYNDROME

"Clearly, a better definition of the Tourette Syndrome behavioural spectrum is needed"

(Kurlan, 1997a, p. 452)

1.2.1. Co-morbid Disorders in Tourette Syndrome

There is a high frequency of associated conditions in TS. These include learning difficulties, Attention Deficit Disorder with or without Hyperactivity (ADHD and ADD), Obsessive Compulsive Disorder (OCD) and conduct disorder (Comings, 1990; Palumbo, Maughan & Kurlan, 1997; Robertson, 1989). In addition, dyslexia, stuttering, depression and phobias are said to occur five to 20 times more often in individuals with TS than in the general population (Comings, 1990). Although there is renewed interest in co-morbidity in TS in the literature, there remains confusion regarding differentiation between the core features of TS, the associated features which are not essential to diagnosis and other conditions that are present in addition to TS. Thus, co-morbidity is a complex question with theoretical and clinical implications.

The relationship between TS and ADHD has received much attention in the literature. ADHD or ADD co-occurs in 50 to 70% of TS cases (Caine et al., 1988, Coffey & Park, 1997) and accounts for most of the learning and behavioural problems observed in TS. It remains equivocal, however, whether there is a genetic association between ADHD and TS (Devor, 1990). The very nature of these co-occurring conditions is debated. On the one hand, attentional deficits may be inherent to the clinical expression of TS. Alternatively, TS and ADHD may exist as unitary disorders that frequently co-occur due to a common

underlying pathogenesis or genetic susceptibility. TS and ADHD are recognised in the literature as distinct conditions however, this division may not be clinical reality. Although some studies have suggested that attentional impairment in TS differs qualitatively and quantitatively from attention profiles in ADHD (Hubbard & Trauner, 1997), investigations into the causal factors of school problems in TS have highlighted impulsivity, inattention, distractibility and overactivity - primary ADHD symptomatology (Kurlan, Fett, Parry, et al., 1991).

Obsessive compulsive disorder (OCD) is a prevalent co-morbid psychopathology in TS. Gilles de la Tourette, in his inaugural report on the condition in 1825, commented on the co-occurrence of OCD in TS. According to Singer et al. (1995), 30 to 60% of individuals with TS are affected with obsessive thoughts and compulsive rituals which pose a barrier to academic progress as these behaviours are associated with attentional impairment. There is overlap between the symptomatology of both conditions. Obsessions and compulsions share characteristic features with tics. In addition, ritualistic behaviours, thoughts and verbalizations are an aspect of TS. However, OCD exacerbates behavioural, social and psychiatric problems in TS and is medically treated when obsessive-compulsive signs predominate.

There are accumulating case reports associating TS with Pervasive Developmental Disorders and co-occurrences of TS, Asperger's Syndrome and Autism have been documented (Comings & Comings, 1991; Littlejohns, Clark & Corbett, 1990; Palumbo et al., 1997; Stern & Robertson, 1997; Sverd, 1991). This association may be because the behavioural problems evidenced in children with TS are similar to those behaviours

common in children with Pervasive Developmental Disorders. Neurobehavioural symptoms often dominate the clinical picture in the primary years and TS is only diagnosed later when tics become apparent. Although more case reports are required before the significance of this relationship is established, a common neurobiological mechanism has been postulated (Palumbo et al., 1997).

1.2.2. The Clinical Continuum of Basal Ganglia Syndromes

In 1992, Kurlan proposed that TS resulted from a sex hormone genetic defect which impacted upon basal ganglia and limbic system development resulting in a neurochemical imbalance. This hypothesis was extended in 1994, wherein Kurlan postulated that the genetic locus of TS is involved in normal brain development and the appearance of a disorder represents an excessive expression of normal developmental characteristics. As discussed previously, this hypothesis is not exclusively related to a unitary disorder. Commonalities between the nosology and pathophysiological processes of many developmental neurological disorders have led to the conceptualization of a developmental basal ganglia syndrome, wherein TS is only one expression along a clinical continuum (Kurlan, 1994, 1997a; Palumbo et al., 1997). The developmental basal ganglia syndrome is hallmarked by motor disturbance, obsessive compulsive behaviour, attentional and executive dysfunction and aggression, caused by disturbed interconnections between structures located in the frontal lobes and basal ganglia and limbic regions. The developmental basal ganglia syndrome spectrum, proposed by Palumbo et al. (1997) is presented in Table 2.

Table 2. The Developmental Basal Ganglia Syndrome: Causes and Disorders

Primary (genetic)

- Tourette Syndrome
- Chronic Motor Tic Disorder
- Chronic Vocal Tic Disorder
- Transient Tic Disorder

Related Primary Neuropsychiatric Disorders

- Primary Obsessive Compulsive Disorder
- Primary Attention Deficit Hyperactivity Disorder
- Developmental Stuttering
- Neuropsychiatric Spectrum Disorder (Conduct Disorder, Bipolar Disorder)

Inherited Neurological Disorders, such as Huntington's Disease**Secondary (symptomatic)**

- Autism and Pervasive Developmental Disorder
- Mental Retardation
- Fetal Alcohol Syndrome
- Intrauterine drug exposure or infection
- Asphyxia
- Carbon Monoxide Toxicity
- Encephalitis
- Head injury
- Stroke

Post-infectious Disorder (Sydenham Chorea)**Physiological**

- Social and Emotional Stresses
-

1.3. COGNITIVE PROFILES IN TOURETTE SYNDROME

From the previous discussion, it can be seen that TS is part of, and represents a broad spectrum of motor and psychiatric disorders that may result from the genetic susceptibility for abnormal dopamine production. Although characterised by the movement disorder, TS is a complex condition in which the tics form only one aspect. Academic and behavioural problems are frequent concomitants of the syndrome. Although children with TS or TS and

associated disorders seem to follow the same normal curve model for intelligence and IQ scores as the general population (Bornstein et al., 1983; Brookshire et al., 1994), several learning difficulties have been noted to occur more often.

Academic and behavioural problems in TS are multi-factorial and may be a consequence of the complications of medications, concomitant attentional deficits, physical limitations, psychological maladjustment and/or a specific learning disability which is related, on a neurochemical basis, to cerebral dysfunction in TS (Kurlan et al., 1991).

Little is known about the academic consequences of neuroleptic medication. It has been suggested that cognitive impairment, associated with memory decline, may be caused by neuroleptic treatment (Singer et al., 1995). Research into the cognitive contraindications of drug therapy is confounded by the direct effects of the disorder on learning and school performance and thus data is limited. Although Bornstein and Yang (1991), in a study of 96 individuals with TS between the ages of six and 18, reported no consequential differences between medicated and unmedicated TS patients on neuropsychological, intellectual and educational measures, few medicated individuals can escape the sedation, mental clouding, restlessness, lethargy and depression caused by the prescribed drugs (Bornstein & Yang, 1991; Freeman, 1997).

Neurological structures in the frontal lobe regions that are intimately involved with behaviour make important interconnections with the basal ganglia and limbic systems. The neurochemical imbalance in TS therefore, results in a frontal lobe-limbic system syndrome that is associated with neuropsychological deficits, such as executive dysfunction and

disinhibition behaviours. Although executive function is a cognitive descriptor of frontal lobe function, it has now been recognised that subcortical regions and their interconnections also subserve such functions. Thus, the pathophysiological mechanisms operant in TS account for signs of executive impairment.

Many recent neuropsychological studies have implicated the executive domain in TS (Denkla, Harris, Alyward, et al., 1991; Lichter, Jackson, & Schachter, 1995; Palumbo, 1997; Singer et al., 1995). It is postulated that the frontal lobe (and subcortical) capabilities to plan and sequence complex behaviours and to organize and sustain goal-directed activities are disrupted in this population group. Authors such as Singer et al. (1995) and Palumbo et al. (1997) however, caution that the results yielded from neuropsychological studies may be associated with co-morbid conditions. Executive dysfunction observed in this population may more accurately reflect the cognitive correlates of ADHD.

Yet, not all of the learning difficulties experienced by individuals with TS can be accounted for by ADHD. Patterns of performance for TS individuals on neuropsychological batteries sometimes differ from matched ADHD subject groups (Brookshire et al., 1994; Hubbard et al., 1997; Singer et al., 1995) and a specific learning disability in TS has subsequently been proposed, the nature of which is discussed with limited scope in the literature. Dyslexia may be a common characteristic of the learning disability associated with TS. Impaired visual perceptual performance, reduced visual motor skills and discrepant nonverbal or performance IQ scores have also been identified (Bornstein, Baker, Bazylewich, et al., 1991; Brookshire et al. 1994).

The patterns of neuropsychological performance suggest an output learning disability which can be accounted for by functional disturbance of the prefrontal cerebral areas (Brookshire et al., 1994). It is said to occur in approximately 22% of individuals with TS (Kurlan et al., 1991). A description of the proposed subtype of learning disability is provided by Rourke (1989) and presented in Table 3.

Table 3: Description of Output Learning Disorder

Neuropsychological Assets	Tactile-perceptual, visual-spatial-organizational, psychomotor, non-verbal problem solving and concept formation skills and abilities are developed to an average to above average degree. Phonemic hearing, segmenting and blending and phoneme-grapheme matching skills are normal.
Neuropsychological Deficits	Difficulty of organizing, directing and orchestrating all aspects of behaviour. In addition, there is a deficit in accessing verbal associations.
Academic Prognosis	Severe problems in oral and written output are prominent in early school years. Advances in word decoding, word recognition and reading comprehension are observed in the middle school years. Written work remains poor, as does the capacity to deliver verbal descriptions and answers to questions.
Socioemotional Prognosis	Such children are characterized as having acting-out disorders. They are at risk for social withdrawal and depression.

1.4. SPEECH AND LANGUAGE PROFILES IN TOURETTE SYNDROME

"There exist between language and the brain complex and in many respects, surprising relationships which challenge the sagacity of neuroscientists."

(Lebrun, 1988, p. 109)

Communicative performance is not purely a function of linguistic factors but is mediated and influenced by cognitive functioning. Thus, in the context of cognitive impairment, it is unlikely that communication remains unimpaired. It is thus surprising that little is known of language features in TS and that speech and language symptoms are not considered integral features of the disorder.

1.4.1. Overview of Previous Studies

Although word retrieval difficulties, reduced expression, poor vocabulary, impaired verbal fluency, language formulation difficulties and reading and writing problems have been identified in TS, research is scant and limited attention has been directed towards describing in more depth the form and range of language abilities in this population.

Previous studies have been directed toward broader neuropsychological deficits and language impairment has not been a specific focus of the majority of the studies reviewed. Isolated aspects of language, such as verbal fluency or spelling, have been investigated in a general and cursory fashion and no emphasis has been placed on assessing higher-order language functions where impairment is most likely to manifest. Previous studies have also shown a lack of consideration of possible contributory factors to language disorder in TS and there is terminological confusion between speech and language functions.

From a clinical standpoint, there has been a failure to assess language performance in the context of academic and social discourse and studies have not provided a cogent argument for the involvement of the speech-language therapist in overall management. Furthermore, in view of the neurobiological mechanisms of TS and the nature of co-morbid learning disabilities, it is felt that previous studies do not consider the cognitive underpinnings of communication and thus, the essence of the communication deficit in TS remains elusive.

O' Quinn and Thompson (1980), in a study of the academic difficulties in five children with diagnosed TS, reported that four of the subjects had a history of developmental speech and language problems. They reported language formulation difficulties in three of the five

children, and problematic word retrieval in two of the subjects. O'Quinn and Thompson (1980) thus concluded that children with TS were more likely to demonstrate language difficulties however, the report was based on clinical impressions and normed instrumentation to evaluate speech and language abilities was not employed.

Brookshire et al. (1994) reported reduced vocabulary and impaired verbal fluency in a group of 31 children and adolescents with TS between the ages of six and 16 years on a battery of neuropsychological tasks. Although vocabulary and verbal fluency tasks stood as isolates within the test battery, the authors suggested that reduced performance observed on verbal measures may reflect a reduction in language abilities as opposed to motor disturbance.

Brookshire, Butler, Ewing-Cobbs, et al., (1989, cited in Brookshire et al., 1994) demonstrated that children with TS showed specific deficits in written language, although the nature of these deficits was not described. Reading and writing problems are frequently recorded concomitants of TS (Comings, 1990; Hagin, Beecher, Pagano, et al., 1988) and visuo-perceptual and motor deficits have been implicated as the source of difficulty of written language deficits in this population. Current theory and clinical insight however, emphasize the linguistic rather than visual aspects of reading disorders.

Ludlow et al. (1982) in a comprehensive examination of speech and language in TS, reported that a subtle expressive language impairment may be associated with TS. Findings from a sample of 54 TS cases using a battery comprised of standardised language tasks and discourse measures to evaluate language abilities, showed that receptive language remains

relatively intact, however expression and elaboration may be compromised. Ludlow et al. (1982) postulated that the language features observed may have a neurological basis and compared language output in TS to that of transcortical motor aphasia. Although Ludlow and his colleagues (1982) provided a less superficial perspective of language in TS than other studies, the group methodology employed detracted from the study's value as a formative description of language profiles in TS. Furthermore, language disorder was explored within a linguistic framework. Abstract language usage was therefore not tapped within the research test battery and limited attention was directed towards cognitive underpinnings.

1.4.2. Possible Causal Factors of Language Impairment in Tourette Syndrome

From the above discussion it is apparent that research on language in TS is limited. This has resulted in a fragmented perspective on language features of the disorder and limited explanation of the contributory factors of the observed communication impairment in TS.

Owing to the nature of the disorder and the diverse array of symptoms and comorbid conditions associated with TS, there are various factors which may contribute to poor communicative competence. These factors are however, interlinked and may alone or in interaction disrupt communicative performance. Explanations regarding the language impairment observed in TS include motor disturbance and tic variables, attentional deficits, disruption in the co-ordination process of expression and basal ganglia/frontal lobe language disturbance. Each will be evaluated individually.

Motor Disturbance and Tic Variables

Disrupted communication in individuals with TS may result from motor disturbance and tic variables (Brookshire et al., 1994). Frequent and intense tics may directly affect communicative competency, resulting in reduced speech output, reduced reading accuracy and poor written expression. Tics may also affect academic and communicative functioning indirectly due to the intrusive effects of the disorder and internal distraction.

Furthermore, phonic and motor tics that involve the face and neck muscles render communication less effective as a result of unusual tonal patterns, poor eye contact and abnormal facial expression. As the limbic system is involved in the pathogenesis of TS, the presence of tics, especially coprolalia, obscures the emotional flavour of verbal and non-verbal language and this impacts upon social-communicative competence.

Hagin et al. (1982) reported however, that the lack of social relationships in TS is more disturbing than motor dysfunction and Camfield, Camfield, Bawden et al. (1996) reported that children and adolescents with TS show social inappropriateness and poor peer relationships that are unrelated to the severity of their motor symptoms. From these reports, it is apparent that although tics contribute to poor communicative competence, motor dysfunction alone cannot account for the extent of the observed interactional problems observed in TS.

Attentional Deficits

Pragmatic difficulties in TS have been frequently reported (Camfield et al., 1996; Dykens, Leckman, Riddle et al., 1990; Hagin et al., 1982). Interestingly, these reports have been

found in the educational and neurological literature and not in the speech pathology literature. Although the psychology of living with a chronic disease and social ostracism may underlie this problem, pragmatic impairment may be a function of attentional deficit. Pragmatic impairment in ADHD is well documented (cf. Barkley, 1990). Impulsivity, inattentiveness and overactivity which form the triad of primary symptoms in ADHD, manifest in an expressive language disorder which is characterised by poor organisation and impaired monitoring of speech output. Although structural aspects of language remain intact in individuals with attention deficit, communicative disruption occurs at the interface between language formulation and use. Attentional deficit is hallmarked by the inability to filter distracting, irrelevant stimuli and inhibit responses. This, according to Luria (1980), results in the interruption of goal-directed language behaviour. Communication problems commonly observed in ADHD, therefore, relate to high order cognitive processes and include dysfluency, abrupt topic switches and drifts, and interjection of unconnected thoughts.

Language deficits in TS have been compared to the communicative profile observed in ADHD subjects (Brookshire et al., 1994) and thus, distractibility and disinhibition may underpin the language impairment in TS. The role of co-morbid or associated attentional deficits has also been implicated in the unique neuropsychological profile reflective of TS (Palumbo et al., 1997; Palumbo, Maughan, Como, et al., 1997; Singer et al., 1995). Some researchers however, feel that not all of the difficulties experienced in TS can be accounted for by ADHD. Dykens et al. (1990) reported that children with pure TS, and no apparent ADHD, demonstrated poor socialization skills compared to their non-neurologically impaired peers. The results of the study by Dykens et al. (1990) suggest additional

underlying mechanisms to account for social and pragmatic failure. Symptomatic overlap between OCD and TS may explain the observed social inadequacy. Nevertheless, the relationship of language skills to poor socialization, academic underachievement and behavioural problems is well known and it is possible that a genuine language disorder in TS may be a contributory factor to the associated problems of the condition.

Language Co-ordination Difficulties

Martindale (1977) demonstrated that the occurrence and severity of verbal and motor tics correlated with syntactic and semantic complexity in the speech of a TS subject. This finding was used to support the theory of a genuine language mediation disorder in TS arising from disturbance in the basal ganglia regions. Martindale (1977) proposed that vocal tics reflect disruption in the co-ordination process of expression, where, at a subcortical level, selected lexical items need to be ordered before the execution of speech. Speech problems, such as dysfluency and unintelligibility, are commonly listed concomitants of TS and there is a higher frequency of stuttering in TS than in the general population (Comings & Comings, 1991; Palumbo et al., 1997; Pauls, Leckman & Cohen, 1993). Reports of such co-occurrences have engendered neurolinguistic theories of dysfluency and suggest the basal ganglia as the common anatomical correlate. Controversy however shrouds this speculation and further research is needed before such hypotheses are verified.

Subcortical/ Frontal Lobe Language Impairment

Another possible explanation for the observed language impairment in TS has a neurological basis. TS is thought to be associated with abnormalities in synaptic

neurotransmission and subsequent damage to the basal ganglia and related subcortical-cortical circuitry (Devinsky, 1983; Kurlan, 1997a; Palumbo et al., 1997; Robertson, 1989; Singer & Walkup, 1991). The functions of the basal ganglia have in recent years received much attention and investigations into movement disorders, stereotactic surgery and subcortical stroke have yielded evidence that the basal ganglia structures are not exclusive motor regions (Crosson, 1992). The basal ganglia structures are now conceptualised as mediating sites for the generation of goal-directed behaviour and the expression and suppression of emotion and response (Palumbo et al., 1997). Thus, basal ganglia regions may subservise certain language and communicative functions.

The basal ganglia may be directly involved in language mediation or indirectly involved through the subcortical-cortical circuitry. The basal ganglia structures form links in this interconnecting circuitry and are associated with projections to the limbic systems and frontal lobe regions. The circuits consist of discrete loops which are thought to play a functional role in motivational and executive control. Dopaminergic disturbances in TS disrupt the subcortical-cortical circuitry and subsequently result in impaired frontal lobe functioning. This is evidenced in the behavioural and neuropsychological deficits associated with TS.

The frontal lobes play a superordinate role in language processing and are thought to monitor the formulation, organisation and integration of language output (Alexander, Benson & Stuss, 1989). It is thus hypothesized that TS may be associated with subtle high level language disturbances as a result of prefrontal damage and a reduction in executive cognitive abilities associated with disturbed anterior cortico-subcortical systems. These

subtle language disruptions overlie deficits in analysis, planning and monitoring of communicative behaviour. Characteristic of frontal lobe language impairment, the observed communication deficits are subtle and frequently manifest in academic or behavioural problems.

1.5. RATIONALE FOR USING DISCOURSE MEASURES TO INVESTIGATE LANGUAGE IMPAIRMENT IN TOURETTE SYNDROME

"The clinical analysis of discourse affords rich opportunities for the quantification of subtle shades of linguistic impairment."

(Cannito, Hayashi & Ulatowska, 1988, p. 124)

It is postulated that the nature of the language disruption in TS will be subtle, manifest in higher-order linguistic operations and reflect frontal lobe language disorder or subcortical involvement in communicative output. A primary linguistic impairment such as this may not be borne out by specific tests of syntax and semantic understanding. Thus, discourse analysis, with its emphasis on cognitive-linguistic interaction, is considered to provide a most appropriate framework for detecting subtle language disruption at the cognitive-linguistic interface. Discourse measures have been shown to be valuable clinical tools for assessing language in neurologically-impaired adult populations and in differentiating between subtypes of neurogenic communicative disorders (Ulatowska, Sadowska, Kordys, et al., 1993). Discourse protocols have proved to be a valuable clinical and research resource for identifying language impairment in children and adolescents with head injury (Chapman, Levin, Matejka et al., 1995; Dennis & Barnes, 1990). Furthermore, the neuropsychological profile associated with TS is characterised by strategy and

performance deficits which will result in patterns of impaired discourse as opposed to deficits in linguistic structure and form.

For these reasons, discourse analysis procedures were employed for language investigation in TS in this study.

1.6. RATIONALE FOR INVESTIGATING ADOLESCENT LANGUAGE SKILLS IN TOURETTE SYNDROME

The developmental evolution of TS is vulnerable to periods of increased emotional upset and thus adolescence presents an exacerbation of Tourette symptomatology and often the beginning of coprolalia. In addition, it has been reported that the cognitive correlates of the syndrome show a reciprocal relationship to age (Bornstein, Carroll & King, 1985). The reasons underlying this correlation are not known, but it must be considered that long term use of neuroleptic medication, increased social awareness and increased severity of tics may all contribute to poorer academic and adaptive functioning in the adolescent period. Furthermore, subtle and high level language disturbance resulting from subcortical and executive dysfunction may only become apparent when academic and interpersonal interactions require comprehension and expression of complex language in all modalities.

For these reasons, adolescent TS subjects formed the subject group for this research study.

1.7. CONCLUDING COMMENTS

"The improvement of the understanding is for two ends; first, our own increase of knowledge; secondly to enable us to deliver that knowledge to others."

John Locke (1632 - 1704)

An overview of the literature on cognitive and communicative characteristics in TS highlights the lack of agreement regarding language disorder in TS. The focus of this study is to investigate language characteristics in adolescents with TS from a theoretical and clinical perspective using a battery of tests sensitive to higher-order and subtle language disruption. It is hoped that the study will add to information supporting the functional role of the basal ganglia and frontal lobe interconnections in language processes and prompt and guide the involvement of the speech-language therapist in the educational and social management of individuals with TS.

This concludes the discussion regarding the theoretical context of language skills in TS. The following section describes the general methodology of the study.

2. METHODOLOGY

"Marshall thy notions into a handsome method. - One will carry twice more weight packed up in bundles, that when it lies flapping and hanging about his shoulders."

Thomas Fuller (1608 - 61)

2.1. AIMS OF THE STUDY

The aim of the research project is to examine the performance of a group of adolescents with diagnosed TS on a battery of tests sensitive to higher-order language processes and social-communicative competence.

More specifically, the study aims to describe in more detail language characteristics of TS and pose an explanatory, neurological basis for observed communicative behaviour in the subject group.

2.2. METHODOLOGICAL DESIGN

In order to address the aims of the study, a descriptive multiple single-case study design was adopted. There is support for the single-case study design in research into the characteristics and deficits of classical syndromes (McReynolds & Kearns, 1983). Inherent in group design is the assumption that within-group subjects will respond similarly to the experimental condition. TS, however, is a heterogenous disorder and the "typical" TS adolescent may not exist. Single-case methodology thus provides the appropriate means

to systematically describe individual differences and patterns of commonality in the subject group.

Language and communication in TS have not been previously described in any detail. In light of the paucity of research into communication in TS, an *a priori* hypothesis of a specific deficit could not be assumed. The study was therefore an attempt to describe and explore the language behaviour of the adolescent TS population and thus an "A-only" type investigation was utilized (Silverman, 1993). This approach to research allows for more in-depth description and evaluation of language in the subject group in the effort to gain a more sophisticated understanding of language processing in TS.

Furthermore, as investigation into the role of the subcortex in linguistic mediation continues, case studies of individuals with proposed disruptions in the basal ganglia regions and circuitry will provide valuable information regarding the contributions of the basal ganglia structures and frontal cortex to language processing.

Assumptions regarding communicative performance within a particular population should only be made within the context of "normal" communication, thus results were compared against normative data where available. A control group consisting of non-neurologically impaired subjects was employed to provide the researcher with insight into normal performance on tasks within the test battery for which normative data is not yet available.

2.3. SUBJECTS

2.3.1. Subject Selection Criteria

Subjects were selected according to the following criteria. Each subject had to:

- be diagnosed by a neurologist as characteristic of TS;
- be between 12 and 18 years of age, to represent the adolescent TS population;
- be in mainstream education to control for subaverage intellectual functioning;
- be a first language English speaker as all tests were administered in English;
- have normal hearing sensitivity according to the case history report.

Subject variables included gender, the severity and classification of tics, co-occurrence of other neurological symptomatology and neuroleptic medication. From a clinical standpoint, it was deemed important to consider the broad spectrum of TS as TS seldom manifests in its pure form. Furthermore, as this study is preliminary in nature, the inclusion of all subgroups was thought to be a relevant point of departure.

Research strategies in neuro- or psychopathology generally support co-morbidity exclusion criteria (Caron & Rutter, 1991). There is limited documentation of the neuropsychological and intellectual functioning of TS wherein the disorder has been distinguished from associated and diagnosable ADHD and OCD (Dykens et al., 1990; Palumbo et al., 1997). Inaccurate characterization, therefore, may have contributed toward the inconsistency in the literature regarding functioning in TS.

Alternatively, however, attentional deficits and obsessive thoughts or behaviours are considered part of the clinical spectrum of TS and categorical boundaries between the disorders remain unresolved. Therefore, subjects who reported attentional difficulties and obsessive tendencies which did not dominate the clinical picture were included in the study.

A comparable debate exists in the literature for the exclusion of medicated subjects. Cognitive impairment in TS may be related to contra-indications of neuroleptic medication. It is also a possibility that patients with more severe symptoms are more likely to be medicated and therefore, within the framework of an exploratory study, both medicated and unmedicated TS subjects were included.

It is acknowledged that the inclusion of subjects presenting with co-morbid neurological symptoms and unknown drug complications may obscure the clinical picture of language features in TS. In order to accommodate this argument, post-hoc clustering was carried out. This allowed for the consideration of individual variation and highlighted variables for investigation for future research.

Informed consent was obtained from the subjects and the subjects' parents prior to testing (Appendix A). The study was approved by the Ethics Committee for Research on Human Subjects of the University of the Witwatersrand, Johannesburg.

2.3.2. Description of the Subject Group

The subject group consisted of ten adolescents between the ages of 12 and 18 years. Seven of the subjects were male and three female. Subjects varied according to their medical and educational histories. In this respect, inclusion criteria remained flexible as the study was committed to an exploratory methodology and executed within a clinical framework.

One subject who attended an assisted learning centre was included in the study. Although mainstream education was a selection criterion for subjects in this study, the subject had attended mainstream schools prior to placement in a special educational needs environment. His educational background did not indicate possible intellectual disability and placement in specialized education was due to the severity of his tics and psychosocial/behavioural problems.

Although, disordered language and intellectual impairment may be associated with epilepsy, two subjects who presented with epilepsy were not excluded from the group. Subject RW had been seizure-free for a period of more than two years prior to the study and a neurological examination at the time of testing was normal. RW was not experiencing academic difficulty and according to his neurologist, his epilepsy was not associated with cognitive decline. Subject LW suffered a seizure one week prior to testing. The subject underwent a neurological examination at the time of testing and no abnormalities were detected save for the presence of motor and phonic tics.

One subject was excluded from the study on the basis of an acquired unilateral conductive hearing loss. One subject was excluded as he was unable to complete the test battery due

to severe tics and attentional difficulties. No responses were provided within the time limits suggested by Wiig and Secord (1985) on the standardized test and results could not be accurately analysed.

The relevant biographical, educational, neurological and medical information of each subject is included in Tables 4 and 5.

Table 4: Biographical and Educational Information of the Subject Group

Subject	Age (in yrs + months)	Date of Birth	Sex	Handedness	First Language	Grade level	School Achievement	Reported communication difficulties
DB	13.9	02.05.85	M	R	English	Grade 8	Variable	Does not speak clearly, poor articulation, lisps
AD	14.1	08.12.84	M	R	English	Grade 8	Poor	Speaks loudly
TP	12.3	03.11.86	F	R	English	Grade 7	Below Average	None
RP	14.10	13.4.84	M	L	English	Grade 9	Above Average	Late talker, poor vocabulary, poor spelling, w/r substitution
PS	12.1	01.02.87	M	R	English	Grade 7	Average	Word finding problems, poor articulation of words, dislikes reading, difficulty expressing himself
SS	13.8	26.06.85	M	R	English	Grade 8	Above Average	Poor reader and speller
KS	16.8	01.05.82	F	R	English	Grade 12	Average	None
GS	17.7	20.07.81	M	R	English	Grade 12	Below Average	Reported that attention and depression has impacted upon academic and social development
RW	17.6	25.09.81	M	R	English	Grade 11	Below average	Difficulty following instructions
LW	18.1	26.01.81	F	R	English	Grade 12	Poor	Difficulty expressing herself and following instructions, word finding problems.

Table 5: Neurological and Medical History of the Subject Group

Subject	Diagnosis	Onset	Age at Diagnosis	Tic variables	Severity of TS (TSSS)	Associated Conditions (according to CGIS)	Family history	Present Medication (daily dosage)
DB	TS	8 yrs	11 yrs	Simple motor	Mild	Borderline OCD	Cousin with TS	Unmedicated
AD	TS	7 yrs	8 yrs	Simple and complex motor and phonic	Very severe	Severe OCD, marked ADHD, behavioural problems	None	Sulpiride 600mg, Paroxetine 60mg, Pimozide 2mg, Clonidine 300mg
TP	TS	5 yrs	5 yrs	Simple motor	Mild	None	None	Unmedicated
RP	TS	3 yrs	12.6 yrs	Simple and complex motor and phonic	Moderate	Mild OCD, behavioural problems	Maternal uncle with tics, father with OCD	Sulpiride 400mg
PS	TS	8 yrs	8 yrs	Simple and complex motor, simple phonic	Severe	Mild OCD, Mild ADD	None	Pimozide 4mg, Methylphenidate 50mg
SS	TS	5 yrs	9 yrs	Simple motor and phonic	Marked	Mild OCD	Father displays OCB	Unmedicated
KS	TS	13 yrs	15 yrs	Simple and complex motor and phonic	Very mild	Borderline OCD	Maternal grandfather with tics	Unmedicated
GS	TS	11 yrs	12 yrs	Simple motor	Moderate	Mild OCD	Father with TS, mother with OCD, brother with tics	Olanzapine 2.5mg, Pimozide 2mg, Citalopram 60mg
RW	TS	11 yrs	12 yrs	Simple and complex motor	Mild	Mild OCD, Mild ADHD, Epilepsy	Father with ADHD	Sulpiride 600mg, Oxcarbazepine 120mg, Methylphenidate 20mg
LW	TS	8 yrs	Not known	Simple and complex motor and phonic	Marked	Mild OCD, Epilepsy	None	Risperdal 8mg, Carbamazepine 400mg

Key: TS = Tourette Syndrome; OCD = Obsessive Compulsive Disorder; ADHD = Attention Deficit Hyperactivity Disorder; ADD = Attention Deficit Disorder without Hyperactivity; TSSS = Tourette Symptom Severity Scale (Shapiro et al., 1988); CGIS = Clinical Global Impression Scale (Lockman et al., 1988).

2.3.3. Description of Non-Neurologically Impaired Subjects

Five non-neurologically impaired subjects were tested on discourse measures for comparative purposes. Consistent with the selection criteria of language, education, age and hearing for the subject group, these subjects were English, between the ages of 12 and 18 and attending a regular mainstream school in a middle-class suburban area. The subjects were non-learning disabled adolescents with no history of speech, language, hearing or academic problems. Table 6 presents the relevant biographical and educational information relating to each subject.

Table 6. Description of Non-Neurologically Impaired Group

Subject	Date of Birth	Age (in yrs + months)	Sex	Educational Level
1	14.01.86	13.1	F	Grade 8
2	31.12.84	14.2	F	Grade 9
3	20.09.83	15.4	M	Grade 10
4	17.02.83	16.0	M	Grade 11
5	22.01.82	17.1	M	Grade 12

2.4. PROCEDURES

2.4.1. Pilot Case Study

A pilot study was conducted in order to identify any methodological or logistic problems that could have arisen before commencing the principle case study. Through identification of problems in this way, it could be ensured that these could be avoided so as not to interfere with the validity of the principle case study.

The pilot study, which is included in detail in Appendix B, revealed the test battery to be a sensitive measure of highlighting language processing difficulties and the influence of cognitive functioning on test performance. As the standardized test included in the test battery is American, test items considered culturally-biased were modified by the researcher so that Americanisms could be replaced with appropriate South African alternatives. These modifications are included in Appendix C. The pilot subject demonstrated familiarity with the language, dialect and scripts within the test battery and was responsive to all test stimuli, suggesting the battery to be appropriate for the adolescent subject group.

The pilot study did not necessitate any modification to the procedures outlined for the principle study and no further modifications were warranted. For this reason, the results of the pilot study were incorporated into the principle study.

2.4.2. Principle Study

Ten subjects from a cohort of 180 TS cases at the Movement Disorder Clinic, Johannesburg General Hospital were selected according to the subject selection criteria. Case history information and language measures were obtained under favourable conditions in the clinic or in the subjects' homes. Biographical, educational, neurological and medical information of each subject was obtained through an initial interview with the subjects' parents. At the time of the test session each subject (except for TP) underwent a basic neurological examination. This examination was administered by a neurologist who accompanied the researcher to each test session. In addition to this, all subjects and their parents were required to complete a Tourette Symptom Severity Scale on the basis of

which tic symptoms were documented and a severity rating determined (Shapiro, Shapiro & Young, 1988) (Appendix D). Clinical Global Impression Scales were administered for OCD and ADHD (Leckman, Towbin, Ort, et al., 1988) (Appendix E). These gave the researcher insight into the presence and impact of associated disorders. Responses were recorded on audio cassette and transcribed verbatim for analysis. Interpretation of test results was carried out following each respective test session.

2.4.3. Collection of Normative Data

The discourse measure included within the research test battery requires the interpretation of fables. The task was employed as it is considered a sensitive tool in the evaluation of higher-order language processing deficits. This task is not standardized, however, and limited data on normal performance on fable interpretation is available. For this reason, preliminary norms for the South African English-speaking adolescent population were obtained. The fable task was administered to each subject of the non-neurologically impaired group individually by the examiner in a quiet room in the school. Responses were recorded and transcribed verbatim.

2.5. THE RESEARCH TEST BATTERY

Language disruption in TS may be more apparent in cognitive-communicative organisational tasks, sensitive to deficits typical of damage to subcortical and pre-frontal regions, as compared to component testing. Thus, discourse measures and complex linguistic processing tasks, which did not focus on discrete aspects of language but tapped

the quality of language performance in communicative interactions, comprised the test battery.

The test battery will now be described in detail.

2.5.1. The Test of Language Competence (TLC) (Wiig & Secord, 1985)

Aim: To evaluate pragmatic and social-communicative language in the school-going adolescent TS population by tapping distinct domains of discourse.

Rationale: The TLC (Wiig & Secord, 1985) approximates how language is used and understood in daily situations. The TLC considers not only structural aspects of language but how knowledge of language is applied within a communicative framework. This standardized language test is thus, consistent with the shift in recent literature that considers strategy rather than performance deficits in language-learning disabled adolescents. The test is normed on a large sample of American adolescents aged nine to 19 years. The sample was considered representative of cultural, educational and dialectal differences in the United States (Wiig & Secord, 1985) and has been shown to be a sensitive measure of cognitive-linguistic disruption and discourse impairment in children and adolescents with traumatic brain injury (Dennis & Barnes, 1990).

Method: The test is comprised of four subtests which involve knowing the alternate meanings of words in context, bridging inferential gaps in social situations, recreating sentences to express the intentions of others and understanding figurative expressions. The subtest, *Ambiguous Sentences*, requires the examinee to provide two interpretations for a sentence which may be syntactically or lexically ambiguous. Linguistic ambiguity resolution is a skill that calls upon semantic knowledge and metalinguistic awareness and improves steadily during the adolescent period (Nippold, 1988). Recognising and understanding ambiguity relates to communicative competence as this form of figurative

language occurs frequently in naturalistic settings. Inappropriate interpretation will lead to comprehension failure of certain jokes, advertisements, newspaper headlines and anecdotal exchanges.

Within the subtest, *Making Inferences*, the examinee is required to identify plausible inferences that best explain two causally connected events. A first statement describing a stereotypical event or script is presented. Following this, a second statement describing the outcome of the event is read. The subject is then required to choose two out of four reasons for the outcome. Commonly referred to "*reading between the lines*", the ability to use known information to form related ideas is an important skill for discourse and reading competence.

The subtest, *Recreating Sentences*, requires the examinee to create a sentence given three stimulus words and a specific situation. This subtest examines the subject's ability to formulate syntactically complex sentences to express the intentions of others.

The subtest, *Understanding Metaphoric Expressions*, taps figurative language proficiency, important for the mastery of reading and peer acceptance (Nippold, 1988). The examinee is required to interpret a metaphorical expression and then identify a metaphor corresponding in meaning within a multiple choice format. Seidenberg and Bernstein (1986) demonstrated that children with language-learning impairment show difficulties recognising and interpreting metaphor.

Scoring: Scoring methods proposed by Wiig and Secord (1985) were followed. A standard score and age percentile were obtained for each subtest of the TLC and a composite score was calculated to determine an age equivalent. Scores were compared against the normative data of Wiig and Secord (1985). As the cited norms are American and there are as yet no norms available for the South African English speaking population, error analysis was carried out and test performance qualitatively described.

2.5.2. Aspects of Narrative Discourse as Illustrated by Ulatowska's Fables

Aim: To evaluate complex discourse processing and narrative competence in the interpretation of fables.

Rationale: Fables possess certain structural features that require narrative discourse ability and metalinguistic skills in their interpretation. To comprehend and relate a fable, information contained in the text requires transformation at the literal and abstract levels, and thus, metalinguistic and complex processing is tapped (Ulatowska, 1993).

Method: Each subject was required to read a fable and then listen to the fable as the examiner read the text aloud. Subjects were then required to relate and transform the text according to the following variables:

Retelling the fable: The subject was required to relate the fable back to the examiner in sequential order including relevant and irrelevant points.

Summarizing of the fable: The subject was required to summarize the text. This skill taps high level processing and requires the deletion of unimportant information and the inclusion and paraphrasing of relevant data (Ulatowska et al., 1993).

Identification and justification of the main character in the fable: The subject was required to select the main character and provide an explanation for their choice. The main character in the fable must be central to the outcome and can be selected on explicit or implicit information. According to Ulatowska et al. (1993), explicitly formulated explanations rely on concrete processing, whereas explanations that are based on implicit information reflect abstract understanding.

Providing the moral of the fable: The subject was required to deduce the lesson of the fable. This task taps the subject's ability to extract from the fable an extra-textual and generalisable didactic theme.

The fable is included in Appendix F. No time limit was imposed on responses and responses were generated without reference to the fable.

Scoring: The subjects' responses were analysed against the backdrop of normal performance in terms of the text transformation; the correct identification of the main actant and the recovery of the didactic component of the fable.

To provide a qualitative and objective framework for evaluating story retell, the fable was analysed and segmented into categories of story grammar proposed by Stein and Glenn (1979) (Appendix G). Responses were superimposed onto this framework and inferences were made regarding the inclusion of all story components in the retell and sequencing of the information.

Summaries were analysed and evaluated in terms of key points included. Information retold verbatim and inclusion of irrelevant detail merited comment as this provided insight into the subjects' abilities to exclude and paraphrase information.

The discussion of the main actants in the fable was evaluated in terms of the justification provided and two categories were created. These were:

- 1) explanations based on explicit or surface information, and
- 2) explanations based on implicit, inferential information.

Explanations regarding the moral of the fable were judged by the examiner to be correct if they were extra-textual didactic expressions that related directly to the stimulus fable. Incorrect explanations included those that were unrelated and suggested misinterpretation of the fable, literal explanations and arbitrary didactic expressions that may relate to other fables. Scoring and evaluation of the fable task remained descriptive and general trends in fable processing were drawn from responses.

2.6 DATA ANALYSIS OF THE TEST BATTERY

"Some attributes of events can be more adequately described through words than numbers."

(Silverman, 1993, p. 106)

The study was committed to a descriptive multiple-case-study design, thus descriptive non-parametric statistics were used to analyse both qualitative and quantitative data. Descriptive statistics provided a method for organising, summarising and describing quantitative data (McCall, 1994). Results are presented in table form. Common patterns and variations between subjects are identified and a discussion of these is offered.

This concludes the description of the methodology of the study. The following section documents the results obtained by the subject group on the test battery.

3. RESULTS AND DISCUSSION OF RESULTS

The TS subjects' performance on both standardized and discourse measures of the research test battery was variable. Intact communicative functioning was demonstrated by six of the ten subjects in the group, however certain tasks within the battery posed particular difficulty for two subjects whose performance was otherwise judged to be within normal limits. Four subjects were differentiated from normal communicative performance by their test results, indicating that it may be a worthwhile exercise to explore possible causal factors of language disorder in TS.

The results of this study are presented in the following manner. Scores obtained on the Test of Language Competence (TLC) (Wiig & Secord, 1985) are presented in table form and performance on each subtest is discussed separately. The performance of the non-neurologically impaired subject group on the fable interpretation task is discussed in relation to each subtask. Thereafter, the performance of each subject in the TS group on the discourse measure is presented and a discussion offered.

Table 7. Standard Scores, Age Equivalent Scores and Percentile Ranks Obtained by the Tourette Syndrome Subjects on the Subtests of the Test of Language Competence

Subject	Ambiguous Sentences	Making Inferences	Recreating Sentences	Metaphoric Expression	Age Equivalent <i>(Chronological Age in brackets)</i>	Percentile Rank
DB	8	4	8	4	≤ 9 (13.9)	4th
AD	9	5	3	7	≤ 9 (14.1)	3rd
TP	8	9	6	9	10.1 (12.3)	14th
RP	13	10	12	10	18.5 (14.9)	70th
PS	6	7	7	5	≤ 9 (12.1)	3rd
SS	14	12	14	10	14.5 (13.8)	68th
KS	10	9	8	15	16.4 (16.8)	55th
GS	11	9	7	12	16.9 (17.7)	45th
RW	9	9	8	14	17.1 (17.4)	61st
LW	4	3	4	3	≤ 9 (18.1)	1st

3.1. RESULTS OF THE TEST OF LANGUAGE COMPETENCE (TLC) (WIGG & SECORD, 1985)

The results of the TLC are presented in Table 7. According to the scoring protocols of Wiig and Secord (1985), raw scores were converted to standard scores, with the mean score equivalent to ten (standard deviation of 2). Age equivalents and percentile ranks were calculated on the basis of overall test performance.

3.1.1. Performance on the Subtest of Ambiguous Sentences

As presented in Table 7, performance of the TS subjects on the *Ambiguous Sentences* subtest was variable. Eight of the ten subjects in the sample group scored within two standard deviations of the mean score. Two of the ten subjects however, performed poorly

on this task and scores of 4 and 6 were calculated for subjects LW and PS respectively. Error analysis revealed that similar responses were provided by LW and PS. There was a trend toward retaining the same conceptual basis in providing alternate meanings and difficulty altering sentence structure or tonal emphasis to explain ambiguity was evident for both subjects. Frequent use of gesture was noted and tangential explanations were provided.

According to Wiig and Secord (1985), vocabulary and knowledge of word meaning are strong predictors of the ability to understand ambiguity. Dennis and Barnes (1990) demonstrated support for this relationship in a study on the performance of head-injured children and adolescents on the TLC and on various tasks of neuropsychological functioning. Poor performance on this task therefore, may indicate limited linguistic flexibility. Alternatively, an inability to disassociate meaning from language may reflect reduced mental flexibility.

Bornstein (1990) documented deficits on the Wisconsin Card Sorting Test (WCST) in TS subjects. The WCST is a measure of mental flexibility and set-shifting abilities thus, Bornstein's (1990) findings suggest that deficits in these skills may be associated with TS. Mental flexibility and set-shifting abilities are considered integral to executive functioning and require intact prefrontal regions. These cerebral regions are intimately related to the basal ganglia-thalamocortical pathways which form part of the underlying pathophysiology of TS and thus, poor performance on the WCST by TS subjects can be explained by the neuroanatomical correlates of the disorder.

Bornstein (1990) reported that limited cognitive flexibility was more likely to be demonstrated by individuals with TS and concomitant OCD than by individuals with pure TS. Subjects PS and LW both reported obsessive compulsive behaviours that were classified as mild against the GCIS. The involvement of executive function in OCD has previously been documented (Head, Bolton & Hymas, 1989) however, other individuals in the subject group who were classified as exhibiting mild to severe obsessive-compulsive characteristics experienced no difficulty on the ambiguity task.

Attention deficits may also underlie set-shifting abilities. Although only one of the two subjects who were unable to recognise and explain ambiguity had attentional difficulties, LW presented with severe Tourette symptomatology and frequent, intense and disruptive tics.

It was of interest that subjects LW and PS who performed poorly on the subtest of *Understanding Ambiguity* demonstrated pervasive difficulties across all language measures. Their language output was concrete and social-communicative difficulties were reported by both parents and teachers of these two subjects. According to Alexander et al. (1989), poor ability to recognise and understand ambiguity has been observed in patients with right dorsolateral and opercular frontal lesions.

3.1.2. Performance on the Subtest of Making Inferences

With reference to Table 7, four of the ten subjects within the group scored outside of the normal range on the *Making Inferences* subtask of the TLC, according to the normative data of Wiig and Secord (1985).

To infer causality, it is necessary to retrieve scripts based on social knowledge and experience, retain the premise of the situation and generate plausible explanations. This process, according to Gathercole and Baddeley (1993), is a function of the working memory - a cognitive descriptor of the internal sketchpad which holds and manipulates language input. In a study on the discourse characteristics of head-injured children and adolescents, Dennis and Barnes (1990) correlated the ability to make inferences in social situations with intact working memory. Dennis and Barnes (1990) concluded that inference abilities were not influenced by language comprehension but appeared to be dependent on working memory. It can thus be postulated that poor inference skills may result from an impairment at the level of the working memory.

Although neuropsychological studies have reported equivocal findings regarding memory skills in individuals with TS, it is generally considered that the abnormalities associated with TS involve spatial, motor and executive functioning skills with relative sparing of memory functions (Bornstein et al., 1983; Brookshire et al., 1994; Hagin et al., 1982). The concept of working memory, however, may correspond closely with the construct of attention. This is interesting as two of the four subjects who scored poorly on this task presented with concomitant diagnosable attentional disorders. Attention has an integral role in language and reading comprehension and thus, a language disorder may be secondary to an attentional deficit in these two subjects.

Error analysis showed that subjects who scored poorly on this task were able to infer one reasonable explanation but experienced difficulty generating an accurate alternative response within the time limit suggested by Wiig and Secord (1985). This was notable as

a delay in response time was not observed for the subjects who scored within normal limits on this task. This may reinforce the suggestion that attentional impairment underlies poor inference abilities. According to Van Zomeren and Brouwer (1994), an attentional deficit may be the outward manifestation of reduced speed of processing and thus, mental slowness may account for failure to attend to and manipulate incoming information.

Two subjects, DB and LW, who performed poorly on this task were not diagnosed with an attentional disorder. Both subjects scored below expected levels on other subtests within the TLC and showed difficulty accurately interpreting the fable. As mentioned previously, LW presented with severe Tourette symptomatology which may explain the possible breakdown in attention, however DB displayed very mild and less intrusive tics.

Poor inference skills may also relate to frontal lobe dysfunction. Alexander et al. (1989) reported that damage to the right dorsolateral frontal regions results in disturbed ability to make inferences given two sequential statements.

3.1.3. Performance on the Subtest of Recreating Sentences

Scores on the *Recreating Sentences* subtest are presented in Table 7. The formulation of sentences posed particular difficulty for five of the ten subjects within the group. This may reflect poor sentence construction skills, limited knowledge of grammatical constraints, comprehension difficulties and reduced vocabulary. Dennis and Barnes (1990) were unable however, to find a significant relationship between sentence construction abilities, language comprehension skills and performance on the *Recreating Sentences* subtest of the TLC.

Two subjects, GS and TP, experienced difficulty formulating sentences within contextual constraints but scored within normal range for the subtests *Ambiguous Sentences*, *Making Inferences* and *Understanding Metaphoric Expression*. Error analysis of responses showed that depressed scores were a function of word omission or syntactical/grammatical incorrectness reflected in unconnected phrases, multiple sentences and inappropriate tense shift. Illustrative examples from the transcripts follow:

Subject GS (17.7 years):

Incongruent conjugations/ tense markers within the same sentence:

"Two people went to a cafeteria and would like to have a pie either on the left or right".

Multiple sentences:

"Again she ran around the athletics track. She was without her shoes and it was difficult."

Subject TP (12.2 years)

Unconnected phrases:

"This is different but it might be regardless of the others."

GS and TP, therefore, may have scored below average on this task as a result of poor organisation and formulation of language output. O'Quinn and Thompson (1980) reported that three out of a cohort of five TS subjects demonstrated language formulation difficulties. Poor formulation of sentences may reflect an attentional deficit, however neither GS nor TP met the DSM III criteria for ADHD nor could they be classified as mild ADHD on the CIGS. Poor formulation of language may also reflect impaired monitoring processes or impulsivity. Although these factors are essentially cognitive processes, this finding highlights the interaction between deficient processing and communication in TS

and provides support for Brookshire's (1994) theory of an output learning disability associated with TS.

The three other subjects who performed poorly on this subtest, also performed below normal on all subtests of the TLC. Error analysis of responses revealed that subject AD scored below normal as a result of delayed responses and a pattern of declining scores with progression of the test was apparent. AD presented with marked ADHD and severe Tourette symptomatology. Of all the subjects in the study, AD appeared to be the most severely affected. Attentional problems may therefore, explain the observed performance and communicative profile in subject AD. Although attention deficits may result in disorganised discourse, AD's performance was characterised by delayed or non-responses.

The poor performance on this subtest by subjects LW and PS was characterised by frequent revisions and restarts; impulsive responses; and tangential, unconnected sentences. Some examples are provided below:

Subject PS (12.1 years)

Frequent restarts and revisions:

"We must, without training it will be a ..., we must do it again because we are fit because it will be without difficulty."

Unconnected phrases:

"It's very hard to do a balancing act because some people like to do somersaults."

"These pies are fresh nor they are very old here."

Subject LW (18.1 years)

Frequent restarts and revisions:

"It's very hard, that this guy is saying to that guy, that that guy on the trampoline is doing very difficulty movements and it's very hard - no - he's doing the movements exactly as hard This guy is doing movements just as hard as that guy."

Unconnected phrases:

"I must, that guy, lawn mowing the grass over there, is very easy for a job."

Irrelevant and tangential response:

"The only... I can maybe give you a job but the only days. Is it week as in week or the other week? This lady is saying that she sells milk or coke, whatever that is, on Mondays and Tuesdays and so she is telling this lady she can work and sell carrots and lettuce on Wednesday and Friday, .. This is difficult."

These extracts typify disorganised and rambling speech. Attentional impairment may lead to the disorganised, tangential and circumlocutory responses evidenced above (Hartley, 1995). Frontal lobe damage is associated with difficulties in formulating, organizing and monitoring language output and Alexander et al. (1989) report that tangential, incohesive and *"vague rambling discourse"* characterizes the verbal communication of patients with right dorsolateral and anterior frontal lesions.

3.1.4. Performance on the Subtest of Understanding Metaphoric Expression

As presented in Table 7, four of the ten subjects scored three to seven standard deviations below the mean. All other subjects showed good abilities to recognise and interpret metaphor, as defined by the subtest, *Understanding Metaphoric Expression*. Error analysis revealed that these four subjects experienced more difficulty matching the metaphoric expression to another expression close in meaning than explaining the meaning of the

expression in their own words. When producing their own meaning, a trend towards repeating the expression verbatim or making a general interpretation was observed, for example 'She casts a spell on me' was explained as "*She casts a spell that he can't talk.*" (subject LW) or "*She casts a spell by the way she dances.*" (subject DB). On choosing a similar metaphoric expression, a tendency toward literal interpretation was apparent.

The ability to understand and interpret metaphor is dependent on cognitive and linguistic factors. It has been suggested that concrete and formal operational thought are prerequisites for understanding metaphor (Nippold, 1988). Furthermore, Dennis and Barnes (1990) found that performance on this subtest of the TLC can be significantly correlated with verbal association skills and vocabulary.

Poor ability to interpret metaphor suggests reduced abstract language usage. This corresponds with the pattern of disordered language, as defined by the test, observed in the four subjects who performed poorly on this task on the other subtests of the TLC. A poor ability to understand and explain metaphor has also been observed in patients with frontal lesions within the left or right cerebral hemispheres and communication following frontal lobe lesion is characterised by a poor understanding and use of abstract, nonliteral language (Alexander et al., 1989).

In conclusion, six subjects within the subject group of ten scored below their expected age equivalents according to the normative data of Wiig and Secord (1985) on one or more of the subtests of the TLC. Although results were variable, these subjects produced responses that were characteristic of deficits in the organisation and monitoring of linguistic output and of deficits of abstract language usage, as defined by the TLC.

3.1.5. Evaluation of the TLC as a Diagnostic Tool

The TLC is a test battery designed to identify language disorder in adolescents and elucidate the influence of language impairment on everyday communicative functioning. The researcher chose to administer this standardised discourse measure to investigate higher-language processing skills and cognitive-linguistic deficits in adolescents with TS. The TLC appeared to be an appropriate tool for differentiating subjects with communicative impairment and, as a measure of communicative strategy, enabled the researcher to evidence the influence of cognitive functioning on test performance. Furthermore, the results of the TLC highlighted for the researcher the impact of a language disorder on social-communicative competence.

Performance by the subject group on the *Understanding Ambiguity* subtest provided the researcher with information that could reflect cognitive and linguistic flexibility as well as language manipulation strategies. *Making Inferences* was considered to be a useful

subtest in providing information regarding attentional abilities and inferential thinking. The subtest *Recreating Sentences* appeared to be the one that posed the most difficulty to the subject group. This task may therefore be a discriminant test of language disorder secondary to attentional impairment and executive dysfunction. On the subtest *Understanding Metaphor* some subjects were able to explain the metaphor accurately in their own words but tended toward literal interpretation when required to match the expression to another metaphor close in meaning. It seems possible that these subjects may have known the meaning of the metaphoric expression from previous exposure or language experience and did not deduce possible meanings through analysis, association and interpretation skills. Thus, the inclusion of the multiple choice task in this subtest was felt to be valuable in detecting reduced abstract language usage.

Although the present study was not aimed to provide inter-subject comparisons, the results of the TLC also indicated that four of the subjects presented with a similar profile of language features. Although this is defined by the test itself, this may show that the TLC is not only valuable in detecting language impairment but in highlighting patterns within the group. A basic precept in neurology is that a common pattern of difficulties may indicate a common underlying cause. The analysis of the performance of subjects on all subtests of the TLC therefore, provided the researcher with insight into possible sources of communication difficulty, such as attentional deficit.

Furthermore, it was felt that the test items were familiar to the subjects who participated in this study and the test material was deemed appropriate for the adolescent population.

3.2. PERFORMANCE OF THE NON-NEUROLOGICALLY IMPAIRED SUBJECT GROUP ON THE FABLE INTERPRETATION TASK

Although the group of non-neurologically impaired and non-language impaired adolescents consisted of only five individuals, the analysis of their results provides preliminary insight into non-neurologically impaired adolescent performance on fable interpretation tasks. These results closely correspond with the normative data of non-neurologically impaired adults and children on similar tasks (Roth & Speckman, 1986; Ulatowska et al., 1993).

A summary of results of the non-neurologically impaired subject group on the fable interpretation task is presented in Table 8. Thereafter, the performance of the subjects is discussed with reference to each subtask and general trends highlighted. Transcriptions of responses are included in Appendix H.

Table 8: A Summary of Results of the Non-Neurologically Impaired Subject Group on the Fable Interpretation Task

Subject	Retell	Summary	Identification of the main character	Justification of the main character	Moral
Subject 1	√	√	x	implicit	√
Subject 2	√	√	√	implicit	√
Subject 3	√	√	x	explicit	√
Subject 4	√	√	√	explicit	√
Subject 5	√	±	x	explicit	√

3.2.1. Retelling the Fable

Each subject's retelling of the stimulus fable was judged by the examiner to be appropriate as, for the most part, all information was retained and related in correct sequential order, according to the story grammar analysis. Most responses were retold almost verbatim,

however one subject did not include the setting of the fable in the retell task and two subjects did not include details of the consequence of the main attempt of the text. The results of this task indicated that preserved narrative superstructure and retention of essential information is associated with normal language skills, however omission of some detail may not necessarily be indicative of disordered language processing. It was of interest to note that no errors of ambiguous reference and no addition of irrelevant commentary or incorrect information were recorded in the non-neurologically impaired subject group on the fable retell task.

3.2.2. Summarizing of the Fable

Four of the five subjects within the group produced coherent and syntactically complex summaries of the fable and irrelevant details were not included by any of the five subjects. Although one subject provided telegraphic responses and two subjects omitted the setting of the fable, responses from each of the five subjects in the group included mention of the initiating event, the consequence and the reaction components of the text. All summaries were paraphrased and no events were quoted verbatim. In close correspondence to the adult subjects described by Ulatowska et al. (1993), subjects used construction and generalisation of information to produce summaries.

3.2.3. Identification and Justification of the Main Character in the Fable

Two of the five subjects correctly identified the father as the main actant in the fable. One subject provided an explanation based on implicit information that the father initiated the actions which provided the moral and therefore functioned as the main character in the

fable. The other explanation however, was based on explicit/literal information that "*the father was spoken about more in the story*".

Three subjects identified the sons as the main characters within the fable. Two explanations were based on surface information that the sons were involved in the entire progression of the story. One explanation was based on implicit processing that the sons were the main characters as they were the ones who carried out the main action in the fable, that of digging up the soil.

These results were of interest as, according to Ulatowska et al. (1993), explicitly formulated explanations of the main character may indicate concrete and disordered language processing. Yet, performance of non-neurologically impaired adolescents on this task suggests a tendency toward explicitly based justifications. This tendency may be a function of the educational system wherein children may be told to recognise the main character on the basis of quantitative and not qualitative information.

In summary, the non-neurologically impaired adolescents performed variably on the task of identification and justification of the main character of the fable in this study. There was a tendency toward explicit reasoning, however all explanations were judged by the researcher to be plausible.

3.2.4. Providing the Moral of the Fable

The morals provided by the comparison group were extra-textual, generalisable and directly associated to the fable. Four subjects of the five subjects provided the moral that treasure may not be a materialistic value. This response demonstrated that the figurative

meaning of "treasure" had been recognised and understood. One subject proposed that the fable functioned to teach us that waiting results in a favourable outcome. The ability to provide an extra-textual moral may therefore reflect normal performance. Although these deductions are necessarily cautious, this has been previously demonstrated in non-neurologically impaired adults by Ulatowska et al. (1993).

In summary, overall performance of the non-neurologically impaired subjects on the fable interpretation task reflected a depth of information processing indicative of intact linguistic processing (Ulatowska et al., 1993), although responses were diverse. On the retell task, all subjects demonstrated observance of discourse grammar and no errors of reference or content were recorded. None of the summarising tasks contained unnecessary detail and generalization strategies were implemented. Identification of the main actant was variable with a tendency towards explicit explanation. In providing the moral, all subjects produced extra-textual and generalisable didactic themes that directly related to the fable.

3.3. PERFORMANCE OF THE TOURETTE SYNDROME SUBJECT GROUP ON THE FABLE INTERPRETATION TASK

Transcriptions of responses of the TS subject group on the fable interpretation task are included in Appendix H. A summary of the performance of TS subjects on this task is presented in Table 9. For ease of interpretation, the response of each subject within the TS

sample group on the fable interpretation task will be presented and discussed separately. Following individual discussion, general trends will be summarised.

Subject DB

The performance of subject DB on the fable interpretation task was judged to be inappropriate. In the story retell task, inclusion of all story grammar components in sequential order was observed and no errors of reference or addition of untrue information were recorded. On the summary task, DB showed some evidence of the ability to delete non-essential information, although the summary produced was equivalent in length to the retell task. The father was correctly identified as the main actant in the fable however the explanation, "*...because he grew a vineyard with grapes*" was based on explicit information and justification of the main character was judged to be a superficial response. DB was unable to uncover the metis of the fable and produced an intra-textual, literal moral, "*It's teaching us that the farmer grew the grapes for the sons to live and it was the most beautiful grapes ever.*"

The overall performance of subject DB on the fable task was therefore poor. He showed difficulty in manipulating the structure of the text and more importantly failed to comprehend implicit information. In contrast, no subjects within the comparative group used intra-textual information to provide the moral and, according to Ulatowska et al. (1993), this reflects a breakdown in higher-order linguistic processing.

Subject AD

Overall performance on the fable task for subject AD was not considered reflective of intact higher-order linguistic processing. Although story retell was judged to be appropriate, AD was unable to transform the text and delete information to produce a summary. AD correctly identified the father as the main character but justification was based on explicit information related verbatim, "*because he raised his sons to be like him.*" An extra-textual didactic theme was provided, however it did not relate directly to the fable, suggesting that the subject failed to uncover the metis of the story.

Overall, AD showed an ability to recall the text however his abilities to transform the content of the story and uncover covert meaning in the text were limited. On the basis of these difficulties, performance was judged to be inappropriate. All subjects within the comparative group were able to summarise the text and provided morals that were directly related to the fable.

Of all the subjects in the study, AD appeared to experience the most difficulty focussing attention and thus, it is the author's contention that poor attentional focus may underpin the apparent processing problems demonstrated by AD on this task.

Subject TP

Although overall performance was reflective of higher-order language processing abilities, TP omitted the attempt and consequence of the text in both the story retell and summarising tasks indicating that the main event within the fable was not recognised for its relevance to the didactic theme. The subject applied deletion and generalisation rules

to produce a summary and no irrelevant information was included. Identification of the main character of the fable was correct and the subject's explanation was reflective of insight into the father's contribution to the outcome. TP provided a universal moral that showed understanding of the figurative meaning of "treasure".

Performance on this discourse measure was therefore variable. The ability to produce a summary, identify the main character on the basis of implicit information and deduce a moral is reflective of higher-order language processing skills (Ulatowska et al., 1993). The subject failed however, to understand that the digging of the soil was an important part of the fable. This may indicate reduced inferential and interpretive abilities.

Subject RP

RP's performance on this task was appropriate. Perseveration of discourse grammar and inclusion of all components were apparent in the retell task. The summary was coherent and syntactically-complex. Generalisation rules were employed to reduce the length of the text and non-essential information was deleted. The subject identified the sons as the main actants in the fable and failed to recognise the contribution of the father to the metis of the text in his justification. The moral produced was appropriate and reflected an understanding of figurative language in the text.

In summary, the performance of the subject on the fable interpretation tasks was not indicative of a higher-order language processing disturbance according to Ulatowska et al. (1993). The tendency to identify the sons as the main characters on the basis on explicit

information was also observed in the performance of the non-neurologically impaired adolescents.

Subject PS

PS's performance on the fable interpretation task was not judged to be appropriate. In the retelling of the fable, essential components including the setting, the consequence and the reaction were omitted. The language produced in the retell task was vague, for example, "*father said to his kids*", and one error of sequencing was observed. The omission of essential information in the story retell task and errors of sequencing were not observed in the performance of the non-neurologically impaired subjects and thus may be reflective of a subtle breakdown in language processing. Furthermore, performance corresponds closely with reports of performance of language-disordered children and adults on retell tasks (Chapman, Culhane, Levin et al., 1992; Chapman et al., 1995; Ulatowska et al., 1993). PS was able to produce a summary of the text which included the father's contribution and the outcome and correctly identified the main actant based on implicit information. The moral showed understanding of the double meaning of treasure which reflected higher-order processing skills, however output throughout the task was poorly structured and vague language was evident.

Subject SS

Performance by this subject on all fable interpretation tasks was judged to be appropriate. Story retell was almost verbatim. In summarizing, SS demonstrated the ability to manipulate sentence structure to abridge a text however some irrelevant detail was included. The sons were recognised as the main characters of the fable, however the

justification provided reflected insight into the didactic purpose of the text - SS chose the sons as the main actants as their actions caused them to change. The subject provided two related morals demonstrating an understanding of the double meaning of treasure and the more universal theme that things aren't always what they seem.

Subject KS

Performance was judged to be appropriate. The fable was related in sequential order and all information was included. The summary was more problematic however, as KS failed to include the attempt and consequence in the response. The sons were incorrectly identified as the main characters and the explanation was based on explicit, literal information that the sons, "*are spoken about more.*" The failure to identify and explain the main character of the fable was observed in the performance of the non-neurologically impaired adolescent group on this task and therefore not considered reflective of a higher-order language processing deficit. Furthermore, performance by KS on all other fable interpretation tasks reflected the ability to abstract information and an extra-textual moral based on the figurative meaning of the word treasure was provided.

Subject GS

GS's performance on the fable interpretation task was reflective of higher-order language processing abilities. Although additional commentary was included in the retell task, this subject's response was not considered verbose and tangential. All information was included and an accurate interpretation of the text was reflected in the retell. The summary was judged to be appropriate and generalisation strategies were applied. The subject identified the father as the main character on the basis of implicit information and the

moral provided was an appropriate, universal lesson. GS showed insight into his responses and demonstrated an understanding of abstract, figurative language.

Subject RW

Performance on this task was judged to be within normal limits. Retell of the fable was verbatim. Response on the summary task was telegraphic and the summary did not contain reference to the outcome of the fable. The subject identified the sons as the main characters and provided a literal, non-interpretive explanation for his choice. Although the summary task was problematic and explanations based on explicit information were provided, these errors were not considered to be indicative of language disorder. The same errors were observed in the responses of the non-neurologically impaired subject group. The moral provided reflected good inference abilities. RW proposed that the fable functions to teach us that hard work pays off, demonstrating an understanding of a double underlying meaning even within the implicit information. Overall, performance was judged to be reflective of higher-order language processing skills.

Subject LW

LW's responses on the fable interpretation task were not considered to be appropriate. LW incorrectly related information on the retell task, misunderstood the term "deathbed" and overlooked the didactic theme of the text. Although the subject demonstrated the ability to summarize output, response on the summarising task showed poor sequencing of output and was reflective of failure to recover the global meaning of the fable. Although the father was correctly identified as the main character, the subject's explanation for the choice and moral of the fable revealed superficial understanding of the text. These

responses do not correspond with the normative data of adults on this task (Ulatowska et al., 1993) nor were they demonstrated by subjects within the comparative group. Responses were tangential, verbose, dysfluent and frequently unrelated to the text. An illustrative example from the transcript is provided below:

"[The moral is] that they mustn't do naughty things. Their father just told them that they, that there is a deathbed, a treasure in a deathbed, the father didn't say they must be naughty. Like on the Lion King, when Scar he tells this other boy small boy, but he's a lion, that he, there's a, that there's a evil place somewhere but he didn't obey it so he went to go, so they weren't listening they just go and they don't obey their father they went to check if there's a treasure on the deathbed and it's dangerous there and they didn't obey their father."

Overall, LW's responses demonstrated concrete processing and an inability to use and interpret abstract language. Chapman et al. (1995) showed that children following traumatic brain injury produced rambling and tangential responses to fable retell and interpretation tasks, suggesting that LW's performance may be indicative of a cognitive-linguistic impairment.

Using the performance of the non-neurologically impaired adolescent group as a point of discussion against which to make inferences regarding the higher-order language processing skills tapped in the fable interpretation tasks, five of the ten subjects within the TS group were judged to have demonstrated abstract understanding abilities and language formulation skills as defined by the fable task. Three subjects produced responses that were considered reflective of disrupted linguistic processing and reduced abstract language usage. Two subjects who were able to provide an appropriate moral performed poorly on the story retell task which was in contrast to retell performance by the non-neurologically impaired subjects.

3.3.1. Evaluation of the Fable Interpretation Task as a Diagnostic Tool

With regard to higher-order language processing, the fable interpretation task was found to be a sensitive means of reflecting perseveration of discourse superstructure, language formulation abilities and abstract language understanding. Ulatowska et al. (1993) in a study on discourse production in aphasic subjects and non-neurologically impaired adults demonstrated that the fable task may highlight language formulation and figurative language deficits in neurologically impaired subjects. The results on the fable task corresponded with results on the TLC in this study thus, reinforcing Ulatowska et al.'s (1993) contentions. For the five subjects whose performance was judged to be inappropriate on this task, the ability to deduce and provide a relevant moral was

compromised for three of them, where two produced inappropriate unrelated morals and one subject produced a literal intra-textual response. Two subjects failed to relate the fable in correct sequential order and one subject overlooked the reaction and attempt components of the text suggesting poor interpretation of events preceding the outcome. One subject was unable to produce a summary of the text. Responses with reference to the main character of the fable were diverse, however explanations based on explicit versus implicit information did not appear to be a discriminant feature of the task. Rather, responses that were unrelated to the text or responses that did not include reference to the qualitative or quantitative contribution of the main character were more reflective of disordered language processing.

In summary, the ability to provide a moral appeared to be the most discriminant task of the discourse measure within this study. This finding was also reported by Ulatowska et al. (1993) in a study on fable interpretation in adult aphasic subjects. Error analysis of individual responses proved to be the most useful approach to interpretation as responses were diverse.

3.4. OVERVIEW OF RESULTS

A summary of the performance by the TS subjects on all tasks of the research test battery is presented in Table 9. Most of the subjects within the group performed within normal limits on the test battery. Subjects who performed poorly on the standardized measure also experienced difficulty on the fable interpretation task although variable patterns of results were obtained.

With reference to Table 9, subjects who were unable to provide an appropriate moral on the fable interpretation task and unable to justify their choice of main character with a relevant, related explanation also performed below normal limits on the *Making Inferences* and *Understanding Metaphoric Expression* subtests of the TLC. This may indicate an underlying inability to comprehend implicit and figurative information as defined by the test battery. Three of the ten subjects within the TS group displayed this pattern of reduced abstract language usage. Four of the five subjects who scored below normal limits on the *Recreating Sentences* subtest, also experienced difficulty retelling and summarising the fable. This pattern may illustrate a poor ability to manipulate and organise output within contextual constraints.

In conclusion, results indicated that difficulties in the understanding and use of abstract language and difficulties in the formulation of language output, as defined by the measures employed in the study, were observed for some subjects within the TS subject group. Although language formulation difficulties have previously been documented in TS subjects (O'Quinn & Thompson, 1980), there is seemingly no documentation of reduced

abstract language usage as a possible feature of TS. Higher-order language processing deficits may often elude tests of clinical language function. In view of this, the results of the present study may possibly be distinguished from previous publications because of the methodology adopted and the test battery employed, which allowed for the qualitative description of aspects of discourse. Opler (1979, as cited by Ulatowska et al., 1993) reported that discourse may evidence language disorder in a neurologically-impaired population even when linguistic subskills such as comprehension and vocabulary appear largely intact. This contention is supported by recent studies which have documented the richness of discourse measures in addressing social-cognitive-linguistic impairment (Chapman, Cuhlane, Levin et al., 1992; Chapman et al., 1995; Dennis & Barnes, 1990). Furthermore, as the test batteries employed in previous studies were not constructed according to particular hypotheses regarding possible causal factors of language in disorder in TS, figurative, abstract and ambiguous language abilities in this population have not previously been investigated.

As discussed in the introduction, other studies have reported reading, writing and spelling difficulties as well as reduced language output and speech difficulties (articulation and fluency) in TS. These aspects of language were not evaluated in the present study and thus comparisons can not be drawn. It was worthy of note however, that six of the ten subjects in the study reported a history of speech and language difficulties in the preliminary case history interview.

In the following section, the results of the TS subjects on the research test battery will be discussed in relation to each other and within a neurological framework.

Table 9: Overview of Performance of the Tourette Syndrome Subjects on All Tasks of the Research Test Battery

Subject	Ambiguous Sentences	Making Inferences	Recreating Sentences	Understanding Metaphoric Expression	Fable Retell	Summarising Task	Identification and Justification of the Main Character	Providing a Moral
DB	√	x	√	x	√	√	x	x
AD	√	x	x	x	√	x	x	x
TP	√	√	x	√	x	x	√	√
RP	√	√	√	√	√	√	√	√
PS	x	x	x	x	x	√	√	√
SS	√	√	√	√	√	√	√	√
KS	√	√	√	√	√	√	√	√
CS	√	√	x	√	√	√	√	√
RW	√	√	√	√	√	x	√	√
LW	x	x	x	x	x	x	x	x

Key: √ = appropriate/intact performance; x = inappropriate/deviant performance

4. GENERAL DISCUSSION

"General observations drawn from particulars are the jewels of knowledge."

John Locke (1632 - 1704)

In this section, attention is given to the results obtained in this study and the implications thereof regarding theories of language impairment in TS. The results are drawn together and common threads are highlighted. Thereafter, the language features are compared to other neurogenic language disorders and results are considered in the light of associated conditions and known neurological mechanisms of TS.

Table 10: Summary of Subject Variables and Overall Communicative Functioning

Subject	Severity of TS	Co-occurring ADHD/ ADD	Medicated	Academic Performance	Communicative Functioning
DB	Mild	None	No	Below average	Disrupted
AD	Very severe	Marked ADHD	Yes	Very poor	Disrupted
TP	Mild	None	No	Below average	Disrupted
RP	Moderate	None	Yes	Above average	Intact
PS	Severe	Mild ADD	Yes	Below average	Disrupted
SS	Marked	None	No	Above average	Intact
KS	Very mild	None	No	Average	Intact
GS	Moderate	None	Yes	Below average	Intact
RW	Mild	Mild ADHD	Yes	Below Average	Intact
LW	Marked	None	Yes	Poor	Disrupted

Although the aim of the study was not to provide inter-subject comparisons, Table 10 presents a summary of subject variables and test performance in an attempt to isolate possible contributory factors to language impairment in the TS population. Interestingly,

no commonalities between the subjects who presented with higher-order language processing deficits were evident. The severity of Tourette symptomatology ranged from mild to very severe across the subjects who performed poorly on the language test battery. It was apparent however, that severity of symptoms showed an inverse relationship to language skills in some subjects. Individuals with marked to severe symptomatology according to the TSSS (Shapiro et al., 1988) were more likely to show disrupted communicative performance. This finding reinforces the proposition put forward by Brookshire et al. (1994), that tic variables and motor disturbance underpin communication problems observed in TS. On the basis of the results gleaned from the present study, it is the researcher's contention that tic variables may impact upon test performance due to physical disruptions and due to the intrusive nature of impulses (which results in poor attentional focus).

Medication across subjects was variable. Two subjects who showed linguistic processing difficulties were unmedicated at the time of the study. In contrast, the other subjects whose communication was judged to be inappropriate were medicated with psychostimulants and/or neuroleptic drugs. Medicated individuals are likely to be more severely affected than unmedicated individuals and therefore, communicative disruption observed in medicated patients may possibly relate to symptom severity.

It is difficult to differentiate poor attentional focus as a result of tic variables from a more pervasive attentional disorder, such as ADHD and ADD, in TS. As discussed in the introduction, the attentional difficulties in TS are considered to be multi-factorial and relate to both the intrusive and disruptive nature of tics and to a physiological basis.

Two subjects with poor communicative skills as defined by the test battery presented with diagnosable attentional deficits. Thus, it appeared that attentional impairment, in addition to symptom severity, precipitated communication breakdown in some subjects. Abnormal attention may result in the inability to process complex linguistic material by altering the efficiency of phonological, graphemic, syntactic, semantic and lexical operations. This finding seems to be consistent with some of the behavioural and cognitive disorders that have been reported in previous studies on TS (Brookshire et al., 1994; Hagin et al., 1982, Packer, 1997). The co-occurrence of ADD or ADHD however, could not alone account for the language difficulties observed in the subject group. Inter-subject comparison showed that, although language disruption is related to symptom severity and attentional deficit, some subjects with perceived disrupted communication did not demonstrate poor attentional focus.

Thus, although language disruption in the subject group showed a possible relationship to tic severity and co-morbid attentional impairment, these factors were not necessarily determinants of impaired communicative functioning. Difficulties with abstract language and higher-order processing demonstrated by some of the subject in this study as well as possible emerging patterns of communicative performance may indicate impairment of the neurological substrate.

Poor performance on the research test battery by subjects within the TS subject group was characterised by deficits in the organisation of linguistic output and by a tendency towards literal, concrete language. Although defined by the tests employed, these language features may reflect deficits in frontal lobe processing functions. Functionally the frontal lobes

seem to be important in formulating and directing cognitive and linguistic operations (Alexander et al., 1989). Lesion to these regions appear to be associated with supramodal deficits and may possibly result in the prominent TS symptom of attentional impairment and in some of the language features observed in the TS subjects in this study.

At this point, it seems relevant to reexamine the neuroanatomical sequelae of TS. The basal ganglia-thalamocortical circuitry, which is implicated in the pathogenesis of TS, is associated with projections to the limbic system and frontal lobe regions. These projections are thought to form multiple, parallel and segregated loops which interconnect the functional systems of the brain and mediate motor, cognitive and behavioural functions.

Inferred and direct evidence from neuroimaging studies supports the theory that TS is associated with dysfunction to the subcortical-cortical circuitry and the motor, oculomotor, dorsolateral, orbitofrontal and anterior cingulate circuits which operate between the frontal, limbic and subcortical systems have all been implicated in the pathobiology of the condition (Brookshire et al., 1994; Singer, 1997). Comings (1987) and Butler (1984) have implicated the ventral mesocortical pathways as central to TS. These dopaminergic pathways consist of dopamine neurons travelling through the striatal and limbic regions to the prefrontal cortex. Damage to the mesostriatolimbic cortical circuitry as a consequence of dopaminergic disturbance is therefore thought to result in deficits of prefrontal lobe functions.

Poor ability to recognise and understand ambiguity is consistent with right dorsolateral and opercular frontal lesions. Furthermore, damage to the right dorsolateral frontal regions results in disturbed ability to make inferences given two sequential statements. Frontal lobe

damage is also associated with poor formulation, organization and monitoring of language output and tangential, incohesive and verbose responses characterize the verbal discourse of patients with right dorsolateral and anterior frontal lesions. An inability to understand and explain metaphor is consistent with frontal lesions and communication following frontal damage is characterised by a poor understanding and use of abstract, nonliteral language (Alexander et al., 1989).

The communicative profiles observed in TS subjects in this study , such as concrete language and poor formulation of language, are therefore comparable to the communicative profiles of individuals with frontal lobe lesions.

It is thus possible that the pathobiology of TS results in impaired frontal lobe processing and subsequent disruption to higher-order communication processes. Previous studies have also suggested frontal lobe dysfunction in TS (Comings, 1987; Gedye, 1991; Sutherland, Kold, Schoel et al., 1982). The framework of viewing TS as cortical-subcortical circuitry dysfunction not only explains the behavioural concomitants, attentional deficits and executive dysfunction associated with TS, but also the non-verbal and paralinguistic communicative disturbances, such deviant prosody and body language, observed in TS as a result of secondary involvement of the limbic system.

Language features which result from the loss of control of superordinate functions mirror those of attentional impairment and the role of attention in superordinate frontal lobe functions such as output monitoring and integration is fundamental. Attention is part of the control structure that directs and monitors cognitive operations. With this in mind, frontal

lobe dysfunction and attentional impairment cannot be realistically isolated for their involvement in language disruption in TS. Although the pathogenesis of the disorder substantiates frontal lobe involvement, the nature of TS (including irrepresible and intrusive thought patterns) implies that limited attentional resources form the crux of the observed language deficits in TS. Perhaps these two hypotheses of language impairment in TS do not refute but rather complement and expand one another.

It must also be considered that lesions to the right cerebral hemisphere are also associated with deficits in processing linguistic information and consequent difficulties in figurative interpretation, drawing inferences and interpreting metaphors and morals (Myers, 1986). As the right hemisphere is more diffusely organised than the left cerebral regions, it may be more susceptible to neurochemical disruption (Bornstein et al., 1983) and therefore the possibility of right hemisphere involvement in communication deficits in TS cannot be excluded.

The above explanations have attempted to capture at least part of the essence of the communication disorder observed in four of the TS subjects in this study. The explanations are however, cautious. Most of the subjects within the group reported no communication difficulties and performed within normal limits on the test battery. In addition, testing targeted higher-order language functions and no formal testing of clinical language functions, such as vocabulary and syntax, was carried out. Although it was assumed that specific linguistic deficits would be borne out by the discourse measures employed in the study, it is a possibility clinical language deficits may underlie communicative performance in some subjects as opposed the postulated neuropsychological limitations.

Although this must be considered when interpreting the results of the study, specific language impairment was not reported for any of the subjects within the group. Furthermore, the nature of the communication deficits observed in the four TS subjects corresponds with knowledge pertaining to the neuropsychological sequelae of TS.

5. CONCLUSIONS AND IMPLICATIONS

In conclusion, the results of this study demonstrate that communicative deficits of a higher-order of language processing may be associated with TS. This conclusion is circumspect as it is based on the finding that four out of a subject group of ten adolescents with TS presented with difficulty on the research test battery. The language difficulties observed in the subject group were characterised by poor formulation of language output and reduced abstract language usage as defined by the test measures employed. These language features suggest that cognitive and neurobehavioural symptoms may be at the core of communication deficits in TS and possibly reflect frontal lobe dysfunction which can be explained by the proposed pathogenesis of TS.

The methodological approach adopted in the study proved to be an appropriate framework in which to address the aims of the study. A multiple case-study design as opposed to a group design allowed for a more qualitative description of language symptoms in the TS subjects in this study. The research test battery also proved to be an appropriate means of identifying high-level language impairment and discriminant tasks that were identified could guide future variables for investigation on larger groups.

5.1. Theoretical and Empirical Implications

The findings of this study question the concept of TS as a purely motor and behavioural disorder and suggest that frontal lobe language disturbance may be an integral feature of TS. Although neuropsychological and cognitive involvement in TS has previously been

reported (Bornstein et al., 1983; Brookshire et al., 1994), this has been based on performance on neuropsychological tests and not language performance. The verbal/linguistic features observed in some individuals with TS provide support for recent neurobiological theories implicating the frontal lobes in the pathophysiology of TS (Comings, 1987; Gedye, 1991; Singer, 1997; Sutherland et al., 1982) and add to the increasing body of literature that confirms and describes the functional role of the basal ganglia and frontal lobe interconnections in language processes. Furthermore, inappropriate communication in TS as a function of frontal and limbic system involvement parallels the communication in individuals with disorders along the developmental basal ganglia syndrome continuum, such as individuals with Asperger's Syndrome. This finding strengthens the association between the disorders and endorses the proposed umbrella term of developmental basal ganglia syndrome (Palumbo et al., 1997).

TS has been placed within this broad spectrum of developmental basal ganglia conditions, of which executive dysfunction is a principal feature. As executive functioning has been associated with the frontal lobes and subcortical circuitry, the finding that discourse may be impaired in some subjects with TS has implications for the relation of executive dysfunction to language competency which has not been fully explored. Thus, further study which compares neuropsychological measures of executive function to discourse and language competency in TS is implicated. This progression of the research will aim to explore the broader controversy that is presently being debated concerning discourse as a measure of executive function (Anderson, 1998). In addition, the need to compare results of a group of adolescents with TS on language tests to other clinical populations, such as

stutterers and adolescents with ADHD, as well as a statistical comparison between medicated and unmedicated individuals, is highlighted.

5.2. Clinical Implications

The nature of the language features observed in TS subjects in this study may reflect supramodal disturbance. A deficit in supramodal functions manifests on multi-levels influencing cognitive functioning, test performance and communicative competence (Alexander et al., 1989). Language is the tool through which cognitive processes are moderated and expressed, and the context in which impaired cognition manifests. Intervention at the level of language therefore may benefit all levels of disrupted processing. In this respect, the speech-language therapist should play an important role in guiding educational and social management of individuals with TS.

There is however, a limited awareness of TS in the field of speech-language pathology. Literature regarding speech and language features and concomitant cognitive or social problems in TS is found within the neuropsychological and neurological literature and not within mainstream speech-language pathology literature. It is postulated that the previous disregard for this clinical population in the field of speech-language pathology is the result of the pre-existing conceptualization of TS as a movement disorder and the inherent bias in neuropsychological studies, where average verbal intelligence quotients are considered reflective of intact linguistic and communicative skills.

There is thus, a call for the involvement of the speech-language pathology profession to research and address language impairment in TS. Continued research which aims to

describe language features of the disorder and isolate contributory factors is implicated. An improved understanding of the nature and basis of communication impairment in TS will guide and direct intervention. The preliminary findings of the present study indicate that the speech-language therapist should approach intervention in the TS population from a cognitive perspective and assist firstly, the development of compensatory strategies to focus attention, and secondly, extend cognitive-linguistic functioning into higher-order processing by developing skills to analyse, manipulate and interpret abstract language. The findings of the study also necessitate the inclusion of TS and associated neuropsychiatric disorders in university curricula.

5.3. Conclusion

It is hoped that the preliminary description of possible language features in TS provided by this study will provide a platform for further research into TS in the field of speech-language pathology. There is still more to be learnt about the communication characteristics of TS and the influence of language disruption on academic and psychosocial functioning in this population. Language in TS needs to be more closely analysed and more precisely defined to introduce unanimity in the literature and provide support for the theories regarding the underlying causes of language disorder raised in this study. Further research will achieve a greater understanding of TS within the speech-language pathology profession and prompt the involvement of the speech-language therapist in the management of TS individuals who demonstrate academic and social difficulties. The results of the present study suggest that the role of the speech-language therapist in this population may be a valuable one.

REFERENCES

- Alexander, M.P., Benson, D.F. and Stuss, D.T. (1989) Frontal lobes and language. *Brain and Language*, 37, 656 - 691.
- Alsobrook, J.P. and Pauls, D.L. (1997) The Genetics of Tourette Syndrome. *Neurologic Clinics*, 15 (2), 381 - 393.
- American Psychiatric Association (1994) *Diagnostic and Statistical Manual of Mental Disorders* (Fourth Edition) Washington D.C.: Author.
- Anderson, V. (1998) Assessing executive functions in children: biological, psychological and developmental considerations. *Neuropsychological Rehabilitation*, 3, 319 - 349.
- Barkley, R. (1990) *Attention Deficit Hyperactivity Disorder: A Handbook for Diagnosis and Treatment*. New York : Guilford Press.
- Bornstein, R., King, G. and Carroll, A. (1983) Neuropsychological abnormalities in Gilles de la Tourette's Syndrome. *Journal of Nervous and Mental Disease*, 171(8), 497-502.
- Bornstein, R.A., Carroll, A. and King, G. (1985) Relationship of age to neuropsychological deficit in Tourette Syndrome. *Journal of Developmental and Behavioural Pediatrics*, 6, p. 284.
- Bornstein, R.A. (1990) Neuropsychological performance in children with Tourette Syndrome. *Psychiatry Research*, 33, pp. 73 - 81.

Bornstein, R.A., Baker, G.B., Bazylewich, T. and Douglass, A.B. (1991) Tourette Syndrome and neuropsychological performance. *Acta Psychiatrica Scandinavia*, 84, 212-216.

Bornstein, R.A. (1991) Neuropsychological correlates of obsessive characteristics in Tourette Syndrome. *Journal of Neuropsychological and Clinical Sciences*, 3, 157 - 162.

Bornstein, R.A. and Yang, V. (1991) Neuropsychological performance in medicated and unmedicated patients with Tourette's Disorder. *American Journal of Psychiatry*, 148, 468-471.

Brookshire, B., Butler, I., Ewing-Cobbs, L. and Fletcher, J. (1994) Neuropsychological characteristics of children with Tourette Syndrome: Evidence for a non-verbal learning disability? *Journal of Clinical and Experimental Neuropsychology*, 16(2), 289 - 302.

Butler, I.J. (1984) Tourette's Syndrome: Some new concepts. *Neurologic Clinics*, 2, 571 - 580.

Caine, E., McBride, M., Chiverton, R., Bamford, K., Rediess, S. And Shiao, J. (1988) Tourette's Syndrome in Monroe County school children. *Neurology*, 38, 472-475.

Camfield, P., Camfield, C., Bawden, H. and Stokes, A. (1996) Peer relationship problems are not related to tic severity in Tourette Disorder. *Annals of Neurology*, 40 (2), 179.

Cannito, M. P.; Hayashi, M.M., and Ulatowska, H. K. (1988) Discourse in normal and pathologic aging. *Seminars in Speech and Language*, 9, 117 - 134.

Caron, C., and Rutter, M. (1991) Comorbidity in child psychopathology: Concepts, issues and research strategies. *Journal of Child Psychology and Psychiatry*, 32, p. 1063.

Chapman, S.B., Culhane, K.A., Levin, H.S. et al. (1992) Narrative discourse after closed head injury in children and adolescents. *Brain and Language*, 43, pp. 42 - 65.

Chapman, S.B., Levin, H.S., Matejka, J., Harward, H. and Kufera, J. (1995) Discourse ability in children with brain injury: Correlations with psychosocial, linguistics and cognitive factors. *Journal of Head Trauma Rehabilitation*, October, pp. 36 - 54.

Coffey, B.J. and Park, K.S. (1997) Behavioural and Emotional Aspects of Tourette Syndrome. *Neurologic Clinics*, 15 (2), 277- 289.

Comings, D.E. (1987) A controlled study of Tourette Syndrome, VII, Summary: A common genetic disorder causing disinhibition of the limbic system. *American Journal of Human Genetics*, 41, 839 - 866.

Comings, D.E., Himes, J.A., and Comings, B.G. (1990) An epidemiologic study of Tourette's Syndrome in a single school district. *Journal of Clinical Psychiatry*, 51, 463-469.

Comings, D.E. and Comings, B.G. (1991) Clinical and genetic relationships between Autism-Pervasive Developmental Disorder and Tourette Syndrome: A study of 19 cases. *American Journal of Medical Genetics*, 39, pp. 180 - 191.

Crosson, B. (1992) *Subcortical Functions in Language and Memory*. New York: The Guilford Press.

Denckla, M., Harris, E., Alyward, E., Singer, H., Reiss, A., Reader, M. Bryan, R. and Chase, G. (1991) Executive function and volume of the basal ganglia in children with Tourette Syndrome and Attention Deficit Hyperactivity Disorder. *Annals of Neurology*, 30 (3), 476.

Dennis, M. and Barnes, M. (1990) Knowing the meaning, getting the point, bridging the gap and carrying the message: Aspects of discourse following closed head injury in childhood and adolescence. *Brain and Language*, 39, 428 - 446.

Devinsky, O. (1983) Neuroanatomy of Gilles de la Tourette's Syndrome - possible midbrain syndrome. *Archives of Neurology*, 40, 508 - 512.

Devor, E. (1990) Untying the Gordian knot: The genetics of Tourette Syndrome. *Journal of Nervous and Mental Disease*, 178, 669-679.

Dykens, E., Leckman, J. , Riddle, M. et al. (1990) Intellectual, academic and adaptive functioning of Tourette Syndrome with and without attention deficit disorder. *Journal of Abnormal Child Psychology*, 18, 607-615.

Freeman, R. (1997) Attention Deficit Hyperactivity Disorder in the presence of Tourette Syndrome. *Neurologic Clinics*, 15 (2), 411 - 420.

Gathercole, S.E. and Baddeley, A.D. (1993) *Working Memory and Language*. Hove, United Kingdom: Lawrence Erlbaum Associates.

Gedye, A. (1991) Tourette Syndrome attributed to frontal lobe dysfunction: Numerous etiologies involved. *Journal of Clinical Psychology*, 47, 233 - 252.

Hagin, R., Beecher, R., Pagano, G. and Kreeger, H. (1982) Effects of Tourette Syndrome on learning. In A. Friedhoff and T. Chase (eds). *Gilles de la Tourette Syndrome*. New York: Raven Press.

Hagin, R. and Kugler, J. (1988) School problems associated with Tourette's Syndrome. In, D. Cohen, R. Bruun and J. Leckman (eds), *Tourette Syndrome and Tic Disorders: Clinical Understanding and Treatment*. New York: John Wiley, pp. 223 - 236.

Hartley, L.L. (1995) *Cognitive-Communicative Abilities Following Brain Injury: A Functional Approach*. California: Singular Publishing Group.

Head, D., Bolton, D. and Hymas, N. (1989). Deficit in cognitive shifting ability in patients with obsessive-compulsive disorder. *Biological Psychiatry*, 25, 929 - 937.

Hubbard, T. and Trauner, D. (1996) Comparison of attention deficits in Tourette Syndrome and Attention Deficit Disorder. *Journal of Investigative Medicine*, 44 (1), p. 195A.

James, G. (1970) *An Introduction to Psychology*. Middlesex: Penguin.

Jankovic, J. (1997a) Preface. *Neurologic Clinics*, 15 (2), p. xvi.

Jankovic, J. (1997b) Phenomenology and Classification of Tics. *Neurologic Clinics*, 15 (2), 267 - 275.

Kurlan, R. (1989) Tourette's Syndrome: Current concepts. *Neurology*, 39, 1625 - 1630.

Kurlan, R., Fett, K., Parry, K., Boettrick, C., Como, P.G. (1991) School problems in Tourette's Syndrome. *Annals of Neurology*, 30, 275 - 276.

Kurlan, R. (1994) Hypothesis II: Tourette Syndrome is part of a clinical spectrum that includes normal brain development. *Archives of Neurology*, 51, 1145 - 1150.

Kurlan, R. (1997a) Treatment of Tics. *Neurologic Clinics*, 15 (2), 403 - 409.

Kurlan, R. (1997b) Future direction of research in Tourette Syndrome. *Neurologic Clinics*, 15 (2), 451 - 456. Lebrun, Y. (1988) Language and Epilepsy: A review. *British Journal of Disorders of Communication*, 23, 97 - 110.

Lajonchere, C., Nortz, M. and Singer, S. (1996) Gilles de la Tourette and the discovery of Tourette Syndrome, *Archives of Neurology*, 53, 567-574.

Lebrun, Y. (1988) Language and epilepsy: A review. *British Journal of Disorders of Communication*, 23, 97 - 110.

Leckman, J.F.; Towbin, K.E., Ort, S.I., et al. (1988) Clinical assessment of tic disorder severity. In Cohen, D.H., Bruun, R., and Leckman, J.F. (eds). *Tourette Syndrome and Tic Disorders: Clinical Understanding and Treatment*. New York: Wiley & Sons.

Lichter, D., Jackson, L. and Schachter, M. (1995) Executive dysfunction in Tourette Syndrome: Clinical. *Neurology*, 45 (Suppl. 4), A254.

Littlejohns, C. , Clark, D. and Corbett, J. (1990) Tourette-like disorders in Asberger's Syndrome. *British Journal of Psychiatry*, 156, 430 - 433.

Ludlow, C.L., Polinsky, R.J. Caine, E.D., Bassich, C.J. and Ebert, M.H. (1982) Language and speech abnormalities in Tourette's Syndrome. *Advances in Neurology*, 35, 351-361.

Luria, A. (1980) *Higher Cortical Functions in Man*, (second edition). New York: Basic Books.

Martindale, C. (1977) Syntactic and semantic correlates of verbal tics in Gilles de la Tourette's Syndrome: A quantitative case study. *Brain and Language*, 4, 231 - 247.

Mason, A., Banerjee, S., Eapen, V., Zeitlin, H. and Robertson, M. (1998) The prevalence of Tourette Syndrome in a mainstream school population. *Developmental Medicine and Child Neurology*, 40, 292 - 296.

McCall, R. (1994) *Fundamental Statistics for Behavioural Science* (6th Edition) Orlando: Harcourt Brace College Publishers.

McReynolds, L and Kearns, K. (1983) *Single subject experimental design in communication disorders*. Baltimore: University Park Press.

Myers, P.S. (1994) Communication disorders associated with right-hemisphere brain damage. In R. Chahey (ed) *Language Intervention Strategies in Adult Aphasia*. Third Edition. Baltimore: Williams & Wilkins.

Nippold, M.A. (Ed.) (1988) *Later Language Development: Ages Nine through Nineteen*. Boston: College Hill Press.

O' Quinn, A.N. and Thompson, R.J. (1980) Tourette's Syndrome: An expanded view. *Pediatrics*, 66, 420 -424.

Packer, L.E. (1997) Social and Educational Resources for patients with Tourette Syndrome. *Neurologic Clinics*, 15 (2), 457 - 473.

Palumbo, D., Maughan, D., Como, P. and Kurlan, R. (1997) Executive dysfunction in Tourette Syndrome: The role of comorbidity. *Archives of Clinical Neuropsychology*, 12(4), 380.

Palumbo, D., Maughan, D. and Kurlan, R. (1997) Hypothesis III: Tourette Syndrome is only one of several causes of a developmental basal ganglia syndrome. *Archives of Neurology*, 54, 475-483.

Pauls, D., Leckman, J. and Cohen, D. (1993) Familial relationship between Gilles de la Tourette's Syndrome, Attention Deficit Disorder, Learning Disabilities, Speech Disorders, and Stuttering. *Journal of American Academy of Child and Adolescent Psychiatry*. 32(5), 1044- 1050.

Robertson, M.M. and Stern, J. (1997) Gilles de la Tourette Syndrome. *British Journal of Hospital Medicine*, 58 (6), 253 - 256.

Robertson, M.M. (1989) The Gilles de la Tourette Syndrome: The current statistics. *British Journal of Psychiatry*, 154, 147 - 69.

Roth, F. P. and Spekman, N.J. (1986) Narrative Discourse: Spontaneously generated stories of learning disabled and normally achieving students. *Journal of Speech and Hearing Disorders*, 17, 219-229.

Rourke, B. (1989) *Nonverbal Learning Disabilities*. New York : Guilford Press.

Shapiro, A.K., Shapiro, E.S., and Young, J.G. et al. (1988) Measurement in tic disorders. In Shapiro A.K., Shapiro, E.S., and Young, J.G. (Eds) *Gilles de la Tourette Syndrome*, ed 2. New York: Raven Press, pp. 451 - 480.

Silverman, F.H. (1993) *Research Design and Evaluation in Speech-Language Pathology and Audiology*. New Jersey: Prentice Hall.

Singer, C. (1997) Coprolalia and Other Coprophomina. *Neurologic Clinics*, 15 (2), 299-308.

Singer, H. and Walkup, J. (1991) Tourette Syndrome and other tic disorders. *Medicine*, 70(1), 15 - 32.

Singer, H., Schuerholz, L. and Denkla, M. (1995) Learning difficulties in children with Tourette Syndrome. *Journal of Child Neurology*, 10(suppl.1), pp. S58 - S61.

Stein, N. and Glenn, C. (1979) An analysis of story comprehension in elementary school children. *New Directions in Discourse Processing*, 2, 53 - 102.

Stern, J.S., and Robertson, M.M. (1997) Tics associated with Autistic and Pervasive Developmental Disorders. *Neurologic Clinics*, 15 (2), 345 - 355.

Sutherland, R.J., Kolb, B., Schoel, W.M. et al. (1982) Neuropsychological assessment of children and adults with Tourette Syndrome: A comparison with learning difficulties and schizophrenia. *Advances in Neurology*, 35, 311 - 322.

Sverd, J. (1991) Tourette Syndrome and autistic disorder: A significant relationship. *American Journal of Medical Genetics*, 39, pp. 173 - 179.

Tanner, C. M. and Goldman, S.M. (1997) Epidemiology of Tourette Syndrome. *Neurologic Clinics*, 15 (2), 395 - 402.

Ulatowska, H., Sadowska, M., Kordys, J., and Kadzielawa, D. (1993) Selective Aspects of Narrative Discourse as Illustrated by Aesop's Fables. In Bronwell, H. and Joanne, Y. (eds.) *Narrative Discourse in Neurologically Impaired and Normal Aging Adults*. California: Singular Publishing Group Ltd.

Van de Wetering, B. and Heutink, P. (1993) The genetics of the Gilles de la Tourette Syndrome: A review. *Journal of Laboratory and Clinical Medicine*, 121(5), 638-645.

Van Zomeren, A.H. and Brouwer, W.H. (1994) *Clinical Neuropsychology of Attention*.
New York: Oxford University Press.

Wiig, E. H. and Secord, W. (1985) *Test of Language Competence*. Merrill.

APPENDIX A
INFORMATION SHEET

THE LANGUAGE SKILLS OF ADOLESCENTS
WITH TOURETTE SYNDROME

Good Day,

I am a postgraduate speech and hearing therapy student at the University of the Witwatersrand. I am conducting a research project into the language skills of adolescents with Tourette Syndrome .

I would appreciate your participation in this project as you would be a suitable candidate to test. Taking part in this study involves doing a series of language tests on one occasion at a time that would be suitable to you. The test session takes about one hour.

This is entirely voluntary, and you are under no obligation to participate. If you choose not to participate, or wish to withdraw at any time during the language testing, you will not be disadvantaged in any way. In addition, the results of this study will be strictly confidential, and your name will not be used at all.

Your help in this study is much appreciated.

Regards
Carol Legg

CONSENT FORM

I have fully explained the procedures of this study and their purpose. I have asked whether or not any questions have arisen regarding the procedures and have answered these questions to the best of my ability.

Date: _____

Speech and Language Pathologist (researcher) _____

I have been fully informed as to the procedures being followed and have been given a description of their purpose. In signing this consent form, I agree to participate in this study and I understand that it will not necessarily provide personal benefit. I understand that I am free to refuse to participate or withdraw my consent and discontinue my participation in this study at any time. I understand also that if I have any questions at any time, they will be answered.

Date: _____

Subject: _____

Parent: _____

APPENDIX B

PILOT CASE STUDY

Case History

The subject was selected from the Movement Disorders Clinic on the basis of the subject selection for the study. The subject was a 14 year old male in Grade 8 at an assisted learning centre. Although mainstream education was a selection criterion for subjects in this study, the subject had attended mainstream schools prior to placement in a special educational needs environment. His educational background did not indicate possible intellectual disability and placement in specialized education was due to the severity of his tics and psychosocial/behavioural problems. He was a right-handed native English speaker.

The subject was diagnosed with TS at age 8. His neurological symptomatology included severe motor tics, such as eye blinking, head nodding, arm jerking and vocal tics, such as sniffing, grunting, shouting and coprolalia. Obsessive behaviour and attentional deficits were indicated, however these did not dominate the clinical picture. Behavioural problems such as aggression, violence and stealing were reported and socialization was problematic.

Developmental milestones were early and it was reported that the subject began producing words and phrases at 10 months. Reading and writing skills were mastered without difficulty and no communication problems were noted.

At the time of the study, the subject's medication included Sulpiride, Paroxetine, Pimozide and Clonidine. His medical history was otherwise unremarkable and no family history of TS or associated disorders was reported.

Procedure

The test battery was administered at the subject's home. He was not required to alter his drug regimen for the purposes of testing.

Results

The results of testing revealed that the subject experienced difficulty on all language tasks of the test battery. The subject's scores on the TLC, presented in the table below, fell outside of normal limits, according to the normative data of Wiig and Secord (1985). An age equivalent of nine years and less was calculated. Error analysis revealed a tendency for initial difficulty and trial items of each subtest were failed. It was also noteworthy that performance declined toward the end of each subtest. Thus, a pattern was evident, suggestive of initiation difficulties and attentional deficits. The subtest, *Recreating Sentences*, posed particular difficulty for the subject.

Subject's Performance on the TLC

Subtest	Standard Score	Percentile Rank (according to Wiig & Secord, 1985)
Ambiguous Sentences	9	37 th percentile
Making Inferences	5	5 th percentile
Recreating Sentences	3	1 st percentile
Understanding Metaphor	7	16 th percentile
TLC Composite Score	72	3 rd percentile

The results on the fable interpretation task revealed difficulty at the level of complex linguistic processing. The subject's retelling of the fable was judged by the examiner to be appropriate as all information was retained and related in correct sequential order. The summarizing task, however, was unsuccessful and the subject did not understand the concept of summarizing. He initially attempted to retell the story verbatim and then provided the gist of the fable. The subject was able to identify the main character, however the protagonist was not identified as the character for whose actions provide the moral. Rather, a literal explanation based on explicit information was provided; *"I think he was most important because he raised his sons to be like him"*. According to Ulatowska et al. (1993), explicitly formulated explanations suggest a tendency towards concrete processing and minimal inferencing. In deducing the moral, the subject's explanation was judged to be inappropriate. Although he showed the ability to produce an extra-textual and

generalisable didactic theme, he provided an associated moral choice instead of one that related directly to the fable.

In summary, the results of the testing revealed a language impairment characterized by reduced abstract language usage and poor formulation of language output. Attentional impairment influenced test performance, however test items were familiar and instructions were clear.

APPENDIX C
MODIFICATIONS TO THE TEST OF LANGUAGE COMPETENCE
(WIG & SECORD, 1985)

Word or expression from test item	Modification (South African alternative)
Thanksgiving	Christmas
shopping mall	shops
moped	motorcycle
movie theatre	movies
pancake house	Wimpy Bar
downtown	town
grade	marks
summer	school holidays
woods	bush
track meet	athletic's meeting
echelon	ranks
guidance counsellor	guidance teacher

APPENDIX D TIC RATINGS

Tourette Symptom Severity Scale (Shapiro et al., 1988)

Variables

Tics are noticeable to others:

- 0 - Tics are not present.
- 0.5 - Tics are infrequent or mild and are usually not noticed by employer, teachers and associates, although some family members or close friends may be aware of the presence of tics. Symptoms can be diminished significantly in controlled public places.
- 1 - Tics are noticed by most friends and occasionally by some employers, teachers or strangers.
- 2 - Tics are noticed by many or most employers, teachers or strangers.
- 3 - Tics are noticed by all individuals.

Tics elicit comments or curiosity:

- 0 - Tics are not present, or are so infrequent and mild that they are not noticed and do not elicit comments or curiosity from employer, teachers and friends, although they may be apparent to close family members.
- 0.5 - Tics are more frequent and apparent and possibly elicit comments or curiosity by some individuals.
- 1 - Tics are frequent and apparent and elicit comments or curiosity by all individuals.

Tics are considered odd or bizarre:

- 0 - Tics are not present or are infrequent and mild and other individuals would not consider the patient odd or bizarre.
- 1 - Tics are more frequent, startling, or distort the appearance of the patient, and some observers consider the patient odd or bizarre.
- 2 - Tics are frequent, startling, or distort the appearance of the patient, and most or all of the observers consider the patient odd or bizarre.

Tics interfere with functioning:

- 0 - Tics are absent or are present but do not interfere with academic, vocational, social, or psychological functioning and co-ordination.
- 1 - Tics occasionally or somewhat interfere with academic, vocational, social, or psychological functioning and co-ordination.
- 2 - Tics frequently, usually or always interfere with academic, vocational, social, or psychological functioning and co-ordination.

Incapacitated, homebound or hospitalised:

- 0 - No
- 1 - Yes

Severity Rating *Total Score*

0	none
0 to 0.5	very mild
1 to 2	mild
2 to 4	moderate
4 to 6	marked
6 to 8	severe
more than 8	very severe

APPENDIX E
PRESENCE OF OBSESSIVE COMPULSIVE BEHAVIOUR AND ATTENTION
DEFICIT HYPERACTIVITY DISORDER

Obsessive Compulsive Behaviour - Clinical Global Impression
(Leckman et al., 1989)

Normal	No OC symptoms, or OC behaviours are developmentally appropriate.
Borderline	Clear symptoms, but they do not impair school, social or occupational function.
Mild	Mild disturbance in school, social or occupational function. Meets DSM-III criteria for OCD. Not obvious to those who do not know the patient.
Moderate	Some disturbance in school, social or occupational function that is noticeable to those who do not know the patient. Patient is still able to sustain fair degree of function.
Marked	Impairment of school, social or occupational functioning to a degree that causes serious concern at home and school or on the job. Ability to continue in full-time employment or study is threatened by OC symptoms.
Severe	At least two areas of function are clearly impaired because of symptoms. School or work function has been reduced because of inability to carry a full load.
Extreme	Disruption in multiple areas of function including home, school, work and peer relationships. Patient is or nearly is incapacitated by symptoms. Spends virtually all day engaged in symptom-related behaviour.

Attention Deficit Hyperactivity Disorder - Clinical Global Impression
(Leckman et al., 1989)

Normal	No reported symptoms of inattention, impulsivity or hyperactivity.
Borderline	Transient, intermittent and infrequent symptoms of inattention and/or impulsivity and/or hyperactivity, causing no impairment. Does not meet DSM III criteria for ADHD.
Mild	Symptoms sufficient to meet DSM III criteria for ADHD. Behaviour organised and appropriate in environment not highly structured. Could function in average home or regular classroom with minimal disruption.
Moderate	Symptoms vary with situation and time. Requires some structuring of environment for behaviour to be organised and appropriate, but rarely requires one-to-one supervision.
Marked	Requires considerable structuring of environment to be organised and appropriate. If supervised at home, has symptoms but is generally well organised and appropriate.
Severe	Pervasive and frequent symptoms of inattention, impulsivity and hyperactivity. Often requires one-to-one supervision.
Extreme	Unable to function in home or school because of constant, pervasive symptoms of inattention, impulsivity and hyperactivity. Needs constant supervision (24 hour care).

APPENDIX F
FABLE

FARMER AND SONS

A farmer worked in a vineyard and became rich. He wanted his sons to be just like him. On his deathbed the farmer told his sons that there was a great treasure buried in the vineyard. After the farmer died, the sons went to the vineyard and dug up all the soil. They could not find a buried treasure. At harvest time, the vineyard produced the best grapes ever. Now the sons understood the meaning of the treasure.

APPENDIX G
STORY GRAMMAR ANALYSIS OF THE FABLE (STEIN & GLENN, 1979)

A farmer worked in a vineyard and became rich.	(major setting)
He wanted his sons to be just like him.	(minor setting)
On his deathbed, the farmer told his sons that there was a great treasure buried in the vineyard.	(initiating event)
After the farmer died, the sons went to the vineyard and dug up all the soil.	(attempt)
They could not find a buried treasure.	(consequence)
At harvest time, the vineyard produced the best grapes ever.	(reaction)
Now the sons understood the meaning of the treasure.	

APPENDIX H
RESPONSES OF ALL SUBJECTS ON FABLE INTERPRETATION TASKS.

RESPONSES OF SUBJECTS IN THE TOURETTE SYNDROME GROUP

Subject BD

Retelling the fable

A farmer had a vineyard. It made him very rich. He wanted his sons to be just like him. On his deathbed, he told them about a buried treasure and then they dug up all the soil and they could not find any treasure. When it was harvest time, the vineyard grew the most wonderful grapes and they understood the meaning of the treasure.

Summarizing of the fable

A farmer grew a vineyard, got very rich. Before he died, he told his sons about a treasure. They dug up all the soil. They found nothing. When it was harvest, beautiful grapes was grown and they understood the meaning of treasure.

Identification and justification of the main character in the fable

Main character: The father

Explanation: Because he grew a vineyard with grapes.

Providing the moral of the fable

It's teaching us that the farmer grew the grapes for the sons to live and it was the most beautiful grapes ever.

Subject AD

Retelling the fable

A farmer worked in a vineyard. He became very rich. He wanted the sons to be exactly like him. On his deathbed, he said there was a great treasure in the vineyard. They went and dug it all up. They couldn't find the treasure and then the harvest came and the best grapes ever and then they knew what the treasure meant.

Summarizing of the fable

The treasures aren't always seen like a real treasure.

Identification and justification of the main character in the fable

Main character: The father

Explanation: Because he raised his sons to be like him.

Providing the moral of the fable

Not to be greedy.

Subject TP

Retelling the fable

There was this man and he had two sons. And on his deathbed, he said there was a treasure in the vineyard and the grapes were growing nice and the sons were going to look for the treasure and then they understood what kind of treasure the father meant.

Summarizing of the fable

There was a farmer and when he was on his deathbed, he told his sons there was a treasure in the vineyard. The grapes were growing very well at the time they went to go and look for the treasure and then they understood what kind of treasure it was.

Identification and justification of the main character in the fable

Main character: The father

Explanation: Because he's the one that told them there was a treasure.

Providing the moral of the fable

The treasure really was the worth of the story - it's not all about money.

Subject RP

Retelling the fable

A farmer worked in a vineyard and became rich. He wanted his sons to be just like him. Before he died, he told them there was a treasure buried in the vineyard. After his death, the sons dug up the vineyard but didn't find the treasure. At harvest time, the vineyard grew the best grapes ever and the sons understood the meaning of treasure. **Summarizing of the fable**

A farmer in a vineyard was rich and when he died he told his sons there was treasure in the vineyard. They dug up the vineyard but didn't find treasure, instead they became rich from a good harvest.

Identification and justification of the main character in the fable

Main character: The sons

Explanation: The father is dead; he doesn't feature.

Providing the moral of the fable

Treasure is not always gold.

Subject PS**Retelling the fable**

His father said to his kids in the vineyard, there is a treasure and he knew that he would die someday so he told his kids. When he died, his kids went to dig it up and they saw, and then the best and then they dug up the soil and then the best grapes were, were grew there and they were the treasure that tasted good and looked good.

Summarizing of the fable

The father said there was a treasure in the vineyard. The kids finally found out when they dug it up, the treasure was actually grapes. Real nice grapes.

Identification and justification of the main character in the fable

Main character: The old man

Explanation: 'Cause he told everything to the sons.

Providing the moral of the fable

Treasures aren't always gold and that. They can be nice things like grapes and fruit. They don't have to be money.

Subject SS**Retelling the fable**

There was a farmer and he owned a vineyard. From that vineyard he became very rich and he wanted his sons to be just like him. And, at his deathbed, he told his sons that there was a treasure buried underneath the vineyard. When he died, they went and they all dug up the soil to try and find treasure but they couldn't find it buried there. And when harvesting season came, they grew the best grapes ever and now the sons truly understood the meaning of treasure.

Summarizing of the fable

This story is about a farmer that got very rich from a vineyard and wanted his sons to be the same as him. When he died, he told his sons that there was treasure buried in the vineyard. When they had dug the whole vineyard up they could not find the treasure. But

next year they truly understood the meaning of the treasure when the grapes grew the best crop they've grown.

Identification and justification of the main character in the fable

Main character: The sons

Explanation: Because they got some information, they tried to use it but they couldn't then something happened that made them really understand something.

Providing the moral of the fable

Well, partly, things aren't always as they seem and secondly, treasure is not really an actual thing. Treasure can be love or something that's nice. You can't see or touch it.

Subject KS

Retelling the fable

A farmer had his own vineyard and became rich. He wanted his sons to be just like him so when he was dying, he told his sons that there was treasure in the vineyard. So when he died, they went to look for it and couldn't find it and then at harvest time, ja grapes, they got the best grapes and then they realised the treasure.

Summarizing of the fable

A farmer had a vineyard and became very rich. On his deathbed, he told his sons that there was treasure. At harvest time, they grew the best grapes and then they realised the meaning of the treasure.

Identification and justification of the main character in the fable

Main character: The sons

Explanation: Because they are spoken about more.

Providing the moral of the fable

That it might not be gold or money, treasure. It could just be goodful doing, like good the grapes.

Subject GS

Retelling the fable

There is a farmer who owns a vineyard. He is going to die but he wants his sons to be rich. So he tells them that there is a great treasure in the vineyard. So the sons misinterpret what

he is saying although they don't know that yet and they go and they dig up the vineyard looking for a treasure, a physical treasure, and they can't find anything, much to their dismay. And in the harvest season, the vineyard grows and there's beautiful wine and they sell the wine and become rich and it was a treasure after all.

Summarizing of the fable

A father is dying and tells his sons that there is a treasure in the vineyard. They mistake the treasure and actually it is the wealth the vineyard can provide.

Identification and justification of the main character in the fable

Main character: The father

Explanation: He's the one who said something very clever and it was actually a moral.

Providing the moral of the fable

You shouldn't look so superficially at things, so literally. You must think about them in more depth, about their significance and what they really mean.

Subject RW

Retelling the fable

A farmer worked in a vineyard and became rich. He wanted his sons to become like him. So on his deathbed, he told them there was a treasure buried in the vineyard. He died and the two sons dug the vineyard and didn't find any treasure. At harvest time, the vineyard yielded the best grapes ever. The two sons understood what their father meant.

Summarizing of the fable

Father had a vineyard. Father died. So he told them to make money and the father told them of a treasure. They dug up the vineyard and became rich.

Identification and justification of the main character in the fable

Main character: The sons

Explanation: They are still here, they are in the now. The story is about them becoming rich not their father.

Providing the moral of the fable

Hard work pays off.

Subject LW

Retelling the fable

There was a farmer that lived on a vineyard and he had sons. Now the farmer and, on the vineyard, there was a farm, a vineyard that produced very good grapes. Now he told his son on, he showed his son the next day his deathbed and he said there's a treasure there by the deathbed. So when the farmer died his sons went to go and check at the treasure at the deathbed and, oh I can't remember, and they couldn't find it. So now, there was also a good soil there and I can't remember. And the sons they got good grapes out of the vineyards.

Summarizing of the fable

There was a farmer, who had sons. The next day, the sons, the farmer died and the sons went to look for treasure on the deathbed and there were good grapes in the vineyard.

Identification and justification of the main character in the fable

Main character: The father

Explanation: Because he's the father, he's got to, he's like your mom and dad, they have to tell you what to do, their sons and daughters in the house they've got to tell you what to do and they got to look after you.

Providing the moral of the fable

That they mustn't do naughty things. Their father just told them that they, that there is a deathbed, a treasure in a deathbed, the father didn't say they must be naughty. Like on the Lion King, when Scar he tells this other boy small boy, but he's a lion, that he, there's a, that there's a evil place somewhere but he didn't obey it so he went to go, so they weren't listening they just go and they don't obey their father they went to check if there's a treasure on the deathbed and it's dangerous there and they didn't obey their father.

RESPONSES OF NON-NEUROLOGICALLY IMPAIRED SUBJECTS

Subject 1

Retelling the fable

There was a farmer and he worked on a vineyard and was very rich. He had two sons and on his deathbed, he told them that there was a treasure buried in his vineyard. So the one day, they went to his vineyard and dug up all the soil to try and when harvest came, they vineyard produced the best grapes and then the sons understood what their father meant.

Summarizing of the fable

There was this rich farmer with a vineyard. He told his sons on his deathbed, there was a buried treasure. They went to look for it but didn't find it. When harvest came, they found it and then the sons realised what their father meant.

Identification and justification of the main character of the fable

Main character: The sons

Explanation: Because they were like the ones that came, they were the ones that went to find the treasure but never found it until harvest.

Providing the moral of the fable

I think it's teaching us that sometimes it's not buried treasure with gold and everything. It can be other things.

Subject 2

Retelling the fable

There was a farmer and he worked in a vineyard and he had sons. And, the one day when he died, he wanted his sons to carry on the farm, I think and he told his sons that there was a great treasure in the vineyard. And, so when he died, the sons went and dug up the vineyard to try find the treasure and when they did not find it, well they didn't find it. Then, when the harvest came they had the best grapes ever and then they understood the meaning of the treasure.

Summarizing of the fable

There was a farmer and he had a vineyard and he had sons and when he was dying, he told his sons that there was treasure in the vineyard but the sons went to find the treasure and

they couldn't find it. Then when harvest came, there were the best grapes ever, and that was the treasure.

Identification and justification of the main character in the fable

Main character: The father

Explanation: Because he was the one who had produced all that harvest and told the sons about the treasure.

Providing the moral of the fable

You mustn't just expect gold and stuff, that you have other things in life that are a treasure.

Subject 3

Retelling the fable

There was a farmer and he had sons and a grape vineyard. Before he died, when he was on his deathbed, he told his sons that there was a great treasure buried in the vineyard. So after he died, the sons went and dug up all the soil to find the treasure - they obviously misunderstood it. Then when the season came all the best season of grapes grew and then they understood what he meant by the treasure.

Summarizing of the fable

A father and sons own a vineyard. Father dies and tell sons that there's a treasure. They look but they don't find it and when the grapes grow they realise what the treasure is.

Identification and justification of the main character in the fable

Main character: The sons

Explanation: Because they're involved from the beginning and are always there but the father dies.

Providing the moral of the fable

If somebody says there's a treasure it may not be what you think of it at first, you've just got to wait and see to find out what they mean.

Subject 4

Retelling the fable

There was a very rich farmer. He had a vineyard and when he died, he told his sons that there was a great treasure buried underneath the vineyard. So when he died the sons went and dug up all the ground to look for the treasure, but didn't find it, but when harvest time

came, the vineyards were growing and the grapes were the best they've ever had and then they finally understood why he said that.

Summarizing of the fable

A father is dying and tells his sons that there is a treasure in the vineyard. They mistake the treasure and actually it is the wealth the vineyard can provide.

Identification and justification of the main character in the fable

Main character: The father

Explanation: He's the one most spoken about.

Providing the moral of the fable

That we must not only look for one treasure, we must look for more treasures.

Subject 5

Retelling the fable

There was a father and he told his sons that he was on his deathbed and there was a great treasure in the vineyard. And then they dug up the vineyard and when harvest came, it bore a great harvest and then they understood the meaning of the treasure. **Summarizing of the fable**

Father told sons great treasure buried in vineyard. Sons dug up vineyard. Harvest time came bore great fruit and they understood the meaning of treasure.

Identification and justification of the main character in the fable

Main character: The sons

Explanation: They made it to the end.

Providing the moral of the fable

Waiting. Not looking into the obvious.

Author: Legg C.F

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