EXTRALINGUISTIC SPEECH CHARACTERISTICS OF CHILDREN WITH CONDUCT AND ANXIETY DISORDER

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EXTRALINGUISTIC SPEECH CHARACTERISTICS OF CHILDREN WITH CONDUCT AND ANXIETY DISORDER

by

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ABSTRACT

EXTRALINGUISTIC SPEECH CHARACTERISTICS OF CHILDREN WITH CONDUCT AND ANXIETY DISORDERS

Sotirios Kotsopoulos, Ph.D.

The purpose of this study was to investigate in child psychiatric patients the associations between reflection-cognitive planning and temporal extralinguistic measures, and between anxiety and speech breath measures. It was postulated that patients with conduct disorder will be significantly less reflective while those with anxiety disorder will be significantly more anxious. Eighteen children were selected to participate in the study; nine fulfilled the criteria of conduct and nine those of anxiety disorder of the tri-axial classification scheme. Independent measures were also taken on the Behaviour Problem Checklist (Peterson-Quay), Junior Eysenck Personality Inventory and Matching Familiar Figures Test. In the experiment, which was carried out during the routine psychiatric assessment, the subjects were requested to respond to verbal tasks (counting, picture description, story telling).

As predicted, disturbance of conduct was associated with short initial hesitation (delay) measures. This was shown both in the comparison between the conduct and anxiety disorder groups and in the correlation between conduct characteristics and initial hesitation. The average length of pauses was not found to vary with any of the independent measures. There was a significant negative association between frequency of pauses and 'Extraversion' on the picture description task. The initial hesitation and pausing variables

were independent of each other. As predicted also, anxiety across subjects was associated with increased breath rate and lower output of speech per breath. The conduct and anxiety disorder groups were not distinguished from each other on speech breath measures; independent measures of anxiety showed also that children with conduct disorder were as anxious as those with anxiety disorder.

It is suggested that the initial hesitation variables are measures of reflection and cognitive planning. Children with disturbance of conduct reflect little when responding to a verbal task; likewise they probably reflect little in planning their actions. Short reflection is a cognitive characteristic associated with disturbance of conduct while anxiety is an emotion not specific to anxiety disorders. It is concluded that extralinguistic measures may be useful in the diagnosis and management (cognitive behaviour therapies) of child psychiatric disorders.

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I. INTRODUCTION

The diagnostic classification of child psychiatric disorders is attracting greater research attention. This investigation assumed that increased diagnostic refinement is necessary for the future development of child psychiatry, and is an attempt to facilitate this process by studying certain aspects of speech in different categories of patients.

Two of the major diagnostic groupings in child psychiatry are those of the conduct and anxiety disorders. These two conditions can be consistently distinguished from one another using characteristic signs and symptoms (Rutter, 1977; Quay, 1979). Research, however, has failed to demonstrate that basic differences in emotional or cognitive characteristics exist between the two groups. The identification of such differences would strengthen the validity of these diagnostic categories and possibly suggest treatment methods more specific for each of these disorders.

The present study explored the possibility of identifying some basic cognitive and emotional characteristics in conduct and anxiety disorders. It was postulated that impulsivity is a cognitive characteristic underlying the conduct disorders, whilst anxiety is a basic characteristic of the anxiety disorders. The study proceeded to test these hypotheses by comparing conduct with anxiety disorders in children on measures of impulsivity and anxiety. Impulsivity and anxiety were measured on extralinguistic variables of verbal behaviour that have been developed by Goldman-Eisler (1968).

Goldman-Eisler's work (1968) suggested that temporal extralinguistic variables, e.g., initial hesitation (delay) and pauses in

speech, are measures of cognitive planning and reflection. She showed, on the other hand, that speech breath activity variables could reliably measure the affective state of anxiety. Speech analysis, therefore, by measuring temporal and speech breath variables, may provide reliable information on the person's cognitive style (reflection-impulsivity) and emotional state (anxiety) which, it is suggested, are basic characteristics in conduct and anxiety disorders respectively. The reasons for formulating these postulates are discussed below.

A. Conduct and Anxiety Disorders

1. Clinical Syndromes

(a) Classification schemes

Operational definitions of child psychiatric disorders is not an easy task. In fact, the difficulties in this area are greater than in adult psychiatric disorders for several reasons. First, there are few child psychiatric disorders which can meet rigorous criteria for diagnostic entities (Jaspers, 1963) and identified as diseases on the basis of their aetiology, clinical symptomatology and their more or less predictable course (Achenbach, 1978). Second, most of the psychiatric disorders present a great variety of behaviours and symptoms which overlap, have multiple aetiologies and do not have a course which can be reliably predicted (Rutter, 1977). Third, these disorders are often patterns of responding during the process of personality development and may be resolved or become part of the attitudes of the psychopathology of adulthood (Livson & Peskin, 1967; Thomas & Chess, 1976 and 1977). It is therefore not surprising that the expectation of working with clearly delineated clinical psychopathological forms in

child psychiatry is often frustrated.

Despite these limitations, considerable progress has been made in recent years in the identification and classification of broad groups of child psychiatric disorders.

Two of these groups are the conduct and anxiety disorders which account for a large proportion of the children referred to child psychiatric services. Further studies, however, are needed in order to substantiate the validity of these disorders and to refine methods and techniques of clinical diagnosis and management.

Attempts at a systematic classification of child psychiatric disorders and the delineation of clinical syndromes are rather recent. A relatively early scheme developed by the Group for the Advancement of Psychiatry (1966) has not been widely used, but has failed to yield reliable results (Beitchman et al., 1978). The multi-axial schemes which have been proposed recently improve upon the previous classification criteria (Cromwell et al., 1975; Rutter, 1977). These schemes provide for diagnosis on various dimensions (e.g., clinical syndromes, aetiological factors, intellectual level), they cover more than one important aspect of the patient's condition and thus have obvious advantages over the single diagnosis schemes (Mezzich, 1979).

The first multi-axial scheme for child psychiatric disorders was developed by a World Health Organization (WHO) study group and was published in 1969 (Rutter et al., 1969). It provided for three axes: the clinical syndromes, the intellectual level and the associated or aetiological factors. In a more recent edition of the same scheme, the aetiological factors were further divided into the organic axis and the psycho-social influences axis (Rutter et al., 1975).

In the practical application of this scheme, the diagnostic categories of conduct and neurotic disorder of the clinical syndrome axis, were the most frequently used (Rutter et al., 1975). A similar trend in diagnoses was observed in a large number of children referred to the child psychiatric facility where the present study was carried out (Kotsopoulos & Nandy, 1981).

The conduct and neurotic disorder categories, which cover broad clinical groups, have recently been incorporated into the child psychiatry section of the ICD-9 (WHO, 1977). They have also been included as conduct and anxiety disorders in the DSM-III developed by the American Psychiatric Association (1980). In both classification systems the conduct and neurotic-anxiety disorders were subdivided into a number of other clinical categories (e.g., unsocialized and socialized conduct, avoidant and overanxious disorder, etc.).

The validity of the conduct and neurotic-anxiety disorder diagnostic groups is generally supported by their association with different aetiological factors and prognosis (Rutter, 1977). Further support for the validity of these groupings has been provided by multivariate analyses of behaviour of measures. A large number of descriptive behaviour characteristics in both clinic and non-clinic children have consistently been shown to cluster in two major groups. These were called 'conduct' and 'withdrawal-anxiety' by Quay (1979) and 'externalizing' and 'internalizing' by Achenbach (1978). The reliability and stability of these broad groups of characteristics has been satisfactory (Achenbach & Edelbrock, 1978). However, despite their similarity it is not known yet whether the statistically derived patterns of 'conduct' and 'withdrawal-anxiety' are identical to the

clinical categories of conduct and neurotic-anxiety disorders. Further studies in this area are obviously needed.

The prevailing characteristic amongst children with conduct and developmental (e.g., hyperactivity) disorders is impulsivity (Messer, 1976) and anxiety is considered the emotion underlying the neurotic-anxiety disorder (Schwartz & Johnson, 1981). These two concepts have been examined in this study from both the clinical and extralinguistic points of view. A review, therefore, of impulsivity and anxiety follows.

(b) Impulsivity and anxiety

(i) Impulsivity. The concepts of impulsivity and reflection, which are viewed as polar opposites, are relatively new in child psychology and psychiatry. Reflection-impulsivity, referred also as conceptual tempo, describes the tendency to reflect or not in choosing among alternatives which are available in the process of problem solving. Responding impulsively, that is without much forethought and consideration of alternatives, may be viewed as insufficient reflection producing an inappropriate or inadequate response.

Children typically become more reflective with increasing age. This coincides with the cognitive and language development as well as with the development of what Vygotsky (1962) called inner speech. Inner speech is important in relation to behaviour (Luria, 1961). The child directs his behaviour by inner speech using the internalized verbal instructions he received from his parents at an earlier stage of his social training. It is suggested that training the impulsive child to reflect more and to use inner speech before embarking upon action could be important in the management of children with conduct

disorder (Meichenbaum, 1977). The evidence so far indicates that increased reflection in children may prevent the expression, but not the experience, of aggressive thoughts (Messer & Brodzinsky, 1979). The results of cognitive therapies based upon this approach, in children with conduct disorder, have been encouraging. However, it is probably too early to determine the value of this treatment approach as it is still being developed (Hobbs et al., 1980).

The measurement of reflection-impulsivity has included response time and errors made on a test task; the subject is requested to select the one answer which is correct among several highly plausible alternatives. The test which has been used most often to measure reflection-impulsivity is the Matching Familiar Figures Test (Kagan et al., 1964), and most research on impulsivity has derived from the administration of this test to both children and adults (Messer, 1976) (see Section II,B,1(d)).

The possible relationship between the temporal phenomena of spontaneous speech and reflection-impulsivity is discussed below.

(ii) Anxiety. Anxiety is the emotion characterizing neurotic-anxiety disorders, but may be present in association with other symtoms; for example, phobias, obsessions and depression. In children the clinical features of the neurotic-anxiety disorders usually are not well differentiated (Hersov, 1977). Anxiety phenomena may be observed as a normal response at different age levels. They are considered abnormal only if they become excessive or persist beyond the appropriate age, e.g., separation anxiety. Other forms of anxiety cannot be considered normal at any age, e.g., panic attacks (Jersild et al., 1975; Hersov, 1977).

Anxiety may be precipitated by life experiences that are dissonant to the temperament of the child, by chronic environmental stress, or communication with chronically anxious dependent or mentally ill parents (Hersov, 1977). It is also possible that anxiety may arise from intrapsychic conflict between instinctual drives and internalized social values and inhibitions (Freud, 1959).

Anxiety becomes manifest as observed behaviour. It is felt, or experienced, and is associated with neurophysiological concomitants (Eysenck, 1975). Identifying and measuring anxiety in children presents a number of problems. First, not a single sign or symptom is pathognomonic of anxiety (Hersov, 1977; Quay, 1979); for example restlessness, which is a very common symptom, may be both a sign of anxiety and hyperactivity. Secondly, the cognitive abilities of children, particularly younger ones, are not sufficiently developed to allow adequate introspection and description of the felt experience. Thirdly, the neurophysiological concomitants may not be specifically related to the emotion of anxiety (Lang, 1971; Lader, 1972). Despite these reservations, behaviours and symptoms which are evoked by events known to arouse anxiety, should be considered valid signs of anxiety (Glennon & Weisz, 1978).

A distinction has been proposed in recent years between state and trait anxiety. State-anxiety may be conceived as an emotional response, the intensity of which varies, or fluctuates, over time. A state exists at a given moment in time and at a particular level of intensity. Trait-anxiety is a personality feature and may be conceptualized as a relatively enduring individual characteristic. It varies between individuals and predisposes them to perceive the world,

and respond to it, in a specified and regularly predictable way (Spielberger, 1972). There are no reports of investigations in children that have considered and measured this dual aspect of anxiety. Such studies may be extremely difficult to carry out because they require the subjects to report feelings experienced habitually (trait-anxiety) as compared to those experienced under stress (state-anxiety).

The reliable measurement of anxiety requires more than one measure, e.g., neurophysiological and answers to a questionnaire (Eysenck, 1975). In children the assessment of anxiety should include other measures in addition to behavioural observations. A relatively easy measure to take, requiring little interference with the child, is respiration during speech (speech breath activity). Respiration varies with anxiety (see Section I,B,3) and it is possible that this variation could be measured whilst the child is responding to a verbal task. Exploration of this possibility is part of the present study.

B. Extralinguistic Speech Phenomena

1. Overview

Speech is a highly complex form of behaviour. It is determined by the intention to communicate an idea (Mahl & Schulze, 1964). The process by which thought (idea) is converted into speech is complicated and only partially understood. According to Luria (1976) it involves the following: a prelinguistic graph (abstract thought that is to be expressed), internal speech (deep syntax structure), expression (surface structure : syntax and morphology), and phonological and phonetic realization of the message. The verbal expression alone, does not determine the meaning of the message. 'How' the message is spoken may be equally important. Non-verbal features such as intonation

(stress), loudness, rate of speaking, fluency, rhythm and pitch participate in qualifying the message.

The non-verbal features which qualify the spoken message and often show the affect associated with it, have been called extra-linguistic (Mahl & Schulze, 1964). Extralinguistics share common ground with psycholinguistics and with other non-verbal communication phenomena, e.g., facial expression and gaze, body movements and gestures, and proximity behaviour (Siegman & Feldstein, 1978; Weitz, 1979). There is, however, as yet no general agreement about which non-verbal features of speech should be covered by extralinguistics (Siegman, 1978) and this term has at times been used interchangeably with that of paralinguistics (Crystal, 1974; Knapp, 1978).

Trager (1958), who has been considered a pioneer in this field, grouped under 'paralanguage' a number of phenomena. These were divided into voice set, voice qualities, and vocal characterizers, qualifiers and segregates. Voice set referred to the 'psychological and physical peculiarities resulting in the patterned identification of individuals as members of a societal group and as persons of a certain sex, age, state of health, etc.'. Voice qualities included such phenomena as pitch range and control, rhythm control and tempo. Vocal characterizers referred to laughing, crying, yelling, whispering, etc. Vocal qualifiers referred to intensity, pitch height and extent. Vocal segregates included non-linguistic sounds (e.g., ah, mm, sh), sounds arising from the function of the articulatory organs, the sounds of inspiration and expiration, and pauses.

Mahl and Schulze (1964) grouped under extralinguistics several other features of speech, in addition to some of those suggested by Trager (1958). They included measures of language style (e.g.

verb/adjective ratio), vocabulary selection and diversity, pronunciation and dialect. Under the heading of voice dynamics they identified voice qualities and rhetorical features, rhythm, verbal output and temporal phenomena, e.g., silent pauses, hesitations, latency, duration of utterances. The term extralinguistics has been used in this study as it was defined by Mahl and Schulze (1964).

Laver and Trudgill (1979), in a more recent classification attempt, considered extralinguistic those voice features which are more or less stable and are associated with sex, age, anatomical condition of the speech organs, and are informative about the person. The same authors used the term paralinguistic for those transient voice features that qualify a verbal message.

Extralinguistic features of speech are an important means in the communication of emotions associated with a spoken message. They were predominant means of expression of emotion in phylogenetically earlier stages of development. In man, however, through evolution the non-verbal vocal cues of expression of emotion were subordinated to the development of language but they have not been totally eliminated (Scherer, 1979).

The study of the non-verbal communication of emotion began with Darwin. In his book 'Expression of Emotion in Man and Animals', Darwin wrote 'with many kinds of animal, man included, the vocal organs are efficient in the highest degree as a means of expression' (Darwin, 1872). Early studies on the expression of emotion in speech relied exclusively on the acoustic impression of trained or untrained listeners (Mahl & Schulze, 1964; Knapp, 1978). In recent years, however, technological developments have made possible the analysis and

measurement of the physical parameters in the speech signal which are associated with the expression of emotion (Scherer, 1979; Weitz, 1979).

Extralinguistic features of speech are part of the routine clinical assessment, and speech semiology can play an important part in the diagnosis and understanding of psychiatric disorders. Jaspers (1963) considered speaking 'an accomplishment of the psychic reality of the individual' and Ey and associates (1963) suggested that the semiology of speech and language is psychiatric semiology 'par excellence'. For example, extralinguistic signs such as pressure of speech, slowness of speech, or flatness of verbal expression, are respectively, symptoms of mania, depression and schizophrenia (Freedman et al., 1975).

Analysis of speech and measurement of extralinguistic variables has shown that emotional states may be identified objectively. For example, the speech of patients clinically believed to have flat affect showed less variance in both amplitude and frequency than speech of controls (Andreasen et al., 1981). Also, the speech rate in depressed patients has been shown to be slower than their normal rate (Szabadi et al., 1976). Furthermore, a number of studies indicate that high degree of psychophysiological arousal is associated with a wide range of variability of fundamental frequency (Fo), high amplitude of intensity and fast tempo (Scherer, 1981).

2. Pauses and Related Temporal Phenomena

Pauses, initial hesitation (or delay) and verbal productivity are extralinguistic features related to time and can vary with cognitive activity, emotional states, personality characteristics and social context (Rochester, 1973; Siegman, 1978). These temporal

features appeared to offer a means of unobtrusively studying impulsivity-reflection as cognitive style in children.

(a) Temporal phenomena and cognitive processes

The systematic study of the temporal speech phenomena and pauses largely begun with Goldman-Eisler (1968). She showed that speech, unlike written script, is a fragmented process. She demonstrated that in adult subjects, speech was emitted in chunks of less than six words, separated by pauses varying in length from 0.25 to 3 seconds. Separations of less than 0.25 seconds duration were not counted as pauses. They were considered to be part of the articulation process, or to have grammatical and syntactic function. Goldman-Eisler (1968) distinguished two types of pauses, hesitation and breath pauses.

In her experiments over several years, Goldman-Eisler (1968) found that pauses increased in relation to the complexity of the cognitive task. Subjects showed increased initial delays (hesitations) and paused more when elaborating on the context of cartoons, than when they had the relatively simple task of describing them. Initial delays, therefore, and pauses were considered to be functions of cognitive planning and reflection. Other studies have further substantiated the association between pausing and the difficulty of cognitive task (Rochester, 1973).

In the clinical application of extralinguistic measures, initial hesitation was found to be significantly longer in thought-disordered schizophrenic patients than in non-schizophrenic subjects on cartoon description and on interview. Non-thought disordered schizophrenic patients occupied an intermediate position between the

thought disordered and the normal subjects. The three groups of subjects did not differ in pausing as much as they did in initial hesitation (Rochester et al., 1977). This study suggests that improvement in the condition of schizophrenic patients is associated with shorter initial hesitation while the frequency and length of pauses do not change appreciably. Extralinguistic measures, however, on schizophrenic patients taken before and after treatment are necessary in order to validate this hypothesis.

In children, there has been one study that attempted to replicate the work of Goldman-Eisler, and this reached similar conclusions (Levin et al., 1967). Children were asked to describe and explain what they observed in the following experiment. Two balloons of different size and colour were released by the child; the larger balloon was inflated with helium and the smaller one with air. The child was also given two discs, identical in size, shape and colour, but one made of lead and the other of wood. Predictably, the length of pauses increased when the child tried to explain the difference in the movement of the balloons and weight of the discs.

Studies in children have further shown that both the length and the frequency of pauses diminish with increasing age and reach their lowest values in adolescence (Sabin et al., 1979). This indicates that shortening of pausing occurs in association with increased cognitive competence of the child.

Extralinguistic studies in clinical settings, of the cognitive characteristics (e.g., impulsivity-reflection) of child psychiatric patients have not been reported in the literature. This is surprising, considering that verbal behaviour can be recorded unobtrusively during

the psychiatric assessment and psychotherapy, and can be analyzed with the aid of modern audio-technology. Extralinguistic measures may be useful both in the assessment and management of child psychiatric disorders whenever the cognitive style of the patient is considered pertinent to the clinical condition.

(b) Temporal phenomena and anxiety

The variation of pausing in relation to anxiety was extensively studied by Mahl (1956) in clinical settings. Studying patients during psychotherapy, Mahl suggested that anxiety had both disrupting and inhibiting effects on the temporal features of speech. Subsequent studies, however, yielded contradictory results (Murray, 1979; Siegman, 1978). Commenting on the evidence from a large number of studies, Murray (1971) suggested that the relationship between anxiety and temporal phenomena is curvilinear rather than linear. According to this hypothesis, medium levels of anxiety are associated with increased verbal output and short overall pausing while increased levels of anxiety reduce the verbal output and increase pausing. This has been referred to as the inverted U hypothesis (Murray, 1971).

This ambiguous association between pausing and anxiety has discouraged the application of pausing measures in clinical practice as indicators of anxiety.

In children, one study which manipulated the level of environmentally induced stress, showed that the frequency of pauses increased under the condition of higher levels of stress (Levin & Silverman, 1965). In this study children were asked to tell a story under two different conditions, to an audience of four adults and to a microphone while no one was listening. The results of this study were in

keeping with those of similar studies in adults. The children paused longer when they spoke in front of the audience. Studies on the relationship between trait-anxiety only and extralinguistic temporal measures in children have not been reported in the literature.

(c) Temporal phenomena and personality

Temporal extralinguistic measures in adults have been shown to vary in relation to two personality characteristics, extraversion and type A personality. Similar investigations in children have not been reported.

Studies on American adult subjects have shown that extraversion was significantly associated with shorter pauses, which produced a faster speech rate (Siegman, 1978). Commenting on these studies, Siegman (1978) suggested that an 'impulsivity factor', which is perhaps confounded by Eysenck's extraversion measure (1963) was responsible for the variation of the temporal measures. The results of the American studies have not been replicated in German subjects (Scherer, 1981).

Some evidence also indicates that personality type A, which is associated with increased incidence of coronary heart disease, may be distinguished from personality type B on extralinguistic measures. One study (Schucker & Jacobs, 1977) has shown that type A subjects spoke with louder volume and faster speech rate, but has not been replicated.

(d) Temporal phenomena in a social and interpersonal context

Since speech is an interpersonal activity, social context factors may be significant contributors to the variation of extra-linguistic measures. A number of studies reviewed by Siegman (1978)

have indicated that the warmth, or coldness, of the interviewer may reduce, or increase pausing, without affecting verbal productivity. The social status, on the other hand, of the interviewer has not been found to have significant effect on temporal measures.

It is obvious that an interviewer effect on pausing may be significant in a psychiatric interview, in psychotherapy, or in a clinical experiment. This effect should be controlled in the experimental situation by presenting the stimuli for verbal responses in a uniform manner.

3. Speech Breath Activity

Breath activity measures vary with anxiety. This has been demonstrated by a number of studies which will be reviewed below. Speech breath activity, on the other hand, has been given much less attention by researchers. Speech breath measures, however, can be taken unobtrusively under ordinary interview conditions (Goldman-Eisler, 1955), that is without the constrains and biases which may be associated with the use of equipment necessary for taking psychophysiological measures. In the following paragraphs the association is examined between breath, speech breath and anxiety measures with a view to identifying those techniques and measurements which might be helpful in clinical studies of speech in children.

Breathing alterations either in the form of experienced feelings (difficulty in breathing, chest constriction) or change in the respiration rate are psychophysiological concomitants of anxiety (Lader, 1972). Faster respiration rate is usually associated with increased levels of anxiety. This has been observed in anxious subjects whilst they were recalling unpleasant experiences (Finesinger,

1939), or under the effect of painful stimuli (Finesinger & Mazick, 1940), as well as on subjects under experimental conditions which manipulated the level of stress (Suess et al., 1980). Other studies have further substantiated Finesinger's earlier observations (Clausen, 1951; Christiansen, 1965). It should also be added that the clinical syndrome of hyperventilation which is characterized by fast breathing is associated predominantly but not exclusively with anxiety both in children and adults (Burns, 1971; Compernolle et al., 1979; Enzer & Walker, 1967).

In the assessment of the association between respiration and anxiety other measures have also been used, and found useful in distinguishing anxious from non-anxious subjects. Mezey and Coppen (1961) measured respiratory efficiency and found it was lower in anxious patients. Suess and his associates (1980) in their study found that the low end-tidal CO_2, as well as increased respiration rate, was associated with increased anxiety; the association between end-tidal CO_2 and anxiety was higher than that between respiration rate and anxiety. The authors of this study (Suess et al., 1980) concluded that respiration rate alone is an insufficient measure of respiratory reactivity to psychological stimuli.

Respiration is not only a vital physiological function which ensures survival. It is also an integral part of speech production. During speech, breathing becomes a voluntary process controlled at the cortical level and the regularity of its rhythm is altered by syntactic and cognitive requirements (Goldman-Eisler, 1968). Despite the alteration of respiration during speech the vital function of breathing is not affected; the alveolar oxygen percentage remains constant, which indicates that increased or diminished respiration

rates during speech are compensated for by commensurate changes in respiratory volume (Haldane & Priestley, 1935).

The association between speech breath activity and emotion has been extensively investigated by Goldman-Eisler (1968). There is no study reported in the literature on the speech breath activity in children. The paucity of research in this area is not surprising. Measuring reliably the speech breath activity with the minimum of constraints on speech and interference with the subjects is not technically easy. Breath measures are usually taken with spirometer, pneumograph or thermistor placed at the nose or the mouth (Brener, 1967). Goldman-Eisler (1955) used the sound of inspiration, which was audible on speech recordings. She has claimed that this is a reliable method of measuring the speech breath activity.

In her experiments, Goldman-Eisler (1968) measured both the respiratory rate and the verbal output per breath (see Section II,B.2(b)) She found that these two measures have a reciprocal relationship, as one increases the other decreases. The verbal output measures proved to be the more sensitive indicators of mood, in discriminating between persons, as well as between different mood states of the same person.

Goldman-Eisler (1968) has interpreted her findings by suggesting that a constant verbal output per breath (syllables) indicates that the affect is under control, and is channelled through verbal activity. A reduction in the output per breath means that larger proportions of the inhaled air current escapes unused. This indicates that the emotional excitation has not been channelled through the verbalization process. According to her, the speech breath rate measures the intensity of the affect, while the output per breath

measures the degree of control and verbal expression of the affect.

Heim and associates (Heim et al., 1968) in their study of four asthmatic patients in psychotherapy, measured the speech breath activity with pneumograph, but did not include measures of output or speech per breath. They found that it was the depth, rather than the rate of respiration, that varied with the affective content of speech. Persistent individual differences were observed suggestive of individual 'styles' in speech breathing. This was in keeping with observations which have indicated that the volume of air which can be converted into voice is specific to each subject. This varies with age, sex, weight and height (Yanagihara et al., 1966).

In conclusion, Goldman-Eisler's method (1955) of measuring speech breath activity by listening to audio recordings is relatively unobtrusive and lends itself to use in clinical settings, particularly in experiments involving children. The literature suggests that speech breath measures vary with anxiety, but this requires further investigation, using independent measures of anxiety.

C. Extralinguistic Phenomena in Association With Conduct and Anxiety Disorders

It was suggested in previous sections that conduct and anxiety disorders are accepted as valid clinical syndromes by current classification schemes. It was also argued that impulsivity appears to be an important characteristic underlying the conduct disorders. Impulsivity may be manifested in spontaneous speech and could be assessed by the temporal extralinguistic measures. These measures of speech, it is postulated, may distinguish the conduct from anxiety disorders.

This hypothesis may be tested by comparing subjects with conduct disorders with those who have anxiety disorders on temporal extralinguistic measures. Also, by examining the relationship of measures of conduct and anxiety across all subjects to these speech measures. Such an investigation will require verbal responses to tasks of increasing cognitive complexity, similar in principle to those developed by Goldman-Eisler for adults (1968). According to the hypothesis, the extralinguistic temporal differences between conduct and anxiety disorders will be accentuated as the verbal tasks increase in difficulty, because the subjects with conduct disorders will not show the changes in the temporal extralinguistic measures associated with an increase of cognitive planning and reflection.

It is further suggested that anxiety is a characteristic of the neurotic-anxiety disorder. Anxiety is reflected in the respiration function including the speech breath activity. Speech breath measures, therefore, may distinguish between conduct and anxiety disorders.

Speech breath activity has been considered part of the wider area of Trager's (1958) paralanguage and Goldman-Eisler's (1968) psycholinguistics. Recent reviews of the extralinguistic phenomena (Siegman, 1978; Wietz, 1979), however, have made no reference to speech breath measures leaving some doubt about their place in the extralinguistic domain. In the interest of clarity it seems appropriate to avoid using the term extralinguistic in referring to speech breath measures.

In planning an investigation of these hypotheses, the extralinguistic and speech breath measures would be the dependent variables. The independent variables of the study would be the clinical diagnoses

of conduct and anxiety disorders, and the scores on measures of attributes possibly associated with these diagnoses (Peterson-Quay Behaviour Problem Checklist, Junior Eysenck Personality Inventory, Matching Familiar Figures Test). In addition, other independent measures, which might have a confounding effect upon the performance of verbal tasks, needs to be assessed (age, sex, IQ, academic level, socioeconomic level of the family, CNS organicity, handedness).

If extralinguistic temporal and speech breath differences between conduct and anxiety disorders are established, then the validity of these clinically derived groups will be enhanced, and some understanding of the mechanisms underlying these disorders achieved. The extralinguistic and speech breath measures might also be useful in the diagnosis of impulsivity and anxiety in clinical settings. The measurement of reflection in impulsive children, under treatment with cognitive or drug therapies, is another possible application of the extralinguistic measures.

The present study was divided into three parts. The first, or Preliminary Study, was devoted to developing the methods and techniques necessary for the study. In the second part, or Main Investigation, the hypotheses were tested. The third and final part of the study was a Follow-up Study, in which the hypothesis that extralinguistic and speech breath measures changed in association with the clinical outcome was tested.

D. Hypotheses

The speech of child psychiatric patients with conduct disorder will differ from that of children with anxiety disorder on certain extralinguistic and speech breath activity measures.

SUB-HYPOTHESIS I: Extralinguistic differences between the conduct and anxiety disorder groups.

In children with conduct disorder a reduction will be observed of those measures which are attributable to cognitive planning and reflection. The differences between the groups will vary with the amount of cognitive planning required for the speech task. They will be greatest in the story telling task followed by the picture description, and least in the automatic speech task-counting.

SUB-HYPOTHESIS II: Correlation between extralinguistic measures and behaviour and personality characteristics.

Those measures of behaviour and personality that distinguish between the conduct and anxiety disorders will be significantly correlated with the extralinguistic measures of speech which are attributable to cognitive planning and reflection. The correlations will be the highest in the story telling task followed by the picture description, and smallest in the automatic speech task-counting.

SUB-HYPOTHESIS III: Speech breath activity differences between the conduct and anxiety groups.

The speech breath activity, said to be an indicator of anxiety, will have a higher frequency in children with anxiety disorder

than in those with conduct disorder.

SUB-HYPOTHESIS IV: Correlation between speech breath activity measures and behaviour and personality characteristics.

Measures of anxiety, which are higher in the anxiety group than in the conduct disorder group, will be positively correlated with the measures of increased frequency of speech breath activity.

II. PRELIMINARY STUDY

Introductory Remarks

The aim of the preliminary study was the development of the methods which were to be followed in carrying out the main investigation. Methods had to be developed and defined for the selection and assessment of the sample of subjects, the identification and measurement of the independent and dependent variables, and the development of the testing procedure.

A. Subjects

1. Criteria for Selection

(a) Clinical

The sample was obtained from children consecutively referred for assessment to a Hospital Child Psychiatric Service where the investigator was a Staff Psychiatrist. The criteria used for inclusion were age range 9 to 12 years and an IQ of 85 or above, with the diagnosis of conduct or anxiety disorder (see below). Excluded were children with developmental disorders, e.g., hyperkinesis, speech disorders, and with psychosis and psychosomatic disorders.

These subjects fulfilled the criteria for conduct and anxiety disorder of Rutter's tri-axial classification system (Rutter et al., 1969) and the more specific criteria of the ICD-9 (WHO, 1977). The inclusion criteria for conduct and anxiety disorder of the tri-axial system are as follows:

Conduct disorder: This category should be used for abnormal behaviour which gives rise to social disapproval but which is neither part of any other psychiatric condition nor associated with personality disorder. The category includes some types of legally defined delinquency and it includes non-delinquent disorders of conduct (e.g., fighting, bullying, destructive behaviour, cruelty to animals). The mere fact that a child has committed a delinquent act is not sufficient for the diagnosis of conduct disorder. It is necessary that the behaviour be abnormal in its socio-cultural context. This may be judged by the frequency and type of behaviour and its association with other symptoms (such as abnormal interpersonal relationships).

Neurotic disorder: This category should be used for disorders in which there is an abnormality of emotions which is not accompanied by marked personality disorder or loss of reality-sense. Emotional disorders in this category include states of disproportionate anxiety or depression. Obsessions, compulsions and phobias (which are abnormal in their developmental context), hypochondriasis and 'conversion hysteria' should also be coded here.

Since the term 'neurotic disorder' may include depression which by definition has been excluded from this study, the term 'anxiety disorder' will be used throughout the study instead of 'neurotic disorder'.

On the ICD-9 the inclusion criteria were more diverse. For children who present either disturbance of conduct or emotions, this system provides a number of categories in each of four diagnostic groups. To classify a case in any category, factors both clinical and

aetiopathological must be considered. The ICD-9 group, categories and glossary are as follows (WHO, 1977):

Neurotic disorder (300.0): In neurotic disorders 'the principal manifestations include excessive anxiety, hysterical symptoms, phobias, obsessional and compulsive symptoms, and depression'. This group of disorders includes a number of clinical categories, the most important in children being 'anxiety states' (300.0) which is defined as follows: 'Various combinations of physical and mental manifestations of anxiety, not attributable to real danger and occurring either in attacks or as a persisting state. The anxiety is usually diffuse and may extend to panic. Other neurotic features, such as obsessional or hysterical symptoms, may be present but do not dominate the clinical picture'. Other neurotic disorders are 'hysteria', 'phobic states', 'obsessive-compulsive disorders', 'neurotic depression', 'neurasthenia', 'depersonalization syndrome', 'hypochondriasis' and 'other neurotic disorders'.

Adjustment reaction (309): These disorders 'are often relatively circumscribed or situation-specific, are generally reversible, and usually last only a few months. , . .' and may take the form of 'depressive reaction', 'disturbance of other emotions', such as anxiety, fear, worry, or 'disturbance of conduct'.

Disturbance of conduct not elsewhere classified (312): Disorders classified in this group involve 'aggressive and destructive behaviour and delinquency. . . . The behaviour must be abnormal in its context'. A number of conditions may be included here such

as 'unsocialized disturbance of conduct', 'socialized disturbance of conduct', 'compulsive conduct', 'mixed disturbance of conduct and emotions' and 'other'.

Disturbance of emotions specific to childhood and adolescence (313): These are 'less well differentiated emotional disorders characteristic of the childhood period and may take the form of 'anxiety and fearfulness', 'misery and unhappiness', 'sensitivity, shyness and social withdrawal', 'relationship problems' or 'other'.

Obviously, a case of disturbance of conduct could be classified on the ICD-9 either as 'adjustment reaction (309.3)' or 'disturbance of conduct, unsocialized (312.0) or socialized (312.1)', depending on factors other than clinical such as obvious precipitating factors, social context where the behaviour occurs, and age of the child. Similarly, a case with predominant symptoms of anxiety could be classified as 'neurotic disorder, anxiety state (300.0)', 'adjustment reaction with disturbance of other (than depression) emotions (309.2)', or 'disturbance of emotions specific to childhood, anxiety fearfulness (313.0)'.

(b) Reliability of diagnosis

In an attempt to estimate the reliability of the diagnosis of conduct and anxiety disorders and the ICD-9 sub-categories, a reliability study was undertaken with the assistance of another psychiatrist who had two years' experience in Child Psychiatry. The investigator assigned diagnoses to ten children using the tri-axial and ICD-9 criteria following the process of routine assessment. The second psychiatrist made the diagnoses after reviewing the records of the children, being 'blind' of the diagnosis.

In a routine assessment, full social and family history is taken by the Psychiatric Social Worker while the child is being seen by the Resident. The case is next discussed in conference with the Staff Child Psychiatrist (the investigator). Following the conference, the child and the parent(s) are interviewed by the psychiatrist who may further pursue the inquiry into the child's problems. At the end, a formulation is made and guidelines for the management are drawn. Requests for other investigations, e.g., psychological assessment, may be made at this point.

The two sets of diagnoses made by the investigator and the second psychiatrist are shown in Tables 1 and 2. There was agreement in the diagnosis of either conduct or anxiety disorder in 9 out of 10 cases. The agreement, however, on the ICD-9 sub-categories within the conduct and anxiety groups, was much lower.

Since the application of the ICD-9 specific criteria was associated with low agreement of diagnosis, it was decided at this stage to employ the less specific and more reliable criteria of conduct and anxiety disorder of the first axis of the tri-axial classification system in the selection of the sample.

In addition to the overall clinical assessment of the subject, systematic data on the subject's condition were collected using the Macfarlane Rating Scale (Macfarlane et al., 1962). The information used to complete it was provided by the parent. The scale had originally been used for the repeated assessment of the development of a large sample of children from the age of 21 months through 14 years. It consists of 36 items descriptive of emotional and behavioural responses of children as well as of personality traits, which are rated

TABLE 1

Comparison of Diagnoses on the Tri-axial Classification System made by Psychiatrists I and II

Child	Psychiatrist I	Psychiatrist II
Ju	Anxiety disorder	Anxiety disorder
To	Conduct "	Conduct "
Dw	Anxiety "	Anxiety "
Sh	Conduct "	Conduct "
Gr	Anxiety "	Anxiety "
He	Conduct "	Anxiety "
Do	Conduct "	Conduct "
El	Anxiety "	Anxiety "
Er	Conduct "	Conduct "
Ti	Anxiety "	Anxiety "

TABLE 2

Comparison of Diagnoses on the ICD-9 Classification System made by Psychiatrists I and II

Child	Psychiatrist I		Psychiatrist II	
Ju	Hysterical disorder, conversion	(300.1)	Hysterical neurosis, conversion	(300.1)
To	Adjustment reaction, conduct disturbance	(309.3)	Conduct disorder	(312.0)
Dw	Anxiety state, neurotic	(300.0)	Neurotic disorder, anxiety state	(300.0)
Sh	Disturbance of conduct and emotions	(312.3)	Conduct disorder	(312.0)
Gr	Anxiety state, neurotic	(300.0)	Disturbance of emotions specific to child	(313.3)
He	Disturbance of conduct	(312.0)	Disturbance of emotions specific to adol.	(313.3)
Do	Disturbance of conduct	(312.2)	Conduct disorder, socialized	(312.1)
El	Anxiety state, neurotic	(300.0)	Disturbance of emotions specific to child	(313.0)
Er	Disturbance of conduct, compulsive	(312.2)	Conduct disorder	(312.0)
Ti	School phobia, separation anxiety	(300.2)	Neurotic disorder	(300.0)

on a five-point scale. The Macfarlane Rating Scale was selected for use because it allowed collection and rating of a wide variety of data on the behavioural and emotional condition of the subjects.

B. Identification and Measurement of Variables

1. Independent Variables

(a) Clinical diagnosis

The two diagnoses of 'conduct' and 'anxiety' were employed.

(b) Behaviour Problem Checklist (BPC) (Peterson, 1961; Quay & Quay, 1965)

The BPC provided a rating of the subject's behaviour by his own parent(s). The BPC has been used in a number of studies and has been reviewed by Quay (1977). Two factors (conduct and personality disorder) which were identified initially by Peterson (1961) and two additional factors (immaturity and socialized delinquency) have consistently emerged in later studies. The factors in current use (Quay, 1979) are: conduct disorder, anxiety-withdrawal, immaturity, and socialized delinquency. Although the reliability of the BPC is reported to be high (Quay, 1977), its validity in clinical populations has not yet been established.

(c) Junior Eysenck Personality Inventory (JEPI) (Eysenck, 1965)

The JEPI was selected because it provided the measurement of the personality traits extraversion and neuroticism. These traits have been associated with variation in extralinguistic phenomena as described in the introduction. The JEPI is answered by the child and yields scores on extraversion and neuroticism. A lie score is also

obtained which gives an estimate of the reliability of the scores. The reliability of the JEPI has been established (Eysenck, 1969), but its usefulness in the clinical situation has not yet been determined (Eysenck, 1969; Chazan, 1972; Manocha et al., 1981).

(d) Matching Familiar Figures Test (MFFT) (Kagan et al., 1964)

This test measures reflection by determining how much the child reflects before responding to a problem-solving task. The test format requires the simultaneous presentation of a standard figure (e.g., a house, a telephone, a cat, etc., a total of 12 pictures) with five very similar and one identical figure. The child is asked to select from the alternatives the one that exactly matches the standard. The time to the first response and the number of errors are recorded. Nearly all studies have shown a negative correlation between time and errors (Messer, 1976). The measures employed are the mean time of first response across all items (mean latency) and the total number of errors across all items. While the reliability of the response time (mean latency) is high, that of errors was found to be less than satisfactory (Cairns, 1977).

(e) Assessment of intelligence on the WISC-R

All three scores on this test, the Full Scale IQ, Verbal IQ and Performance IQ, were selected as independent variables.

(f) Other variables employed were neurological examination and EEG, 'handedness' assessed on Annett's (1970) questionnaire and school performance assessed on the Wide Range Achievement Test (WRAT).

(g) The socioeconomic level was determined using the Blishen Scale (1968). Even though information on various aspects of the subject's family history was recorded, only the socioeconomic level was used as an independent variable. Although the relationship between socio-economic background and verbal abilities is an area of interest for Sociologists, Psychologists and Linguists, the problem lies outside the scope of this study.

2. Dependent Variables

A review of the literature on the extralinguistic or para-linguistic phenomena identified a number of representative variables (Levin & Silverman, 1965; Levin et al., 1967; Goldman-Eisler, 1968; Reynolds & Paivio, 1968; Rochester et al., 1977). Two sets of variables were selected; first, were variables that measured the pausing phenomena and, secondly, speech breath variables. The variables were either measured directly from the data or were derived ratios. The measures were made for each speech task.

(a) Extralinguistic variables

Duration of Utterances (DU) in seconds. This was the duration of speech on each task and was measured on the visual speech record from the beginning of the first to the end of the last word spoken. The recording procedure is described in Section II, C, 2.

Total Verbal Output (TVO). Both Words and Syllables were counted on the typescript of the subject's speech. Sounds which did not form a meaningful word were not counted.

Number of Pauses (NP). All pauses of duration 0.2 seconds and longer were counted.

Total Pause Time (TPT). This was the sum total of the duration of all pauses.

Average Length of Pauses (ALP) in seconds. This was the ratio of the Total Pause Time divided by the Number of Pauses (NP).

Relative Pause Time (RPT). This was the ratio of the Total Pause Time divided by the Duration of Utterances time.

Silent Pause Ratio (SPR). SPR was defined as the ratio of the Number of Pauses to the Total Verbal Output (Words). This variable measures the frequency of pauses.

Initial Hesitation in seconds (IH). This was defined as the time which elapsed from the moment the presentation of the stimulus was completed (see below) to the beginning of the subject's utterance.

Initial Relative Hesitation (IRH). This was the ratio of Initial Hesitation to the Initial Hesitation plus the Duration of Utterances (DU).

Speech Rate (SR). The SR was calculated both for Words (SRW) and Syllables (SRS) and showed the number of speech units spoken per second. It was derived by dividing the number of words or syllables by the Duration of Utterances (DU).

Articulation Rate (AR). AR was calculated for syllables only and was derived by dividing the number of syllables by the Duration of Utterances less the Total Pause Time (TPT).

All listed variables were used for extralinguistic measurements on the verbal tasks of picture description and story telling. For the measurements on the automatic speech the following selected variables were used: Total Time (TT) taken to count, Number of Syllables (NS) which was constant, Number of Pauses (NP), Total Pause Time (TPT), Speech Rate Syllables (SRS), and Articulation Rate (AR).

(b) Speech breath variables

Number of Inspirations (NI). Inspirations were identified by listening to the audio recording and were noted on the typescript of the subject's utterances.

Frequency of Inspirations (FI). It was obtained by dividing the Duration of Utterances by the Number of Inspirations.

Speech Breath Rate (SBR). This was defined as the ratio of the Number of Inspirations to the Duration of Utterances (Goldman-Eisler, 1968).

Output of Speech per Breath (OSPB). This was calculated for both Words (OSPBW) and Syllables (OSPBS). It was derived by dividing the number of words and syllables by the Number of Inspirations. The OSPB showed the number of speech units spoken per breath.

Ventilation Index (VI). This was the reciprocal of OSPB and it was derived by dividing the Number of Inspirations by the number of words (VIW) and syllables (VIS) multiplied by 100. The VI was the proportion of air current returned per word or syllable spoken (Goldman-Eisler, 1968).

All speech breath variables were used for measurements on the picture description and story telling tasks. The following selected variables were used on the automatic speech: Number of Inspirations (NI), Speech Breath Rate (SBR), Output of Speech per Breath Syllables (OSPBS), Ventilation Index Syllables (VIS).

C. Development of the Experimental Procedure

In developing the experimental procedure, four basic problems were encountered. First, a method of eliciting spontaneous speech from the subjects (Ss) had to be developed. Second, a technique ensuring high quality of recording both of the speech and breathing activity during speech had to be achieved. Third, a reliable technique of transcribing and recording onto paper the speech and breathing activity had to be found. Fourth, the effect of extraneous variables resulting from the environmental conditions during the actual testing had to be controlled.

1. Eliciting Spontaneous Speech

(a) Visual stimuli

The guidelines of Goldman-Eisler's (1968) technique of eliciting speech were followed. Her technique involved the presentation to the adult subject a series of cartoons, originally published in the New Yorker, which the subject was asked to describe and then make up a story for each one of them. Obviously, this technique could not be applied to children without modifications. Children's cognitive abilities are not fully developed to allow them to describe sufficiently the content and explain the meaning of cartoons. Therefore, simpler visual stimuli

had to be employed in this experiment.

A search was made at the Public Library, the Red Cross office and the Fire Department for pictures or posters which have been suitable for children and were rich in content. Because the available material was unsatisfactory, it was decided to have two pictures drawn up for the experiment. The pictures were drawn by a professional medical illustrator following the investigator's instructions. The pictures are given in the Appendix (Appendix 1, a, b).

The pictures were presented to the first three Ss (Ju, Cl, To) (Table 3) who were instructed first to describe the content and then make a story about it. While all Ss were able to respond with satisfactory amount of spontaneous speech describing the pictures, none was able to make up a story to fit the pictures.

A decision was made, therefore, to limit the speech to a description of pictures. Three pictures suitable for description by children were selected from the Developmental Syntax Program (Coughran & Liles, 1976) and were used throughout the rest of the study. The pictures showed a classroom with children involved in various activities, an amusement park with children strolling and watching animals in cages, and a picnic scene by the sea. The two pictures drawn specially for the experiment were abandoned.

(b) Verbal stimuli

The visual stimuli produced lengthy utterances, which largely consisted of a catalogue of the pictures' content. It was, however, necessary to elicit a sample of speech which reflected a greater degree of cognitive activity on the part of the subject. Other methods were considered and tried.

(i) A short story, that of 'The Dove and the Ant' from the Ladybird version of Aesop's fable was read for the subject who was asked to retell it in his own words. The two Ss on whom this method was tried, responded with heightened tension and relatively little speech (Ju, 87 words in 27 seconds; Ch, 58 words in 25 seconds), and so this method was also abandoned.

(ii) A method similar to that employed in a study of verbal behaviour of children was tried (Levin & Silverman, 1965). This consisted of presenting to the subject three stem words in random order which he was asked to use in a story. The words of each stem could easily be related to each other and they were as follows: (a) summer, camp, swimming, barbecue; (b) car, radio, friend, traffic lights; (c) airplane, engine, co-pilot, runway. Ten Ss were given the stem words. Their responses varied widely in terms of speech spoken, both between Ss and between the three stories of each subject (Tables 3 and 4). The amount of speech elicited by the word-stems was inadequate for the purpose of the experiment. The mean number of words emitted by the Ss was 28 which compares unfavourably with the 500 words emitted by the Ss of the apparently similar experiment by Levin and Silverman (1965). Perhaps such a wide difference between the two samples is due, at least partly, to the dissimilar family background of the Ss. Most Ss of the present study came from the lower socioeconomic classes, while the Ss of the Levin and Silverman (1965) study were children of Cornell University faculty. Therefore, the word-stem method of eliciting speech was abandoned.

(iii) A method developed by Gottschalk (1976) in his studies on the meaning of the content of spontaneous speech, was tried next.

TABLE 3

Duration of Utterances in Seconds

Child	Pictures			Stems of Words		
Ju	ac 13.0	c 25.5	-			
Ch	ac 9.0	c 11.0	-			
To	ac 61.2	c 59.4	-	a 28.5	cr 15.2	-
Sc	p 35.0	z 37.6	cl 31.3	a 57.2	cr 98.8	-
Dw	z 67.4	cl 91.8	-	s 10.2	cr 10.0	a 14.4
Sh	cl 37.0	p 23.0	-	a 6.0	cr 5.4	-
Gr	z 42.8	cl 38.4	p 48.4	s 4.8	cr 14.6	a 13.2
He	z 8.6	cl 14.8	p 15.4	a 21.2	cr 25.0	s 8.0
Do	p 52.8	cl 59.0	z 42.4	s 8.2	cr 10.2	a 16.8
El	z 36.4	cl 39.0	p 63.0	s 8.2	a 9.0	cr 12.0
Er	cl 40.2	p 43.4	z 43.6	s 20.3	cr 14.6	a 21.8
Ti	cl 32.0	p 41.2	z 35.9	s 9.8	cr 10.8	a 15.4
	$\bar{x}$ 36.28	40.34	40.0	17.44	21.36	14.5
	SD 18.24	21.25	13.71	15.16	26.3	3.9

Pictures: ac - accident on ice; c - camping; p - picnic; z - zoo; cl - classroom

Stems of Words: a - airplane; cr - car; s - summer

TABLE 4

Number of Words

Child	Pictures			Stems of Words		
Ju	ac 31	c 61	-			
Ch	ac 25	c 22	-			
To	ac 152	c 123	-	a 58	cr 42	-
Sc	p 57	z 79	cl 68	a 29	cr 55	-
Dw	z 46	cl 82	-	s 23	cr 22	a 26
Sh	cl 40	p 40	-	a 15	cr 19	-
Gr	z 63	cl 53	p 43	s 12	cr 20	a 19
He	z 17	cl 13	p 43	a 62	cr 49	s 24
Do	p 64	cl 93	z 74	s 18	cr 23	a 31
El	z 82	cl 86	p 78	s 16	a 20	c 28
Er	cl 70	p 67	z 73	s 33	cr 30	a 39
Ti	cl 55	p 53	z 54	s 16	cr 27	a 22
	$\bar{x}$ 58.5	64.3	61.8	28.2	30.7	27.0
	SD 33.5	26.6	13.8	17.1	12.5	6.1

Pictures: ac - accident on ice; c - camping; p - picnic; z - zoo; cl - classroom

Stems of Words: a - airplane; cr - car; s - summer

Gottschalk elicited speech from both adults and children by asking them to talk for about five minutes in front of a microphone on a dramatic or interesting event they might have experienced. Five Ss were asked to talk under conditions identical to those described by Gottschalk. Four of them responded readily and one responded after some further encouragement. The average amount of speech elicited, 154 words (Table 5), was adequate and it was decided to include in the experiment this method of eliciting speech.

(c) Automatic speech

Describing the content of pictures and telling a personal story requires varying degrees of cognitive effort and so a sample of speech, which requires little thought was obtained. Counting, which has been used in studies of Parkinsonism (Mawdsley & Gamsu, 1971) and depression (Szabadi et al., 1971; Greben & Carroll, 1980; Mellor & Selby, 1981) as an example of automatic speech, was therefore included in the experiment.

In adults counting is considered to be an automatic speech activity affected by psychomotor speed.

(d) Final method

The experiment and its final form was as follows: the subject was asked in sequence, first to count from one to 30, then to describe the content of the three pictures presented in random order, then to tell a personal story, and finally to count again from one to 30. The average length of time required for the experiment was approximately 15 minutes.

TABLE 5

Some Measures of Speech Fluency on the Story Told by the Child

Child	Duration of Utterances in Seconds	Number of Words
Do	44.0	142
Er	76.2	123
Ti	136.4	329
Ro	41.0	114
Shr	37.6	92
Pa	86.0	154

2. Measuring the Dependent Variables

(a) Recording of speech and breathing

The recording of high quality of the speech sound and the identification of breathing to yield the extralinguistic and the concurrent breathing variables, was a necessary condition for this study.

Recording separately the respiration movements by a pneumograph around the chest was not considered appropriate, as this additional constraint would have made the subject self-conscious and the conditions of the experiment less natural. For similar reasons, Goldman-Eisler (1955) did not use a pneumograph in her experiments and measured the breathing activity by counting the inspiration sound on the speech recording. The possibility of recording the inspiration sound on a second channel of the tape recorder was considered as it would have facilitated the measurement of both sets of variables. Unfortunately, the microphone had to be placed on the chest or the throat and thus was open to the same objections as the use of the pneumograph. In addition, adventitious sounds from friction with the subject's clothes impaired the quality of the recording.

The possibility of observing the subject while talking and recording the occurrence of respiration by making a sound on a second channel of the tape recorder was considered, but this was not attempted since the experience achieved with the first few Ss tested showed that this would have required the investigator to devote too much attention on the subject's breathing, with a consequent neglect of other aspects of the interview.

It was finally decided to measure the breathing activity from the speech recording. The inspiration is difficult to hear when there

is no ongoing speech, but it becomes audible when breathing is serving the speech production. This is because the duration of inspiration when speaking is one-quarter the length of that occurring at rest (Mead, 1966). However, this method of measuring the breathing activity was far from ideal because, first, it did not measure the amount of air inhaled and, second, some shallow inspirations or inspirations occurring during long pauses might not be recorded. Goldman-Eisler (1955), who had used a similar method, indicated that the occasional nearly noiseless inspiration implies shallowness. The failure to identify such shallow inspirations was not, she believed, of serious consequence when the ventilation index was being measured.

The cassette tape recorder used to make the tape recording was a Panasonic Model RQ-2345. In addition to the quality of the recording and the portability, this model provided the option of auditing the output to the polygraph (see below). The recordings were made on TDK-SA60 tapes.

A regular microphone at first, and a condenser microphone (Sony, ECM-16) later which hang by a clip in the clothes of the subject, were used for the recording, but both often failed to pick up the inspiration sound. A condenser microphone (Sony, ECM-200) was finally selected because it was found it could record all audible inspiration sounds when placed on the desk facing the subject at a distance of 25-30 cm. from his mouth.

(b) Processing the audio-recording for analysis

(i) Typescript of speech. A verbatim typescript was prepared from the recording. When some utterances were not understood well the assistance of an experienced Newfoundland secretary was sought. The

typescript was neither edited nor punctuated and showed all utterances, including word repetitions and any other voiced sounds, as well as the location of inspiration sounds (Figure 1a).

(ii) Graphic record of audio-recording. A graphic record of the audio recording with a time base was a technical prerequisite for the study. The direct input of the speech recording to a polygraph were of no value because the frequency of speech sounds vary between 50 and 5,000 Hz with some sounds reaching as high as 10,000 Hz (Denes & Pinson, 1973) whilst the frequency response of the available polygraphs does not exceed 100 Hz (e.g., Lafayette, Beckman).

Szabadi et al. (1976) have used an oscilloscopic tracing for analyzing extralinguistic characteristics of speech, but the problems in obtaining a satisfactory record of this where there is a large amount of material, presented difficulties and a simpler and more clinically applicable method was sought.

The solution was a speech activated switch placed between the tape recorder output and the polygraph. A tracing could thus be made by the polygraph showing presence and absence of speech. A speech activated switch (attack time 20-60 Msec, decay time 30-175 Msec) was built at the Technical Services of the Health Sciences Centre. The switch was connected with a Lafayette polygraph which was available for the experiment. When the speech recording was fed into the switch, the polygraph traced on paper the presence or absence of speech (Figure 1b). The tracing obtained with this technique was considered satisfactory since pauses as short as 0.1 of a second were registered. To achieve uniformity in the amplitude of the tracings, particularly if the volume of the voice of the subject was low, minute adjustment could

 Someone looks like they're on a beach  . having a picnic and ah . looks like they're gone swimming or something .  . and there are seagulls and . . cups and everything there and .  . shoes and . . some picnic stuff knives and forks and . . there's the ocean  . . and a large umbrella . . . and some glass

Words: 49

Syllables: 61

 Inspirations: 5

Figure 1a. Example of a Speech Transcript and Measurements on it. Description of the Picture "Picnic Scene" by Subject #8.

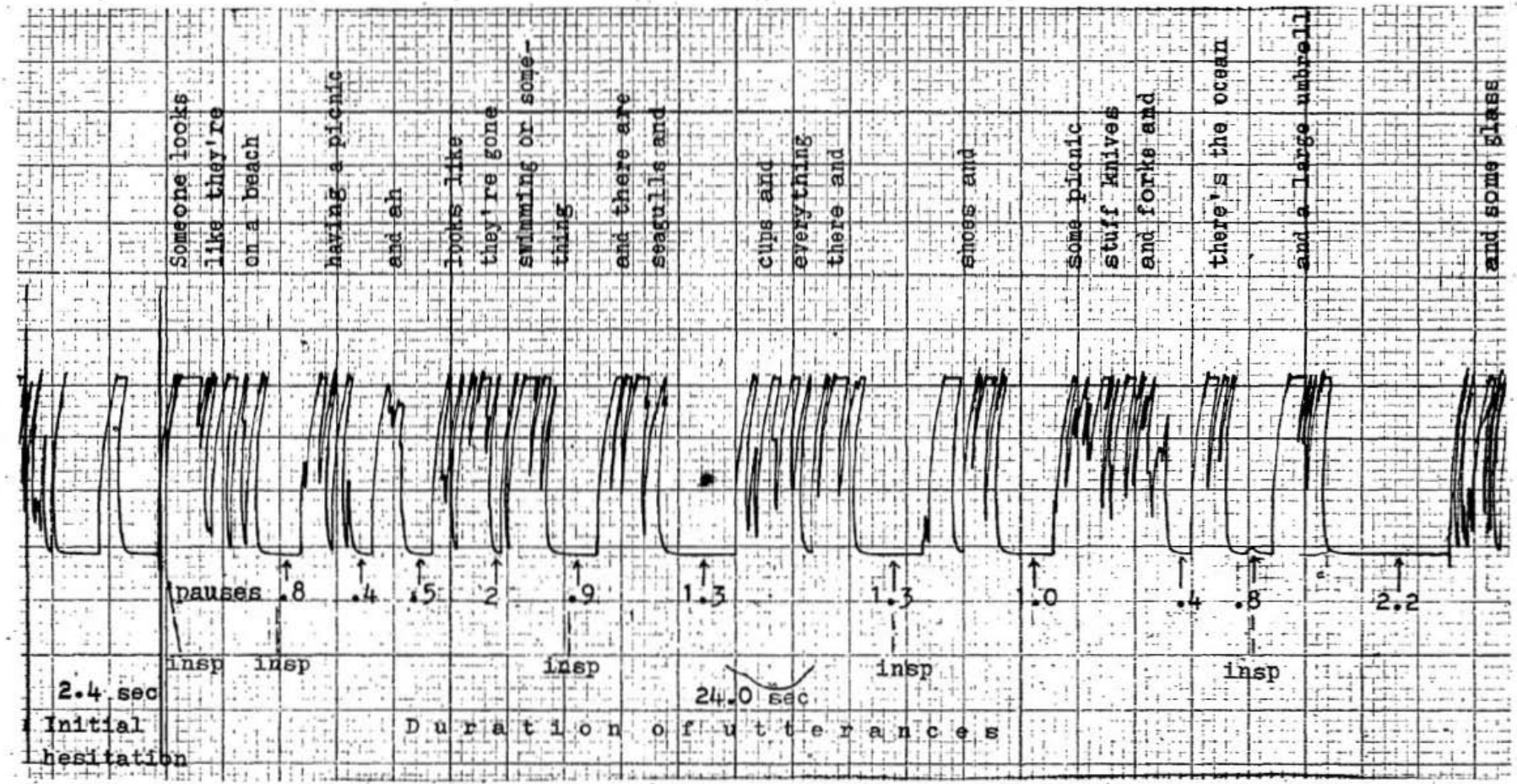

Figure 1b. Example of Speech Tracing. Description of the Picture "Picnic Scene" by Subject #8.

be made to the sensitivity of the speech activated switch and the volume output of the recorder. The attack and decay time of the switch were kept constant throughout the experiment at 30 Msec. The paper tracing was satisfactory when compared with that produced by an oscilloscope.

Careful monitoring with headphones of the ongoing tracing and following the transcript allowed matching of the recording and the tracing, as well as identification of the location of the inspirations on the tracing (Figure 1b).

(iii) Analysis of the recording. Pauses 0.2 of a second and higher were measured, as this is the minimum duration most frequently employed in pause studies (Siegman, 1978). Measuring the pauses no distinction was made between 'non-filled' or 'non-ah' and 'filled' or 'ah' pauses (Mahl & Schulze, 1964) because of the lack of evidence that the two types of pauses represent two different phenomena (Dalton & Hardcastle, 1977; Scherer, 1979). Also, no distinction was made between breathing and non-breathing pauses as recommended by Goldman-Eisler (1969). A breathing pause may also have other functions, e.g., cognitive activity or anxious hesitation.

Mispronunciations or repetitions were counted as syllables in the script and utterance in the tracing if they could be identified as mispronounced words or parts of words.

3. Procedure

The environmental conditions were uniform for each subject. Experience showed that it was inappropriate to involve the child in an experiment on the first visit to the psychiatrist, because it interfered

with the child's routine evaluation and aroused excessive anxiety.

Three children (Ju, Ch, Sc) who were shown on their first interview one or two of the testing pictures and were asked to describe the content, while their voice was being tape recorded, became obviously tense and responded with short utterances; two of them responded with longer utterances on a subsequent interview. Involving the child in the experiment after several follow-up sessions was also not considered feasible because of difficulty in controlling the frequency and duration of these sessions.

It was decided that a child selected to participate in the study should be tested for the purpose of this experiment on the second visit to the psychiatrist-investigator, after possible fears about the hospital and the psychiatrist were dispelled, and before a significant relationship developed. The participation in the testing procedure was explained to the child at first as a test, later as a game, and to the subjects of the main investigation as an 'experiment of conversational habits', copying Gottschalk's instructions (1975).

If a child was selected, the parental consent was sought for the participation in the experiment. The second session with the child was started with a discussion of about 10 minutes' duration on subjects emotionally neutral, e.g., TV shows, activities during weekends, etc. Then, it was explained to the subject he was about to participate in an experiment and the tape recorder was brought out from a filing cabinet and installed on the desk. At the same time, the subject was asked about previous experiences he might have had with tape recorders and was encouraged to explore it if he wished. The subject sat diagonally in relation to the investigator and had to turn about 45-90° towards the

desk during the experiment. Throughout the experiment the investigator maintained a friendly but non-interfering attitude towards the subject. He remained silent after he gave the instructions, watching the subject and being careful not to encourage or discourage him either verbally or by gestures (Rosenthal, 1976). At the end of each completed task he thanked the child. An artist's impression of the experiment setting is shown in Appendix 2.

D. Summary

The objective of the preliminary study was the development of the methods which were to be used in the main investigation. In this part of the study, criteria were defined for the selection and assessment of the Ss. The independent and dependent variables were identified and methods and techniques were developed for their measurement. The experimental procedure was also defined.

The Ss were selected from children referred consecutively for assessment to a Hospital Child Psychiatric Service where the investigator was a Staff Child Psychiatrist. The selection criteria were: age range 9 to 12 years, IQ of 85 and above, clinical diagnosis of conduct and anxiety disorder on the tri-axial classification system. The diagnosis of conduct and anxiety disorder could be made fairly reliably as it was shown in a reliability study carried out by the investigator and a second psychiatrist. The two psychiatrists assigned diagnoses of either conduct or anxiety disorder to 10 Ss. There was agreement in 9 out of the 10 cases.

The independent variables selected were: (a) the clinical diagnosis of conduct and anxiety disorder; (b) the scores of Conduct,

Anxiety, Immaturity and Socialized Delinquency on the Behaviour Problem Checklist (Peterson-Quay) which was answered by the parent(s); (c) the scores of Extraversion, Neuroticism and Lie on the Junior EPI; (c) the reflection (Mean Latency of Response) and Errors on the Matching Familiar Figures Test (MFFT). Other independent variables recorded were: IQ on the WISC-R (Full scale IQ, Verbal IQ, Performance IQ), neurological assessment (including EEG), handedness, school performance assessed on the Wide Range Achievement Test (WRAT), socioeconomic level of the family on the Blishen Scale.

The dependent variables were selected among those reported in earlier studies. They were altogether 20 and consisted of two groups. The first was the group of the extralinguistic variables which were the following: Duration of Utterances (DU), Total Verbal Output of Words (TVOW) and Syllables (TVOS), Number of Pauses (NP) of Duration 0.2 and longer, Total Pause Time (TPT), Average Length of Pauses (ALP), Relative Pause Time (RPT), Silent Pause Ratio (SPR), Initial Hesitation (IH), Initial Relative Hesitation (IRH), Speech Rate in Words (SRW) and Syllables (SRS), Articulation Rate (AR). The second was the group of the speech breathing variables. They were the following: Number of Inspirations (NI), Frequency of Inspirations (FI), Speech Breath Rate (SBR), Output of Words (OSPBW) and Syllables (OSPBS) per Breath, Ventilation Index for Words (VIW) and for Syllables (VIS).

A series of preliminary experiments were carried out with 12 Ss in order to develop the techniques for the reliable extralinguistic and speech breath measurements and to define the conditions of the experimental procedure.

A high quality of recording of the speech and the breathing sound, which was a necessary condition of the experiment, was achieved by using a condenser microphone (Sony, ECM-200) placed 25–30 cm. close to the subject's mouth, and a Panasonic tape recorder (Model RQ2345) (tape, TDK-SA60). An unedited typescript, which was prepared next, showed all speech sounds as well as the location of the inspiration sounds. The next step involved the transcription of the speech sound into a tracing on paper showing the presence and absence of speech. This was achieved by interposing between the tape recorder output and a Lafayette polygraph a speech activated switch specially built for the experiment. The tracing on paper showed pauses as short as 0.1 second but only pauses of 0.2 and longer were identified and measured. Monitoring with headphones the tracing process allowed the identification on the paper the speech and breath sounds. All pausing and initial hesitation variables were measured on the tracing.

The experimental procedure in its final form was as follows: the subject was asked to participate in an experiment during the second visit to the psychiatrist-investigator. He sat by the investigator's desk and was asked first to count from one to 30, then he was shown in random order three pictures selected from the Developmental Syntax Program (Coughran & Liles, 1976). Next he was asked to tell a personal story (Gottschalk, 1975), and finally to count again from one to thirty. The procedure lasted 15 minutes on the average.

III. MAIN INVESTIGATION

A. Method

1. Subjects

(a) Sample selection. Age, sex

Eighteen children, who met the selection criteria as they were defined in the previous part of the study (section II, A, 1), were selected to participate in the main investigation (Table 6). Two of them (subjects #9, #17) were included in the sample although their IQ was lower than 85 (Table 9) because the psychologist who tested them suggested that their IQ was an underestimate of their intelligence. One child (subject #16) was not assessed on an intelligence test but was included in the sample because she was clinically considered of average intelligence (this girl was in Grade 7 and had always been a good student). The age of the Ss ranged from 8 years 10 months to 12 years 8 months ($\bar{x}$ 10.9 years) (Table 6). There were 11 males and 7 females.

(b) Clinical assessment

The Ss were clinically classified into two groups according to the selection criteria, the conduct and anxiety disorder groups. Table 7 (a, b) shows the main symptoms and/or behaviours present in each subject which led to the selection and classification into the groups. A summary on each subject will be found in Appendix 3. Two male Ss (subjects #2, #9) who were classified in the conduct disorder

TABLE 6

Age and Sex

	Subject #	Age (in months)	Sex
Conduct Group	1	106	M
	2	141	M
	3	127	F
	4	141	M
	5	124	M
	6	119	M
	7	129	M
	8	130	M
	9	122	M
Anxiety Group	10	137	F
	11	137	F
	12	143	M
	13	125	M
	14	118	F
	15	136	F
	16	152	F
	17	126	M
	18	137	F
		$\bar{x}$ 130.5	Males 11
		SD 10.7	Females 7

group, also presented serious emotional disturbance and could be considered as mixed cases (disturbance of conduct and emotions). The assigned ICD-9 diagnoses are also shown in Table 7 (a, b). In the sample there were more male than female Ss in the conduct (8 to 1) and more female than male in the anxiety group (6 to 3). Males with conduct disorder are generally more numerous than females among those referred to child psychiatric services, while males and females with anxiety disorder are nearly equal in number (Graham, 1979). The over-representation of male Ss in the conduct and females in the anxiety disorder group of the sample occurred by chance since the variable Sex was not controlled.

(c) Psychological assessment. Independent variables

(i) Behaviour Problem Checklist (BPC). The parent who attended the hospital rated the subject on the BPC. This was done by the mother except for one subject (#16) who was rated by the father, and one (subject #10) who was rated by both parents. The BPC was scored by assigning 0, 1 or 2 points to each question according to the selection done by the parent, and grouping the questions following the instructions by Peterson and Quay (undated manuscript). The scores of each subject are given in Appendix 4(a). Table 8 shows the mean and standard deviation of both groups on these measures and the significance of the differences between the means using Student's t-test. The differences between the groups were in the expected direction in that the measures of Conduct and Socialized Delinquency were higher ($p < .001$ and $p < .05$), respectively in the conduct groups. No significant differences, however, were observed between the groups on the Anxiety and Immaturity measures.

TABLE 7 a

Main Symptoms and Behaviours: Classification on the ICD-9 Conduct Group

Subject #	Symtoms and Behaviours	ICD-9
1	Stealing, breaking and entering, no friends	Compulsive conduct disorder 312.2
2	Stealing, fighting, disruptive at school, experimenting with drugs, tempers, fear of the dark, abdominal pain, fainting	Mixed disturbance of conduct and emotions 312.3
3	Shoplifting, staying out late, disobedient, quarrelsome, night terrors, sleepwalking	Unsocial.disturbance of conduct 312.0
4	Fighting, stealing, disobedient, tempers, no friends	Unsocial.disturbance of conduct 312.0
5	Fighting a lot, broke windows, killed a cat, set fires, quarrelsome, swearing, restless in sleep, cannot sleep alone, no friends	Unsocial.disturbance of conduct 312.0
6	Restless, irritable, aggressive, bossy, tempers, occasional abdominal pain and headache	Unsocial.disturbance of conduct 312.0
7	Disobedient, disruptive in the class, stealing, aggressive, lying, headbanging at bedtime	Unsocial.disturbance of conduct 312.0
8	Fighting, defiant and stubborn, tempers, jealous and aggressive to younger brother	Unsocial.disturbance of conduct 312.0
9	Wandering in the streets, destructive at home, tempers, restless, biting his nails incessantly	Mixed disturbance of conduct and emotions 312.3

TABLE 7 b

Main Symptoms and Behaviours:. Classification on the ICD-9
Anxiety Group

Subject #	Symptoms and Behaviours	ICD-9	
10	Contruction and pain on left leg	Hysteria	300.1
11	School refusal, tempers, home-bound, no friends, spell of aphonia and stiff right arm, excessive dependence on mother	Neurotic dis-order, hysteria	300.1
12	Afraid to be alone at any time, fear of darkness, apprehensive and fidgety, restless sleep, peptic ulcer	Anxiety state	300.0
13	Easily upset and frightened by father-teacher-aggressive boys, withdrawn, unassertive, fears bodily injury	Anxiety state	300.0
14	Worried excessively about possible school failures, oversensitive, pain in the "back"	Anxiety state	300.0
15	School refusal, irritable, tempers, unable to sleep alone, may panic if left alone	Anxiety state	300.0
16	Apprehensive, irritable, sexual preoccupation and guilt about it, dysuria and frequency	Anxiety state	300.0
17	School refusal, irritable, tempers	Anxiety state	300.0
18	Withdrawn, undecisive on any task, excessive handwashing, worried about mother's health, episodes of fainting	Anxiety state	300.0

TABLE 8

Means and Standard Deviations of Behaviour and Personality Measures of the Conduct and Anxiety Groups, and Significance of Differences Between Means

Behaviour and Personality Characteristics	Group				Difference Between Means	
	Conduct		Anxiety			
	$\bar{x}$	SD	$\bar{x}$	SD	t value	
Conduct	18.5	7.4	8.0	3.5	3.85	$p < .001$
Anxiety	10.4	5.1	12.8	7.5	.77	NS
Immaturity	5.1	3.1	3.4	3.2	1.12	NS
Socialized Delinquency	2.8	2.9	0.4	1.0	2.29	$p < .037$
Extraversion	15.1	3.5	15.0	4.9	.05	NS
Neuroticism	15.1	2.4	16.4	3.3	.88	NS
Lie	4.0	2.4	4.8	2.1	.73	NS
Mean Latency of Response	16.1	10.2	24.5	18.5	1.00	NS
Errors	10.5	3.1	5.8	3.2	2.82	$p < .014$

(ii) Junior Eysenck Personality Inventory (JEPI). This was answered by all Ss except one (#18) who failed to complete it; this was a girl who had doubts about the 'correct answer' and finally failed to answer most of the questions. No difference between the conduct and anxiety disorder groups were observed on the Extraversion, Neuroticism and Lie measures (Table 8). The scores for each subject are given in Appendix 4(b).

(iii) Matching Familiar Figures Test (MFFT). Fifteen Ss were tested on the MFFT. Three Ss were not tested because this test had to be given at a later testing session to some subjects and they failed to keep their appointments. The differences between the groups were significant only on the Errors ($p < .05$) (Table 8). The difference between the two groups on the Mean Latency Response was in the predictive direction, being shorter for the conduct group. The scores of each subject are given in Appendix 4(c).

(iv) Comments. The conduct and anxiety groups did not differ from each other on measures of anxiety. The scores of the groups on Anxiety in the BPC and Neuroticism in the JEPI were very similar. The groups differed on measures of disturbance of conduct (Conduct and Socialized Delinquency on the BPC) and one measure of impulsivity (Errors on the MFFT) in that the conduct group scored significantly higher on these measures.

The BPC, JEPI and the MFFT have all together yielded the following nine behaviour and personality independent variables: Conduct, Anxiety, Immaturity, Socialized Delinquency, Extraversion, Neuroticism, Lie, Mean Latency of Response, Errors.

(d) Intelligence

The intelligence of 16 Ss was assessed on the WISC-R (Table 9). One subject (subject #16) failed to attend for testing. The mean Performance IQ was slightly higher than the mean Verbal IQ. A difference, always in favour of the former of 15 points or more, was observed in two Ss (subjects #7, #13). Although such a wide discrepancy may be observed in some children of a normal population (Field, 1960), it has consistently been observed in aggressive and delinquent children (Wechsler, 1958; Reisman, 1973; Camp et al., 1977). On the other hand, low Vocabulary scores on the WISC, which may lower the Verbal IQ, has been observed in children of low socioeconomic level (Burnes, 1970). Likewise, Bernstein (1960) observed that young working class adults scored lower on the Mill-Hill Vocabulary Scale as compared to middle class subjects. In the Ss of this study, relatively low Verbal IQ was observed in both the conduct and anxiety groups. In fact, the mean Verbal IQ of the anxiety ($\bar{x}$ 91.9) was lower than that of the conduct ($\bar{x}$ 97.0) group. When the relation between both the Verbal and Performance IQs and the socioeconomic level of the Ss (see below) was examined, it became obvious that among those of the lowest level there were proportionally more with lower Verbal than Performance IQ (Table 10). Since nearly all Ss clustered in the lower socioeconomic classes it is quite possible that the observed discrepancy in scores in favour of the Performance IQ was related to thefr class background rather than to other factors.

(e) Other Variables

All Ss were physically healthy, except one (subject #12) who had a peptic ulcer. None showed neurological abnormalities and routine

TABLE 9

Intelligence: IQ on WISC-R*

Subject #	Full IQ	Verbal IQ	Performance IQ
1	118	115	115
2	102	105	100
3	95	96	95
4	96	95	100
5	86	84	93
6	108	109	105
7	91	82	102
8	105	105	106
9	78	82	77
10	88	82	96
11	102	105	102
12	96	94	101
13	100	84	118
14	94	91	100
15	105	-	-
16	-	-	-
17	82	82	95
18	99	105	92
	$\bar{x}$ 96.8	94.7	99.2
	SD 9.6	11.0	9.7

*Subject #15 was assessed on Raven Progressive Matrices.

TABLE 10

Verbal and Performance IQ in Relation to Socioeconomic Class (Blishen Scale) of 16 Ss

Social class	VIQ/PIQ
4	105/106
5	105/92, 82/96, 109/105, 95/100
6	91/100, 105/102, 115/115
7	105/100, 96/95, 84/93, 82/102, 94/101, 84/118, 82/85, 82/77

EEGs done on ten of them was normal. Sixteen Ss (88.9%) were fully right-handed, one was left-handed (subject #18), and one was ambidextrous (subject #7) (Annett, 1970). The proportion of the left-handed among the Ss was similar to that of a normal population (Hardyck & Petrinovich, 1977).

The academic achievement of 16 Ss was assessed on the Wide Range Achievement Test (WRAT). For each of the three scores of the test (Reading, Spelling, Arithmetic) the difference was recorded in months between the expected level of the subject at the time of testing and the observed level on the test. The difference obtained showed the delay in academic months of each subject (Table 11). The norms of the tests are based on American populations. Ten out of 16 Ss tested on the WRAT were three months or more behind their expected level in reading and/or spelling. Their achievement in Arithmetic was worse than that; 14 of them were below their expected level. The significance of the academic failure, which is observed very frequently in the clinical population from which the sample was drawn (Kotsopoulos & Nandy, 1981), is not clear. It is not known whether the low score on the test is the result of the application of American norms or whether academic failure is generally an important factor which contributes to the decision for the psychiatric referral. Since academic backwardness, as shown by the WRAT scores, was present in the majority of the Ss, the scores which were initially intended to form a set of independent variables, were omitted from further analyses.

TABLE 11

Wide Range Achievement Test:
Months Below the Expected Academic Level

	Subject #	Reading	Spelling	Arithmetic
Conduct Group	1	0	0	3
	2	18	25	31
	3	0	0	10
	4	20	3	14
	5	11	5	0
	6	3	2	5
	7	0	0	11
	8	18	10	13
	9	0	4	14
Anxiety Group	10	0	2	13
	11	0	15	12
	12	21	29	9
	13	13	16	14
	14	0	0	11
	15	-	-	-
	16	-	-	-
	17	8	9	18
	18	0	4	2
		$\bar{x}$ 7.0	7.7	11.2
		SD 8.2	8.8	7.0

(f) Socioeconomic level

The socioeconomic background of all Ss on the Blishen (1968) Scale is shown in Table 12. Sixteen of the Ss came from the three lowest classes. This distribution resembles closely that observed in the referrals to the same psychiatric service during a one-year period (Kotsopoulos & Nandy, 1981) (Table 13), with the exception of social class 7, which was overrepresented in the present sample.

2. Experimental Procedure

The actual experiment was carried out in the form which was finalized in the preliminary study. Each subject was tested under uniform conditions in the office of the investigator on the second visit to the hospital. The subject was requested, in sequence, to count from 1 to 30, to describe the three pictures from the Developmental Syntax Program (Coughran & Liles, 1976), tell a personal story (Gottschalk, 1975), and finally count again from 1 to 30.

All Ss were cooperative and none failed to respond to the request to describe the content of the three pictures. Obviously, the task was simple and all Ss felt they could cope with it. This was not the case, however, with the request to tell a personal story. On this request, six Ss, three of each of the conduct and anxiety groups, initially failed to respond, but did so after encouragement. No difference was observed between the Verbal IQ of those Ss who found it easy and those who found it difficult to tell a story.

Some Ss became mildly tense and fidgety (subjects #5, #8) during the experiment and one (subject #9) became very restless. Some Ss withdrew from the microphone (subjects #12, #13) and one male subject (13) shrunk into his chair while telling his story which was about

TABLE 12

The Subjects' Social Class on the Blishen Scale

Social Class	Number of Subjects	Subject Number
1		
2		
3	1	15
4	1	8
5	5	4, 6, 10, 16, 18
6	3	1, 11, 14
7	8	2, 3, 5, 7, 9, 12, 13, 17

TABLE 13

The Distribution by Percent of the Ss and All Hospital Referrals for a One-Year Period on the Blishen Scale

Social Class	Ss	One Year Referrals
3	5.5	8.6
4	5.5	4.8
5	27.8	24.1
6	17.7	17.1
7	44.4	30.5

a traumatic early life experience. Also, the volume of the voice of some few Ss dropped (subjects #10, #12, #13); all of them were of the anxiety group. No systematic effort was made to measure the behaviour and the emotions of the Ss during the experiment since this was not part of the study design.

No major technical problems were encountered in the transcription of the voice signal into a continuous tracing on the polygraph. The inspiration sound was audible in most recordings, but in two of them (subjects #10, #18) it could not be reliably identified.

3. Extralinguistic Measures. Dependent Variables

(a) Description

(i) Automatic speech, counting. Table 14 shows the mean and standard deviation of the extralinguistic (and speech breath) measures on both the initial and final counting and the comparison with each other on the t-test. The comparison showed that the time taken for the second counting was shorter, but the difference did not reach statistical significance. Since the number of syllables is constant, the Total Time is the function of the Total Pause Time and the Articulation Rate. In the final counting the Total Pause Time became shorter and the Articulation Rate faster, but the changes were not statistically significant.

(ii) Picture description task. Three sets of 13 extralinguistic measures (Section II, B, 2(a)) (and seven speech breath measures) resulted from the description of the pictures. The comparison (F-ratio) between the three sets of means for all Ss on each variable

TABLE 14

Means of Extralinguistic Measures, Initial and Final Counting Compared
Main Experiment

Variable	Initial		Final		t value
	$\bar{x}$	SD	$\bar{x}$	SD	
Total time in seconds	17.93	6.02	16.26	4.04	2.04
Number of syllables (constant)	63.00		63.00		
Number of pauses	10.28	10.39	6.64	7.32	1.81
Total pause time	3.83	4.01	2.63	2.63	1.78
Speech rate, syllables	4.06	1.53	4.18	0.98	0.63
Articulation rate	4.91	1.38	5.14	1.16	1.40
Number of inspirations	4.00	2.71	3.08	0.95	1.45
Speech breath rate	0.23	0.08	0.20	0.05	1.31
Output of speech per breath, syl.	20.35	8.88	22.36	6.90	1.81
Ventilation index	6.35	4.27	4.89	1.49	1.44

Level of significance * 0.05 two-tail

showed no significant differences, except for the Initial Hesitation (IH). To reduce, therefore, the amount of data, the mean of the three measures, including the IH, was used for each subject (Appendix 5, a and b). The IH on the first picture was longer than for the second and third pictures ($p < .05$). The IH differences will be discussed further when the measures of the conduct and anxiety groups will be compared with each other.

A verbal output adequate for measuring the extralinguistic measurements, was attained by the response of the three pictures. The mean number of syllables of the three measures was 83 (Table 15). This compared favourably with the verbal output of children subjects of two related studies. In the first (Kowal et al., 1975), the mean syllable verbal output was 89 for an age group nearly similar to the present one. In the four tasks of the second study (Levin et al.,[4] 1967), the mean verbal output was 26, 15, 55 and 84 words; in the present study, the mean word output was 65 (Table 15). Work, however, involving description of pictures comparable to those used in the present study, has not been previously done with children and comparisons are not possible. In adult subjects, Goldman-Eisler (1969) considered a verbal output of 100 syllables necessary for adequate extralinguistic measurements.

The mean, standard deviation, kurtosis and skew of all 13 variables are shown in Table 15. Most of them showed increased kurtosis and were skewed to the left; this was more pronounced in the Average Length of Pauses, Initial Hesitation, Speech Rate for Words and Syllables.

TABLE 15

Extralinguistic and Speech Breath Variables: Pictures, Main Experiment

Descriptive Statistics

	Variable	Mean	SD	Variance	Kurtosis	Skewness
Extralinguistic variables	Duration of utterance in seconds	36.29	12.47	155.40	1.39	0.88
	Total verbal output, words	65.14	20.24	409.14	2.62	1.40
	Total verbal output, syllables	83.86	23.31	543.52	1.25	1.11
	Number of pauses	16.62	5.97	35.62	-0.20	0.26
	Total pause time in seconds	16.01	8.36	69.86	1.64	1.23
	Average length of pauses	0.99	0.48	0.23	7.69	2.48
	Relative pause time	0:42	0.12	0.01	1.73	0.06
	Silent pause ratio	0.26	0.06	0.003	4.02	-1.55
	Initial hesitation in seconds	7.30	7.61	57.86	4.66	2.30
	Initial relative hesitation	0.16	0.12	0.01	3.24	1.77
	Speech rate, words	1.90	0.54	0.29	6.31	1.84
	Speech rate, syllables	2.44	0.64	0.41	5.57	1.70
	Articulation rate	4.29	0.75	0.56	0.44	0.96
Speech breath variables	Number of inspirations	8.00	2.51	6.29	0.02	0.73
	Frequency of inspirations	4.40	0.97	0.94	-1.05	0.67
	Speech breath rate	0.24	0.05	0.002	-1.16	-0.26
	Output of speech per breath, words	8.64	2.54	6.43	-0.22	0.08
	Output of speech per breath, syllables	11.16	3.12	9.75	-0.68	0.06
	Ventilation index, words	13.06	4.92	24.21	4.99	1.88
	Ventilation index, syllables	9.97	3.40	11.58	3.51	1.57

(iii) Story telling task. The scores on the 13 extralinguistic, including seven speech breath variables, of all Ss are given in Appendix 6 (a and b). The mean verbal output on this verbal task was 162 syllables. The descriptive statistics are given in Table 16. A number of variables, e.g., Number of Pauses, Average Length of Pauses, Initial Relative Hesitation showed marked kurtosis and skew to the left.

(b) Intercorrelation of measures. Dependent variables

A correlation matrix was computed for each of the two sets of 13 extralinguistic (and seven speech breath) variables, that is the mean of three pictures and the scores on the story (Appendices 7 a, b, c, d, and 8 a, b, c, d). The high intercorrelations between the variables were similar for both verbal tasks with some exceptions. In the following description of the variable interrelationships no distinction will be made between the two sets of variables on the two tasks unless it is otherwise indicated.

Inspection of the correlation matrix shows that seven groups of variables can be identified by their high intercorrelations and descriptive utility. They are as follows:

(1) Output of speech variables: Duration of Utterances (DU), Total Verbal Output Words (TVOW), Total Verbal Output Syllables (TVOS). The variables were highly intercorrelated ($p < .001$) with the exception of DU and TVOS which showed lower intercorrelation ($p < .05$) on the picture description task. Significant correlations ($p < .001$) were observed between the DU and the pausing variables Number of Pauses and Total Pause Time. It is obvious more pauses and pause time are

associated with longer duration of speech. Negative correlations were observed between the DU and the speech rate variables (Speech Rate Words, Speech Rate Syllables), but these were significant only on the picture description task ($p < .05$ and $p < .01$, respectively). Positive correlations were observed between the three speech output variables and the Number of Inspirations; this correlation became significant on the story task ($p < .001$).

(2) Pausing variables: Number of Pauses (NP), Total Pause Time (TPT), Average Length of Pauses (ALP), Relative Pause Time (RPT), Speech Pause Ratio (SPR). Significant correlations ($p < .01$) were observed between each one of these variables and at least one other in the group. The pausing variables fall into two groups. The first, which consists of the NP, TPT and RPT, measures the overall pause time which, as one might expect, is associated with the total time spent on a verbal task. The second group, which consists of the ALP and SPR and are measures of the length and frequency of pauses, are not directly related to the duration of the speech. High negative correlations ($p < .01$ or $p < .001$) were observed between all pausing variables, with the exception of NP, and the speech rate variables (see below).

(3) Initial hesitation variables: Initial Hesitation (IH), Initial Relative Hesitation (IRH). The correlation of these variables between each other was high ($p < .001$) on the picture description task and lower ($p < .01$) on the story task. Positive correlation ($p < .05$) was observed between the IRH and the speech rate variables (see below) on the picture task only. This correlation perhaps indicates that a relatively longer period of initial reflection was followed by

decreased pausing during the description of the pictures.

(4) Speech rate variables: Speech Rate Words (SRW), Speech Rate Syllables (SRS). As expected, these variables correlated highly with each other ($r = .98$) in both verbal tasks. Negative correlations ($p < .01$ or $p < .001$) were observed between these two variables and all pausing variables. The speech rate obviously varies inversely with the frequency and length of the pauses. High correlations were observed between the speech rate and the output of speech per breath variables (see below) on the picture ($p < .01$) and the story ($p < .001$) tasks.

(5) Articulation Rate (AR). This was considered an independent extralinguistic variable by Goldman-Eisler (1969). In the present picture description task, AR was fairly independent since there was only one significant correlation between it and another variable (Speech Rate Words, $p < .05$). In the story task, positive correlations were observed between the AR and the Speech Pause Ratio ($p < .01$) both the speech rate variables ($p < .001$) and the output of speech per breath variables ($p < .01$).

4. Speech Breath Measures. Dependent Variables

(a) Description

(i) Automatic speech, counting. Information on how these variables are measured will be found in a previous section (II, B, 2(b)). Table 12 shows the speech breath (and extralinguistic) variables on both the initial and final counting. The Number of Inspirations and the Output of Speech per Breath in Syllables were increased on the

final occasion of counting, but this was not statistically significant.

(ii) Picture description task. The mean score on the three pictures of all subjects are given in Appendix 5(b). Table 15 shows the descriptive statistics of all seven speech breath (and extra-linguistic) variables. It should be noted that the Ventilation Index variables showed increased kurtosis and were skewed to the left.

(iii) Story telling task. The scores on the seven speech breath (and extralinguistic) variables will be found in Appendix 6(b). Table 16 shows the descriptive statistics of all seven speech breath variables.

Unlike the extralinguistic measures which showed some important differences between the picture description and story telling tasks (section II, A, 3(a)(iii)), the speech breath measures showed little difference between the two verbal tasks.

(b) Intercorrelation of measures

Two correlation matrices were computed, one for each set of measures on the picture description and story tasks. The matrices, which include the extralinguistic measures, are given in Appendices 7 and 8. Two groups of variables may be distinguished. They are:

(1) Speech breath, number and frequency variables: Number of Inspirations (NI), Frequency of Inspirations (FI), Speech Breath Rate (SBR). The three variables are in fact two. The SBR is a function of the FI, being its inverse. The correlation between the NI and FI was negative and significant ($p < .05$) only on the picture description task. Positive correlation was observed between the NI

TABLE 16

Extralinguistic and Speech Breath Variables: Story, Main Experiment

Descriptive Statistics

	Variable	Mean	SD	Variance	Kurtosis	Skewness
Extralinguistic variables	Duration of utterance in seconds	60.83	29.23	854.31	2.73	1.59
	Total verbal output, words	136.44	63.84	4075.08	2.18	1.27
	Total verbal output, syllables	162.00	74.74	5587.06	1.60	1.17
	Number of pauses	27.61	17.54	307.66	10.00	2.83
	Total pause time in seconds	25.55	15.79	249.44	0.70	1.27
	Average length of pauses	1.00	0.57	0.33	5.98	2.22
	Relative pause time	0.41	0.12	0.015	1.36	1.00
	Silent pause ratio	0.20	0.06	0.004	1.26	1.09
	Initial hesitation in seconds	10.02	6.01	36.12	0.50	0.66
	Initial relative hesitation	0.18	0.16	0.03	7.01	2.41
	Speech rate, words	2.34	0.67	0.45	-0.40	-0.36
	Speech rate, syllables	2.77	0.77	0.59	-0.13	0.003
	Articulation rate	4.66	0.57	0.32	0.02	0.65
Speech breath variables	Number of inspirations	14.56	8.47	71.86	6.25	2.31
	Frequency of inspirations	4.35	1.08	1.16	-0.88	0.28
	Speech breath rate	0.24	0.06	0.004	-0.08	0.52
	Output of speech per breath, words	9.86	3.46	11.96	2.78	1.51
	Output of speech per breath, syllables	11.80	4.27	18.23	3.66	1.71
	Ventilation index, words	11.12	3.31	10.99	0.93	0.35
	Ventilation index, syllables	9.31	2.68	7.18	-0.21	-0.09

and the extralinguistic variables which were associated with longer duration of speech (Duration of Utterances, Total Verbal Output Words, Total Verbal Output Syllables, Number of Pauses, Total Pause Time). The correlation between most of these variables was significant on the picture description task ($p < .05$) and highly significant on the story task ($p < .001$). No significant correlations were observed between the FI (and SBR) and the extralinguistic variables, but there were significant correlations ($p < .05$) between them and the output per breath variables, mainly on the picture description task.

(2) Output of speech per breath variables: Output of Speech per Breath in Words (OSPBW), Output of Speech per Breath Syllables (OSPBS), Ventilation Index Words (VIW), Ventilation Index Syllables (VIS). High intercorrelations were observed, as expected, because they are dependent upon one another, between these variables both on the picture and story tasks. There were, also a number of significant negative correlations between them and a number of extralinguistic variables on both verbal tasks, e.g., the pausing variables Average Length of Pauses, Relative Pause Time and Speech Pause Ratio ($p < .05$ or $p < .01$). Obviously, longer pauses and relative pause time in the pictures and, in addition to that, increased frequency of pauses in the story, were associated with decreased verbal output per breath. Furthermore, there were significant correlations ($p < .01$) between this group and the speech rate variables on the picture task; similar correlations on the story were higher ($p < .001$); in the story, there was positive significant correlation between the same variables and the Articulation Rate ($p < .01$). Evidently, faster talk was associated with increased verbal output per breath.

5. Statistical Procedures

In the statistical analyses of the data three procedures were used: Student's t-test, discriminant function analysis, and the Pearson product-moment correlation analysis.

The t-test was used in the comparison of the extralinguistic and speech breath activity measures between the conduct and anxiety groups. The programme for the t-test computed the variance ratio first. If this was highly significant ($p < .001$), then the t-test was not carried out as the assumption of common or equal variances was considered to be doubtful, despite the robustness of this test, particularly when the Ns of the groups are similar (Kerlinger, 1970).

The discriminant function analysis was employed in order to determine whether the extralinguistic and speech breath activity measures could significantly distinguish between the conduct and anxiety groups on the picture description and story telling tasks. In the discriminant analysis, a stepwise procedure was employed. In the procedure, an initial variable is selected which has the greatest discriminatory power. The selection of a second variable follows which, in combination with the first, provide the best discriminating value between the groups. The procedure continues until the addition of any further variables fails to increase significantly the discrimination between the groups. In the analyses, the variable selection was determined by minimization of Wilk's lambda and multivariate F-ratios to enter greater than unit. Since there were only two groups to distinguish, only one function was carried out. The results were interpreted by considering the following sets of values: (a) canonical discriminant functions, (b) standardized canonical discriminant function coefficients of each of the

discriminating variables, (c) group centroids of the discriminant scores for the conduct and anxiety groups, and (d) percent of the clinically grouped Ss correctly classified according to their group membership on the discriminant analysis.

The Pearson product-moment correlation coefficients were employed to determine the association between the dependent (extra-linguistic, speech breath activity) and independent variables (behaviour, personality characteristics).

Programmes provided in the Statistical Package for the Social Sciences (Nie et al., 1975) were used for all statistical analyses.

B. Results

The speech of child psychiatric patients with conduct disorder will differ from children with anxiety disorder on certain extra-linguistic and speech breath activity measures.

1. SUB-HYPOTHESIS I: Extralinguistic differences between the conduct and anxiety groups.

In children with conduct disorder a reduction will be observed of those measures which are attributable to cognitive planning and reflection. The differences between the groups will vary with the amount of cognitive planning required for the speech task. They will be greatest in the story telling task, followed by the picture description, and least in the automatic speech task-counting.

The measures on each verbal task will be analyzed in the sequence the task was carried out in the experiment, that is, automatic speech, picture description and story telling task.

(a) Automatic speech counting

Table 17 shows the extralinguistic (and speech breath) measurements of the conduct and anxiety groups on the initial counting compared on the t-test. The Total Time to count was significantly longer in the conduct group ($p < .05$). This was the cumulative effect of the increased Number of Pauses ($p < .01$) and the slower pace of the Articulation Rate ($.10 > p > .05$) in the conduct group. The overall slower counting of the conduct group was evident on the Speech Rate Syllables ($p < .05$).

The measurements of the groups on the final counting are shown in Table 18. The Total Time to count became considerably shorter for the conduct and slightly so for the anxiety group as compared to the initial counting; the difference between the groups was marginally significant ($.10 > p > .05$). The Articulation Rate (AR) of the conduct group increased in the final counting reducing the differences between the groups to non-significant levels. The Speech Rate in Syllables, however, remained significantly lower in the conduct group ($p < .05$).

To conclude, contrary to the hypothesis, the conduct group showed longer pausing and slower Articulation Rate in counting. The differences between the groups were heightened in the initial counting. In the final counting the Speech Rate and the Articulation Rate of the conduct group were increased but only the former continued to be significantly slower than in the anxiety group.

The possibility should be examined at this point whether other important independent variables such as Sex, Age and IQ confounded the results. In Appendix 9 (a, b, c, d) the t-test values of the comparison of the extralinguistic (and speech breath) measures between the sexes will be found, as well as the product moment correlations between the

TABLE 17

T-test of Difference between Means of the Conduct and Anxiety Groups on the Initial Counting

Main Experiment

	Variable	Conduct $\bar{x}$	Conduct SD	Anxiety $\bar{x}$	Anxiety SD	t value
Extralinguistic variables	Total time in seconds	21.07	5.02	15.37	5.10	2.32*
	Number of syllables (constant)	63.00		63.00		
	Number of pauses	16.12	10.59	4.25	2.96	3.05**
	Total pause time	5.87	4.35	1.70	1.04	(F=17.61***)
	Speech rate syllables	3.14	0.72	4.80	1.55	2.75*
	Articulation rate	4.23	0.60	5.38	1.62	1.89
Speech breath variables	Number of inspirations	5.12	3.18	3.12	1.36	1.64
	Speech breath rate	0.24	0.09	0.22	0.06	0.61
	Output of speech per breath, syl.	14.98	5.59	23.49	8.95	2.16*
	Ventilation index	8.14	5.04	4.96	2.12	1.63

Levels of significance *0.05 two-tail
**0.01 two-tail
***0.001 two-tail

TABLE 18.

T-test of Difference between Means of the Conduct and Anxiety Groups on the Final Counting

Main Experiment

	Variable	Conduct $\bar{x}$	Conduct SD	Anxiety $\bar{x}$	Anxiety SD	t value
Extralinguistic variables	Total time in seconds	17.67	4.05	14.29	3.51	1.79
	Number of syllables (constant)	63.00		63.00		
	Number of pauses	8.87	8.92	6.25	8.41	0.61
	Total pause time	3.52	3.21	2.22	2.51	0.90
	Speech rate syllables	3.14	1.22	4.61	0.99	2.66*
	Articulation rate	4.84	0.86	5.45	1.29	1.10
Speech breath variables	Number of inspirations	3.43	0.53	2.62	1.06	1.81
	Speech breath rate	0.21	0.04	0.19	0.07	0.66
	Output of speech per breath, syl.	18.73	2.83	26.51	7.35	2.62*
	Ventilation index	5.44	0.80	4.19	1.66	1.81

Levels of significance *0.05 two-tail
**0.01 two-tail

same dependent variables and Age and IQ (Full, Verbal, Performance).

On the counting task, there were significant associations, first between the Verbal IQ and a few variables (Total Time, Number of Pauses, Total Pause Time, Speech Rate in Syllables) in the initial counting, and second, between Sex and Number of Pauses in the final counting. The Verbal IQ and Male Sex were associated with slower overall counting. It is obvious these two variables confounded the clinical group effect on the extralinguistic measures. This study could not proceed beyond this point to determine what was the relative effect of each of the three variables.

(b) Picture description task

According to the hypothesis the conduct group was expected to show shorter pausing (cognitive planning) and initial hesitation (reflection) as compared to the anxiety group.

(i) Comparing the group measures on the t-test. Table 19 shows the means and standard deviations of the extralinguistic (and speech breath) variables of the conduct and anxiety groups compared on the t-test. The Initial Relative Hesitation (IRH) was shorter for the conduct group ($p < .05$) and highly significant F was observed on the Initial Hesitation (IH). As it was reported in an earlier section (III, A, 3(a)(ii)) the mean IH of both groups on the first picture was longer ($p < .05$) than the IH on each of the two pictures which followed. Recomparison between the groups on each picture resulted in high F-ratios as a result of large variance of the IH values in the anxiety group (Figure 2).

TABLE 19

Picture Description Task
Extralinguistic and Speech Breath Variables of the
Conduct and Anxiety Groups Compared on the t-test

Variable	Group	Mean	SD	t value
Duration of Utterances	Conduct	36.71	8.87	.14
	Anxiety	35.84	15.84	
Total Verbal Output Words	Conduct	71.28	22.77	1.31
	Anxiety	59.01	16.35	
Total Verbal Output Syllables	Conduct	89.81	25.81	1.09
	Anxiety	77.91	20.23	
Number of Pauses	Conduct	17.99	4.81	.97
	Anxiety	15.24	6.95	
Total Pause Time	Conduct	14.35	3.55	.83
	Anxiety	17.65	11.39	
Average Length of Pauses	Conduct	0.83	0.19	1.41
	Anxiety	1.14	0.63	
Relative Pause Time	Conduct	0.39	0.06	.92
	Anxiety	0.45	0.16	
Silent Pause Ratio	Conduct	0.26	0.03	.08
	Anxiety	0.26	0.08	
Initial Hesitation	Conduct	3.90	1.59	(F = 37.09***)[x]
	Anxiety	10.70	9.72	
Initial Relative Hesitation	Conduct	0.10	0.05	2.38*
	Anxiety	0.22	0.14	

Levels of significance: * 0.05 two-tail
** 0.01 " "
*** 0.001 " "

[x]If the F ratio was highly significant ($p < .001$) the t value was not computed.

TABLE 19 (Continued)

Variable	Group	Mean	SD	t value
Speech Rate Words	Conduct	1.94	0.21	.31
	Anxiety	1.86	0.75	
Speech Rate Syllables	Conduct	2.44	0.24	(F = 14.45***)
	Anxiety	2.44	0.91	
Articulation Rate	Conduct	4.15	0.69	.75
	Anxiety	4.23	0.82	
Number of Inspirations	Conduct	8.91	2.63	1.83
	Anxiety	6.83	1.91	
Frequency of Inspirations	Conduct	4.21	0.94	.87
	Anxiety	4.64	1.02	
Speech Breath Rate	Conduct	0.25	0.05	.93
	Anxiety	0.22	0.05	
Output of Speech per Breath Words	Conduct	8.52	2.52	.20
	Anxiety	8.78	2.75	
Output of Speech per Breath Syllables	Conduct	10.80	3.04	.50
	Anxiety	11.61	3.41	
Ventilation Index Words	Conduct	12.64	3.35	.35
	Anxiety	13.60	6.71	
Ventilation Index Syllables	Conduct	9.93	2.50	.05
	Anxiety	10.03	4.54	

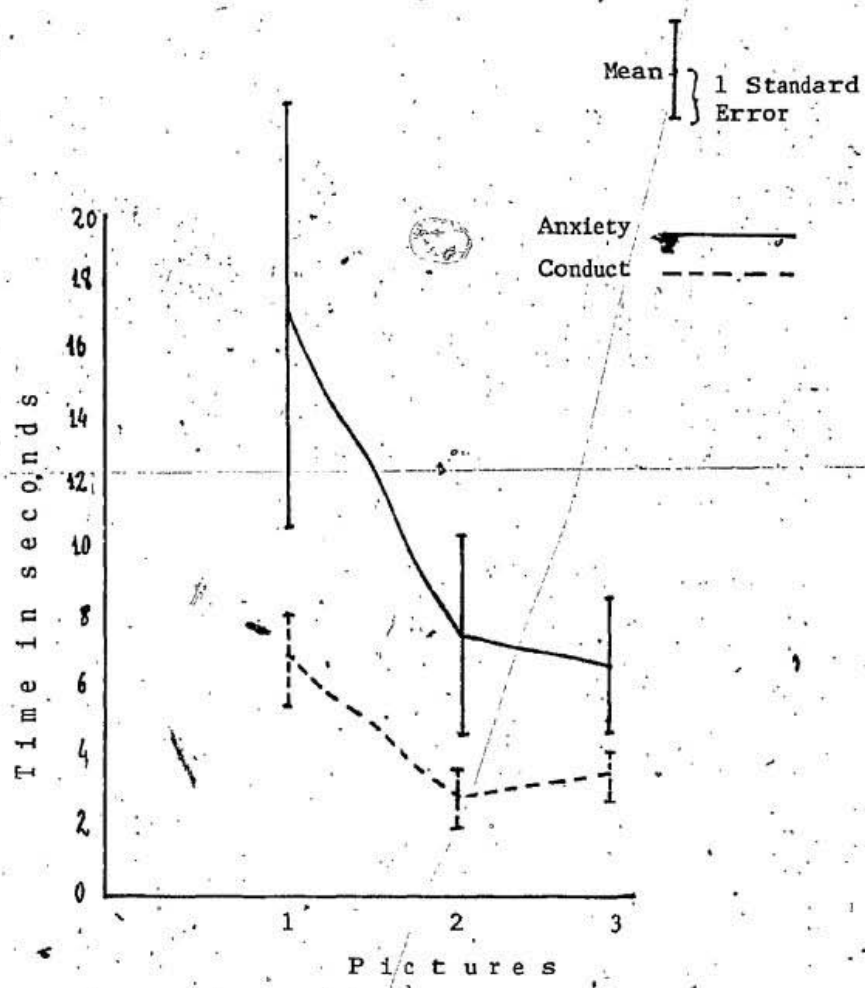

Figure 2. Initial Hesitation on the Three Pictures. Conduct and Anxiety Disorder Groups. Mean and Standard Error.

Other differences between the groups should be noted (Table 19) although they did not become significant. First, the verbal output of the conduct group was longer (Total Verbal Output Words and Syllables). Second, the pausing variable Average Length of Pauses (ALP) was shorter in the conduct group but large variance of the ALP scores in the anxiety group led to high F-ratios. Two more pausing variables (Total Pause Time, Relative Pause Time) and the speech rate variables (Speech Rate Words and Syllables) which are dependent on the length (ALP) and frequency of pauses (Silent Pause Ratio) showed, also, high F-ratios as a result of the wide variances of the scores in the anxiety group.

To conclude, in line with the hypothesis, the conduct group hesitated significantly less before starting to talk and spoke with less pausing overall. Furthermore, the conduct group spoke longer and wide variation was observed in the pausing measures of the anxiety group.

(i) Discriminant function analyses. A series of discriminant function analyses (Section III, A, 5) were carried out on the extralinguistic (and speech breath) variables in order to determine whether these variables could distinguish the conduct and anxiety groups from each other, as the hypothesis indicated, and to select the variables which were most specific in distinguishing the groups.

All 13 extralinguistic and the seven speech breath variables were entered in the first analysis which showed that the two groups were distinct from each other. Nine variables contributed to this. In sequence of selection, they were: Initial Relative Hesitation (IRH), Average Length of Pauses (ALP), Output of Speech per Breath Syllables (OSPBS), Articulation Rate (AR), Total Verbal Output Syllables (TVOS),

Total Verbal Output Words (TVOW), Total Pause Time (TPT), Initial Hesitation (IH), Output of Speech per Breath Words (OSPBW). The values of the canonical discriminant function (Table 20) were highly significant and the difference between the group centroids (Table 21) was wide. The assigned group membership was correct (94.4%) in 17 out of 18 Ss. Because the last four of the discriminating variables (TVOW, TPT, IH, OSPBW) were dependent to varying degrees upon the first five (IRH, ALP, OSPBS, AR, TVOS) and in order to avoid this additive effect, a further analysis was carried out by entering these five last variables only. The second analysis distinguished the groups equally significantly (Tables 20 and 21). A third analysis was carried out by entering selected pausing variables (Average Length of Pauses, Silent Pause Ratio, Relative Pause Time), the initial hesitation variables (Initial Hesitation, Initial Relative Hesitation) and the Articulation Rate variable. Two variables, among the six entered, distinguished the groups significantly of each other; they were the Initial Relative Hesitation (IRH) and the Average Length of Pauses (ALP) (Tables 20 and 21). The standardized canonical coefficients of the two variables were: IRH 1.178, ALP 1.036. Obviously, the two variables had nearly equal discriminating power. The last analysis showed that 16 out of the 18 Ss had been given the correct group assignment. Figure 3 shows the group centroids on the histogram and the position of each subject on the continuum of the discriminant scores.

In summary, the discriminant function analyses showed that the conduct and anxiety groups could be significantly distinguished on the extralinguistic variables. Two of them, one pausing (Average Length of Pauses) and one initial hesitation (Initial Relative Hesitation)

TABLE 20

Picture Description Task
Canonical Discriminant Functions

	Eigenvalue	Percent of Variance	Canonical Correlation	Wilks' lambda	x^2	d.f.	Significance
1st Discriminant analysis	146.4986	100.00	0.9966	0.0068	47.44	9	0.0000
Entered: All 20 variables Selected: 9							
2nd Discriminant analysis	2.5148	100.00	0.8459	0.2845	14.45	5	0.013
Entered: 5 variables Selected: 5 variables							
3rd Discriminant analysis	1.1392	100.0	0.7297	0.4674	11.41	2	0.003
Entered: Pausing, Initial Hesitation and Articulation variables Selected: IRH, ALP							

TABLE 21

Centroids of the Discriminant Scores

Groups	Discriminant Analyses 1	2	3
Conduct	-9.9850	-1.3082	-1.0063
Anxiety	12.8379	1.6820	1.0063

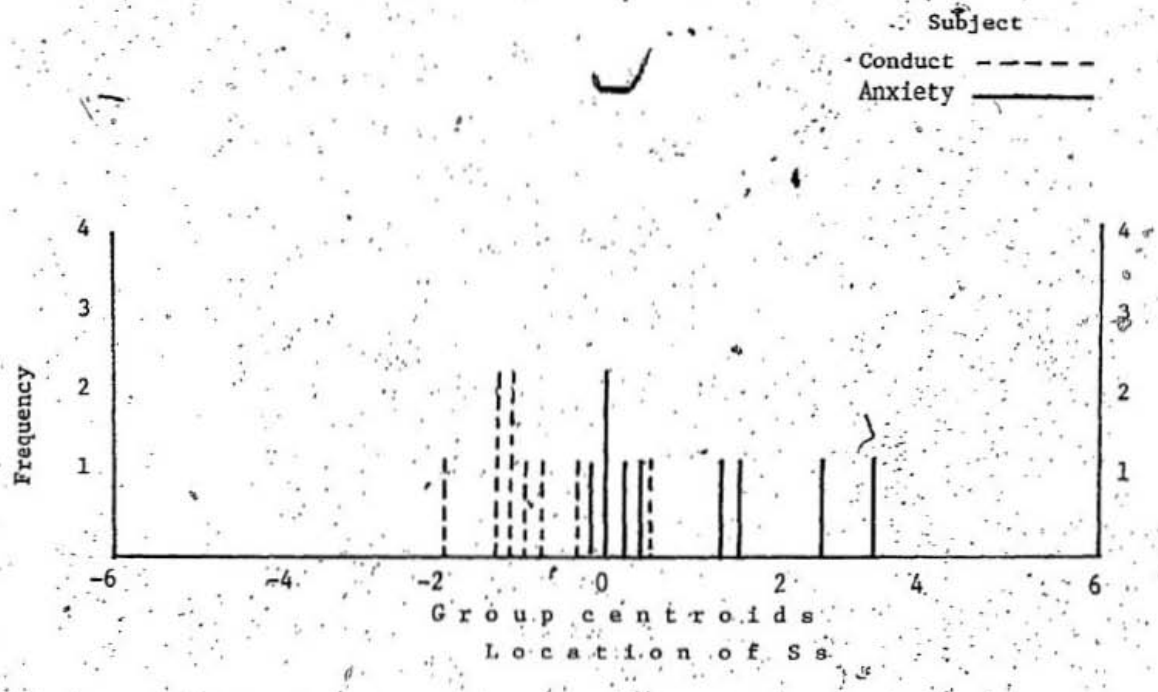

Figure 3. Canonical discriminant function: Histogram
Main experiment: Pictures
Variables: ALP, IRH

could distinguish the groups. This was in line with the hypothesis tested.

(c) Story telling task

According to the hypothesis, the difference between the conduct and anxiety groups was expected to be the greatest on measures attributable to cognitive planning (pausing variables) and reflection (initial hesitation variables) on this task as compared to the two previous tasks of automatic speech and picture description.

(i) Comparing the group measures on the t-test. Table 22 shows the scores of the conduct and anxiety groups on the extralinguistic (and speech breath) measures compared with each other on the t-test. Contrary to the hypothesis, there were no significant differences between the groups.

(ii) Discriminant function analyses. The procedure followed in the analysis of the picture description measures was repeated on the measures on the story task. All variables were entered in the first discriminant analysis but did not distinguish between the conduct and anxiety groups. In the analysis, three variables only were selected discriminating the groups (Articulation Rate, Number of Inspirations, Speech Breath Rate). The values of the canonical discriminant function (Table 23) were low and not significant, the group centroids were not distant of each other (Table 24), and the assigned group membership was correct only in 61.1% of the Ss. It should be noted that the centroid of the anxiety group achieved negative value. In a second analysis the following variables were entered: Average Lenth of Pauses (ALP), Silent Pause Ratio (SPR), Relative Pause Time (RPT),

TABLE 22

Story Telling Task

Extralinguistic and Speech Breath Variables
of the Conduct and Anxiety Groups Compared on the T-test

Variable	Group	Mean	SD	t value
Duration of utterances	Conduct	66.13	36.43	.76
	Anxiety	55.33	20.61	
Total verbal output, words	Conduct	148.33	77.71	.78
	Anxiety	124.55	47.99	
Total verbal output, syllables	Conduct	178.67	88.32	.94
	Anxiety	145.33	58.71	
Number of pauses	Conduct	30.67	23.84	.73
	Anxiety	24.55	8.02	
Total pause time	Conduct	26.51	17.69	.25
	Anxiety	24.59	14.66	
Average length of pauses	Conduct	0.92	0.32	.64
	Anxiety	1.09	0.76	
Relative pause time	Conduct	0.39	0.10	.62
	Anxiety	0.43	0.14	
Silent pause ratio	Conduct	0.19	0.05	.58
	Anxiety	0.21	0.07	
Initial hesitation	Conduct	8.44	5.53	.78
	Anxiety	11.33	6.57	
Initial relative hesitation	Conduct	0.12	0.09	.75
	Anxiety	0.15	0.05	
Speech rate, words	Conduct	2.35	0.59	.07
	Anxiety	2.33	0.78	
Speech rate, syllables	Conduct	2.84	0.67	.40
	Anxiety	2.69	0.89	

TABLE 22 (Continued)

Variable	Group	Mean	SD	t value
Articulation rate	Conduct	4.65	0.64	.10
	Anxiety	4.67	0.52	
Number of inspirations	Conduct	16.78	10.95	(F=41.29***)[x]
	Anxiety	11.71	1.70	
Frequency of inspirations	Conduct	4.24	1.22	.41
	Anxiety	4.46	0.95	
Speech breath rate	Conduct	0.25	0.07	.44
	Anxiety	0.24	0.51	
Output of speech per breath, words	Conduct	9.82	3.81	.04
	Anxiety	9.90	3.25	
Output of speech per breath, syllables	Conduct	12.01	4.90	.22
	Anxiety	11.53	3.67	
Ventilation index, words	Conduct	11.04	2.75	.11
	Anxiety	11.23	4.16	
Ventilation index, syllables	Conduct	9.14	2.46	.27
	Anxiety	9.51	3.13	

Levels of significance *0.05 two-tail
**0.01 two-tail
***0.001 two-tail

[x]If the F ratio was highly significant ($p < .001$) the t value was not computed.

TABLE 23

Story Telling Task

Canonical Discriminant Functions

	Eigenvalue	Percent of Variance	Canonical Correlation	Wilks' lambda	x^2	d.f.	Significance
1st Discriminant analysis Entered: All variables Selected: AR, N1, SBR	1.5120	100.00	0.7758	0.3981	5.99	3	0.112
2nd Discriminant analysis Entered: Pausing, initial hesitations and articulation rate variables Selected: AR, ALP	0.9494	100.00	0.6979	0.5130	5.01	3	0.171

TABLE 24

Centroids of the Discriminant Scores

Groups	Discriminant Analysis 1	2
Conduct	1.09981	-0.96547
Anxiety	-1.09981	0.80456

Initial Hesitation (IH), Initial Relative Hesitation (IRH), Articulation Rate (AR). They were the same set of variables (pausing, initial hesitation and articulation rate) which had been used in the final analysis on the picture description measures. Three of these variables were selected in the analysis (AR, ALP, IH) distinguishing the groups. The values, however, and indices of the analysis were again low (Tables 23 and 24). The assigned group membership of 13 out of the 18 Ss was correct but this level of assignment did not become significant ($p > .05$).

In summary, the discriminant analyses did not distinguish the groups significantly of each other on the predicted extralinguistic variables on the story telling measures.

(d) Summary and remarks

The comparison between the extralinguistic measures of the conduct and anxiety group on the three verbal tasks of automatic speech (counting), picture description and story telling showed that the groups differed significantly, first on the automatic speech, mainly the initial counting, in a direction not predicted in the hypothesis; this possibly being the effect of the independent variables of Sex and IQ; and, second, on the picture description task in the direction predicted in the hypothesis. There were no significant differences between the groups on the story telling task, contrary to the hypothesis which predicted that the widest differences between the groups should have occurred on this verbal task.

No significant associations were observed between Sex, Age and extralinguistic variables except of the IRH on the story task which showed negative association with Age ($p < .01$) (Appendix 9, c, d). The absence of other significant associations between Age and extralinguistic variables was perhaps due to the narrow age range of

the Ss. Pausing and speech rate vary from one age group to the other (Sabin et al., 1979). In early childhood the pauses are frequent and long and the speech rate slow, but, with the increasing cognitive and linguistic competence of the child, pausing becomes shorter and the speech rate faster to reach their lowest and faster levels, respectively, in adolescence.

The IQ, the Verbal IQ in particular, showed a number of significant positive associations with the measures of the initial counting only (Total Time, Number of Pauses, Total Pause Time, Speech Rate in Syllables). On the picture description task two significant associations were observed: the Verbal IQ showed positive association with the Duration of Utterances ($p < .05$) and negative with the Articulation Rate ($p < .05$). The extralinguistic variables which distinguished the conduct and anxiety groups on the picture task (Average Length of Pauses, Initial Relative Hesitation) did not show significant associations with the IQ. On the story telling task, the verbal output variables (Duration of Utterances, Total Verbal Output Words and Syllables) showed a number of positive associations with IQ, both Full and Verbal ($p < .05$). A highly significant association was also observed between the IRH and Verbal IQ ($p < .01$). Again, the variables which distinguished the groups on the story task (Articulation Rate, Average Length of Pauses, Initial Hesitation) did not show significant associations with IQ.

It may be concluded that there was no evidence of a significant effect of the independent variables of Sex, Age and IQ on the extralinguistic variables which distinguished between the conduct and anxiety groups on the picture description and story telling tasks. Sex and

Verbal IQ, however, were significantly associated with extralinguistic measures in the counting task and it is quite possible, therefore, that these two variables confounded the extralinguistic differences observed between the conduct and anxiety groups in this verbal task.

2. SUB-HYPOTHESIS II: Correlation between extralinguistic measures and behaviour and personality characteristics.

Those measures of behaviour and personality that distinguish between the conduct and anxiety groups will be significantly correlated with the extralinguistic measures of speech which are attributable to cognitive planning and reflection. The correlations will be highest in the story telling task followed by the picture description and smallest in the automatic speech task-counting.

The analysis of the measures on each verbal task will follow the sequence of the task in the experiment, that is automatic speech, picture description and story telling task.

(a) Automatic speech counting

According to the hypothesis, either non-significant or minimal negative correlations should be expected between the pausing measures and the behaviour and personality measures of disturbance of conduct (Conduct, Socialized Delinquency) and impulsivity.

Table 25 shows the product-moment correlations between the initial counting and the behaviour and personality measures. Significant correlations were observed between the extralinguistic and the measures of Conduct, Socialized Delinquency and Extraversion. The Total Time to count (TT) was positively associated with Conduct ($p < .05$) and Socialized Delinquency ($p < .01$). Conversely, the TT was

TABLE 25

Pearson Correlation Coefficients between
Behaviour, Personality and Extralinguistic, Speech Breath Variables

Main Experiment: Initial Counting

		TT	NSyl	NP	TPT	SRS	AR	NI	SBR	OSPBS	VIS
Peterson-Quay	Conduct	.456*	Constant	.376	.169	-.495*	-.568*	.018	-.244	-.312	.016
	Anxiety	-.112		-.134	-.089	.199	.195	-.119	.013	.301	-.120
	Immaturity	.357		.367	.178	-.245	-.274	.056	-.245	-.012	.056
	Socialized del.	.564**		.684**	.545*	-.493*	-.396	.311	.054	-.376	.314
JEPI	Extraversion	-.580**		-.515*	-.412	.513*	.427	-.384	-.146	.425	-.386
	Neuroticism	-.074		-.210	-.290	-.151	-.351	-.048	-.099	-.120	-.053
	Lie	-.316		-.192	-.091	.423	.486	.190	.275	.229	.191
MFFT	Mean latency of response	-.147		-.423	-.364	.060	-.015	-.191	-.153	.219	-.194
	Errors	.133		.486	.435	-.372	-.305	.265	.073	-.401	.267

Levels of significance *0.05 two-tail
**0.01 two-tail

TABLE 26

Pearson Correlation Coefficients between
Behaviour, Personality and Extralinguistic, Speech Breath Variables

Main Experiment: Final Counting

		TT	NSyl	NP	TPT	SRS	AR	NI	SBR	OSPBS	VIS
Peterson-Quay	Conduct	.361		.085	.137	-.433*	-.595**	.254	.021	-.344	.256
	Anxiety	-.090		.249	.254	.141	.249	.073	.077	.256	-.082
	Immaturity	.089		.108	.129	-.411	-.143	.000	-.008	.027	.001
	Socialized del.	.267		.174	.230	-.422	-.207	.098	.045	-.254	.107
JEPI	Extraversion	-.443*		-.411	-.349	.412	.307	.040	.361	-.038	.034
	Neuroticism	-.230		-.308	-.259	.135	-.202	.202	-.296	-.106	.200
	Lie	-.195		-.225	-.233	.576*	.452	-.347	-.531*	.403	-.357
MFFT	Mean latency of response	-.184		-.126	-.116	.149	.028	-.173	-.090	.198	-.175
	Errors	.350		-.171	-.143	-.290	-.475	.651**	.385	-.714**	.654**

Levels of significance *0.05 two-tail
**0.01 two-tail

negatively associated with Extraversion ($p < .01$). The Number of Pauses (NP) and the Total Pause Time (TPT) showed positive association with Socialized Delinquency ($p < .01$ and $p < .05$); the NP showed negative association with Extraversion ($p < .05$). The Articulation Rate and the Speech Rate Syllables (SRS) showed negative association with Conduct. Furthermore, the SRS showed negative association with Socialized Delinquency ($p < .05$) and positive with Extraversion ($p < .05$). In summary, the high scores on conduct measures (Conduct, Socialized Delinquency) were associated with slow counting resulting from increased number of pauses and longer overall pause time.

In the final counting most of the significant associations observed in the initial counting were not present (Table 26). Negative associations were present between TT and Extraversion ($p < .05$) and both SRS and AR and Conduct ($p < .05$). It is obvious that the relative slowness observed during the initial counting associated with high scores on Conduct and Socialized Delinquency diminished on the final counting task.

In conclusion, the significant correlations observed on the counting task between the pausing and the behaviour and personality measures was opposite to that predicted in the hypothesis.

(b) Picture description task

The hypothesis predicted that negative correlations should be observed between the extralinguistic variables of pausing and initial hesitation and the behaviour and personality measures of conduct and impulsivity.

Table 27 shows the product moment correlations between the extralinguistic (and speech breath) and behaviour and personality measures.

TABLE 27

Product Moment Correlations between
the Extralinguistic, Speech Breath and Behaviour, Personality Measures

Picture Description Task

		DU	TVOW.	TVOS	NP	TPT	ALP.	RPT	SPR	IH	IRH
Peterson-Quay	Conduct	-.189	.096	-.011	.000	-.362	-.292	-.303	-.103	-.263	-.177
	Anxiety	.372	.203	.136	.258	.367	.321	.194	.196	.429*	.228
	Immaturity	.091	-.102	-.307	.065	.135	.291	.257	.239	-.022	-.148
	Socialized del.	-.110	-.078	-.193	.038	-.160	-.175	-.068	.099	-.319	-.335
JEPI	Extraversion	.037	.380	.361	-.016	.055	.029	-.056	-.554*	-.090	.025
	Neuroticism	-.423*	-.226	-.132	-.324	-.321	.095	-.072	-.165	.379	.478*
	Lie	-.037	-.010	.295	-.142	.012	-.012	-.154	-.339	-.153	.034
MFFT	Mean latency of response	.708**	.529*	.491*	.625**	.557*	.059	.153	.279	.542*	.086
	Errors	-.402	-.212	-.201	.288	-.421	-.135	-.158	-.118	-.198	-.037

TABLE 27 (Continued)

	SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
Conduct	.200	.173	.001	.283	-.373	.391	-.127	-.137	.037	.028
Anxiety	-.231	-.314	-.293	.215	-.041	-.012	-.297	-.368	.402	.433*
Immaturity	-.315	-.265	-.090	.301	-.262	.222	-.387	-.335	.471*	.406
Socialized del.	-.034	.021	-.091	.278	-.376	.390	-.275	-.224	.140	.136
Extraversion	.508*	.467*	.643*	.116	-.256	.281	.256	.223	-.273	-.246
Neuroticism	.209	.245	.181	.112	-.432	.442*	-.267	-.247	.343	.309
Lie	.269	.232	.198	-.021	-.054	.133	.074	-.014	-.062	.008
Mean latency of response	-.266	-.278	-.336	.341	.140	-.159	.033	.071	-.116	-.107
Errors	.096	.094	.090	-.026	-.268	.289	-.118	-.085	-.025	-.037

Levels of significance *0.05 two-tail
**0.01 two-tail
***0.001 two-tail

The verbal output variables showed a distinct positive association with reflection measured by the Mean Latency of Response on the MFF Test (Duration of Utterances (DU) $p < .01$, Total Verbal Output Words (TVOW) and Syllables (TVOS) $p < .05$)). Similar associations were observed between two pausing variables (Number of Pauses (NP), Total Pause Time (TPP)) and reflection ($p < .01$ and $p < .05$), evidently as a result of the association of these two pausing variables with the verbal output variables. The verbal output variables showed opposing trends in their association with the two anxiety measures, Anxiety and Neuroticism, but, only the negative correlation between Duration of Utterances (DU) and Neuroticism reached levels of significance ($p < .05$). The seemingly contradictory association between the two anxiety measures and the verbal output variables may be explained. The two variables measure, apparently, different aspects of anxiety. The variable 'Anxiety' measures behaviours that are presumed to be expression of anxiety in children; this was associated with increased verbal output. Neuroticism measures the child's own description of anxiety; this was associated with shorter DU.

The pausing variables showed one more significant association in addition to the two (NP and TPT with reflection) reported in the previous paragraph. The Silent Pause Ratio (SPR), which measures the frequency of pauses, showed negative association with Extraversion ($p < .05$).

Initial Hesitation (IH) showed positive association with both Anxiety and Mean Latency of Response ($p < .05$) and Initial Relative Hesitation (IRH) with Neuroticism ($p < .05$). The variables Speech Rate Words (SRW) and Syllables (SRS) and Articulation Rate (AR) showed

positive association with Extraversion.

In summary, the significant associations were as follows: (a) the verbal output variables showed positive association with reflection; (b) the DU showed negative association with Neuroticism; (c) SPR showed negative association with Extraversion (decreased frequency of pauses); (d) increased Initial Hesitation (IH) was associated with Anxiety and reflection and Initial Relative Hesitation with Neuroticism; (e) the speech rate (SRW, SRS) and the AR variables showed positive association with extraversion. The significant association (d) was predicted in the hypothesis and the association (a) was compatible with the hypothesis.

(c) Story telling task

Some of the significant correlations observed on the picture description task became evident again on the story telling task. Table 28 shows the product moment correlations between the extra-linguistic (and speech breath) and the behaviour and personality measures.

The verbal output variables as well as the pausing variables Number of Pauses (NP) and Total Pause Time (TPT) showed significant positive association with reflection (Mean Latency of Response). Negative association was observed between Duration of Utterances (DU) and the measure of impulsivity Errors ($p < .05$). Of the two measures of anxiety, Anxiety showed positive association with the verbal output variable DU ($p < .05$). The variables TVOW and TVOS, also showed positive association with Extraversion ($p < .05$).

Among the pausing variables only Total Pause Time (TPT) showed significant associations, first, positive with Anxiety ($p < .01$)

TABLE 28

Product Moment Correlations between
the Extralinguistic, Speech Breath and Behaviour, Personality Measures

Story Telling Task

		DU	TVOW	TVOS	NP	TPT	ALP	RPT	SPR	IH	IRH
Peterson-Quay	Conduct	.045	.124	.166	.011	-.113	-.143	-.273	-.379	-.602*	-.586*
	Anxiety	.533*	.356	.396	.452*	.545**	.239	.235	.292	.047	-.393
	Immaturity	.027	-.177	-.140	-.174	.123	.395	.283	-.069	-.493	-.595*
	Socialized del.	.139	.044	.084	-.044	.036	.055	.006	-.124	-.386	-.262
EPI	Extraversion	.399	.456*	.441*	.496*	.295	-.098	-.046	.183	.325	-.107
	Neuroticism	.099	.113	.111	.032	.139	.189	.109	-.184	-.441	-.618*
	Lie	-.103	-.127	-.100	.008	-.003	-.060	.050	.33	.185	.209
MFFT	Mean latency of response	.705**	.455*	.461*	.486*	.718***	.124	.295	.204	.759**	.054
	Errors	-.446*	-.316	-.297	-.398	-.441*	.011	-.177	-.456*	-.245	385

TABLE 28 (Continued)

	SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
Conduct	.190	.282	.156	.174	-.203	.201	.046	.110	-.093	-.137
Anxiety	-.254	-.246	-.188	.483*	-.120	.148	-.340	-.348	.421	.420 ($p < .052$)
Immaturity	-.280	-.250	-.102	-.052	.062	-.078	-.290	-.237	.282	.213
Socialized del.	-.225	-.191	-.388	.124	.007	-.091	-.220	-.172	.058	.011
Extraversion	.097	.097	.117	.469*	-.176	.099	-.067	-.077	.021	.023
Neuroticism	.104	.094	.331	.126	-.059	.023	-.108	-.099	.117	.043
Lie	-.038	.007	.067	-.157	.153	-.121	.067	.130	.009	-.050
Mean latency of response	-.344	-.367	-.358	.635**	.122	.066	-.205	-.294	.085	.186
Errors	.226	.311	.406	-.383	-.013	-.107	.255	.306	-.264	-.331

Levels of significance
*0.05 two-tail
**0.01 two-tail
***0.001 two-tail

and reflection ($p < .001$), and second, negative with Errors ($p < .05$). The three pausing variables (Average Length of Pauses (ALP), Relative Pause Time (RPT), Silent Pause Ratio (SPR)) which are not affected by the amount of verbal output did not show significant associations except of SPR which showed negative association with Errors ($p < .05$).

The initial hesitation variables (IH, IRH) showed negative association with Conduct ($p < .05$); similar association, not significant though, was observed between IH, IRH and Socialized Delinquency which was calculated only on four Ss. Increased IH was associated with high scores of reflection (mean Latency of Response) ($p < .01$); similar association was also observed on the picture description task. Finally, the Articulation Rate (AR) showed negative association with Socialized Delinquency ($p < .05$); similar, but not significant, association was observed on the picture task.

In summary, the significant associations were as follows: (a) the verbal output variables showed positive association with reflection; (b) the DU showed positive association with Anxiety; (c) the verbal output variables showed positive association with Extraversion; (d) Total Pause Time (TPT) showed positive association with Anxiety and reflection (negative with Errors); (e) the initial hesitation variables showed negative association with Conduct and positive with reflection. The significant associations (d) and (e) had been predicted in the hypothesis.

(d) Summary

In the correlation analyses, the measures of conduct (Conduct, Socialized Delinquency) showed positive association with slower counting, which was not in line with the hypothesis and was possibly related to

the effect of the variable Sex and Verbal IQ (Section III, B, 1(a)). The measure of reflection (Mean Latency of Response) showed positive association with the Initial Hesitation (IH) in the picture description ($p < .05$) and story telling ($p < .01$) tasks. Reflection also showed positive association with the verbal output variables in both verbal tasks. The measure 'Conduct' showed negative association with the initial hesitation measures (IH, IRH) in the story telling task. Extraversion showed positive association with the Speech Rate (SRW and SRS) and Articulation Rate (AR) in the picture description and with the verbal output variables in the story telling task.

3. SUB-HYPOTHESIS III: Speech breath activity differences between the conduct and anxiety groups.

The speech breath frequency, said to be an indicator of anxiety, will have a higher frequency in children with anxiety disorder than in those with conduct disorder.

(a) Automatic speech counting

According to the hypothesis, no differences should be observed between the groups in the frequency of the speech breath activity on this verbal task, or if there was any it should be in the direction of the anxiety group showing increased frequency of breathing.

Table 17 (p. 80) shows the speech breath (and extralinguistic) measures on the initial counting of the conduct and anxiety disorder groups compared on the t-test. There was no significant difference between the groups on the Speech Breath Rate (SBR) variable, which is the inverse of the Frequency of Inspirations. The Output of Speech per Breath in Syllables (OSPBS), however, was lower in the conduct group ($p < .05$). The differences between the groups on the OSPBS remained significant in the final counting (Table 18). It is possible the lower OSPBS in the conduct group was associated with the slower overall counting in that group.

To conclude, there was no difference between the groups in the frequency of breathing (SBR) but the conduct group showed decreased Output of Speech per Breath which had not been predicted in the hypothesis.

(b) Picture description task

It was predicted in the hypothesis that the anxiety group will show increased breath activity.

(i) Comparing the group measures on the t-test. Table 19 (p. 83) shows the scores on the speech breath (and extralinguistic) measures of the conduct and anxiety groups compared on the t-test. There were no significant differences between the groups on either the Frequency of Inspirations (and SBR) or the output of speech per breath (OSPBW, OSPBS, VIW, VIS) measures.

(ii) Discriminant function analysis. Because there was no evidence of any significant differences between the groups on the t-test, no separate discriminant analysis was carried out on the speech breath variables. These variables were, however, included in the initial analysis of the extralinguistic variables. In this, all-variable analysis, one of the speech breath variables (OSPBS) (p. 86) was selected contributing to the distinction of the groups.

In summary, the predicted differences between the groups on the speech breath measures were not confirmed in the picture description task.

(c) Story telling task

The differences between the conduct and anxiety disorder groups were expected to be the highest on the verbal task.

(i) Comparing the group measures on the t-test. Table 22 (p. 92) shows the scores of the speech breath (and extralinguistic) measures compared on the t-test. There were no significant differences between

the groups. Increased variance was observed on the Number of Inspirations (NI) in the conduct group, as a result of increased verbal output by two Ss (#3, 8) (Appendix 7 a, b).

(ii) Discriminant function analysis. No separate discriminant analysis was carried out on the speech breath measures. In the analysis which included both the extralinguistic and speech breath measures, two of the latter (Number of Inspirations, Speech Breath Rate), together with the extralinguistic variable Articulation Rate, were selected distinguishing the groups (p. 91). The discriminant scores, however, were low and non-significant (Table 23).

In summary, no significant differences on the speech breath variables were observed between the groups on the story telling task.

(d) Summary and remarks

The suggested differences in the speech breath activity between the conduct and anxiety groups were not confirmed on the picture description and story telling tasks. Two possible reasons may be accountable for this. First, the method of measuring the speech breath activity might have been inadequate. It should be recalled (p. 44) that the breath activity was measured on the recorded inspiration sounds. Shallow breaths or breaths occurring during long pauses may have remained unrecorded. Second, it is quite possible the two clinical groups did not vary significantly in breath activity because the Ss in both groups were equally anxious. On the measures of anxiety (Anxiety, Neuroticism) the groups did not show significant differences (Table 8, p. 58).

The observed differences between the groups on the automatic speech (counting) which were contrary to the hypothesis, were probably

confounded by the variables Sex and Verbal IQ (Appendix 10, a, b).

4. SUB-HYPOTHESIS IV: Correlation between speech breath measures and behaviour and personality characteristics.

Measures of anxiety, which are higher in the anxiety group than in the conduct disorder group, will be positively correlated with measures of increased frequency of speech breath activity.

(a) Automatic speech counting

According to the hypothesis, there should be no significant correlations between the speech breath measures and the measures of anxiety and/or other measures of behaviour and personality characteristics, on this speech task.

Tables 25 and 26 (pp. 99 and 100) show the product-moment correlations between the speech breath (and extralinguistic) measures and the behaviour and personality measures on the initial and final counting. There were no significant correlations on the initial counting. In the final counting the Number of Inspirations (NI) showed significant positive associations with Errors ($p < .01$); also, the variable Output of Speech per Breath Syllables (OSPBS) showed negative association with Errors ($p < .01$). The two associations were contrary to the hypothesis. Errors, which was a measure of impulsivity on which the conduct group scored significantly high (Table 8, p. 58), should have shown negative association with NI and positive with OSPBS. A possible explanation of these findings is that the variable Sex (Appendix 10, b) confounded the results.

(b) Picture description task

It was predicted that the speech breath measures will show positive correlations with measures of anxiety.

Table 27 (p.102) shows the product-moment correlations between the speech breath measures and the behaviour and personality characteristics. Three significant correlations were observed. The Speech Breath Rate (SBR) showed positive association with Neuroticism ($p < .05$). The Ventilation Index variables of Syllables (VIS) and Words (VIW) showed positive association with Anxiety and Immaturity respectively ($p < .05$). Ventilation Index measures the proportion of air returned per syllable or word spoken (Goldman-Eisler, 1969).

In summary, the predicted positive correlations between speech breath and anxiety measures were confirmed.

(c) Story telling task

Table 28 (p.106) shows the product-moment correlations between the speech breath (and extralinguistic) measures and the behaviour and personality characteristics. The Number of Inspirations (NI) showed significant positive association with Anxiety, Extraversion and Mean Latency of Response. It is likely these associations occurred as a result of the highly significant association between the NI and the Duration of Utterances (Appendix 9, b) which was associated with Anxiety, Extraversion and reflection (Mean Latency of Response). There were no significant correlations between the speech breath frequency variables and the independent variables except of the Ventilation Index measures, VIW and VIS, which showed a marginally significant association with Anxiety ($p < .052$).

In summary, there were no significant associations between the speech breath frequency measures and the behaviour and personality characteristics, except of the Ventilation Index variables which showed a nearly significant association with Anxiety. A similar but significant association was observed between the Ventilation Index measures and Anxiety on the picture description task.

Summary and Remarks

The predicted significant correlations between the speech breath activity and the anxiety measures were confirmed on the picture description task.

C. Summary

Eighteen children, who met the selection criteria, participated in the experiment. Their mean age was 10.9 years (age range 8 years 10 months to 12 years 8 months). There were 11 males and seven females. All Ss were physically healthy, except one who had peptic ulcer; none showed neurological abnormalities; 16 were fully right handed. Sixteen came from the three lower socioeconomic classes (Blishen, 1968). It should be noted that the socioeconomic background of most children referred to the Child Psychiatric Service where the Ss were seen, is generally low.

Nine Ss were classified in each of the conduct and anxiety groups. There were eight males and one female in the conduct group and three males and six females in the anxiety group. Two males Ss of the conduct group showed, also, obvious emotional disturbance and could be classified as mixed cases of conduct and anxiety disorder. On the Behaviour Problem Checklist there were significant differences between

the groups on the measures of Conduct ($p < .001$) and Socialized Delinquency ($p < .05$). No significant differences were observed between the groups on the Junior EPI. On the Matching Familiar Figures Test, significant differences were observed on the measure Errors ($p < .05$); the conduct group made more Errors. The mean IQ (WISC-R) of the Ss was 96.8, SD 9.6 (Verbal $\bar{x}$ 94.7, SD 11; Performance $\bar{x}$ 99.2, SD 9.7).

All Ss responded promptly to the request to count and describe the content of the three pictures. Twelve Ss were able to tell a story promptly upon the formal request; the remaining six told a story after some encouragement; no initial hesitation measures were recorded on the story of these six Ss.

Three sets of measurements resulted from the three verbal tasks. They were those of counting, initial and final, the description of the three pictures and the story. Since there were no significant differences among the measurements on the three pictures, their mean was used in all further analyses. The measurements were 20 (13 extralinguistic, 7 speech breath) for each of the picture and story tasks, and 10 (6 extralinguistic, 4 speech breath) for each counting.

Analyses of the measurements on the pictures and the story showed that the data were normally distributed. Some of the measures, however, showed increased kurtosis and skew to the left; the Average Length of Pauses (ALP) showed these characteristics on both the pictures and story measurements. Correlation matrices among each set of data allowed the identification of the interrelations of the variables and their groupings. On the basis of the intercorrelations the variables were grouped as follows: Extralinguistic variables: (a) output of speech (Duration of Utterances, Total Verbal Output Words and Syllables),

(b) pausing (Number of Pauses, Total Pause Time, Average Length of Pauses, Relative Pause Time, Silent Pause Ratio), (c) initial hesitation (Initial Hesitation, Initial Relative Hesitation), (d) speech rate (Speech Rate Words and Syllables), and (e) Articulation Rate. The speech breath activity variables were grouped in (a) speech breath, number and frequency (Number of Inspirations, Frequency of Inspirations, Speech Breath Rate), and (b) output of speech per breath (Output of Speech per Breath Words and Syllables, Ventilation Index Words and Syllables).

In the statistical procedures, the t-test was used for the comparison between the extralinguistic and speech breath variables of the conduct and anxiety groups. Discriminant function analysis was also used to determine whether the two clinical groups could be distinguished on the extralinguistic variables. The Pearson product-moment correlation analysis was employed to determine the associations of the extralinguistic and speech breath variables with the behaviour and personality characteristics. All statistical procedures were carried out on SPSS programs.

The suggested differences of the extralinguistic measures between the conduct and anxiety group were confirmed on the picture description task. The Ss of the conduct group hesitated less starting to talk. On the t-test the groups differed significantly on the Initial Relative Hesitation (IRH) ($p < .05$) and the discriminant function analysis distinguished the groups significantly on two variables, the Average Length of Pauses (ALP) and Initial Relative Hesitation (IRH). The differences between the groups on the story task were non-significant. The difference on the automatic speech (counting) were in a direction not compatible with the hypothesis. The conduct group showed longer pausing and slower Articulation Rate. It was suggested that differences

associated with Sex and Verbal IQ confounded the results. In the final counting nevertheless, the conduct group paused less and showed increased Articulation Rate.

The correlations between the extralinguistic measures and the behaviour and personality characteristics were largely in line with the hypothesis and confirmed the results of the comparison between the groups. Measures of disturbance of conduct (Conduct, Socialized Delinquency) showed positive associations with pausing on the counting task (see previous paragraph). On the picture description and story telling tasks a number of significant correlations were observed between the behaviour and personality and the extralinguistic measures. The significant associations may be distinguished in two groups; first, those involving measures of conduct and anxiety (Conduct, Anxiety, Neuroticism), and second, the associations involving more stable personality characteristics such as reflection and extraversion. Of the measures of conduct and anxiety, Anxiety showed positive association with Initial Hesitation (IH) ($p < .05$) and Neuroticism negative association with Duration of Utterances (DU) ($p < .05$) both on the picture description task. Conduct showed negative association with Initial Hesitation ($p < .05$) and Anxiety positive association with Total Pause Time (TPT) ($p < .01$) both on the story task. Reflection (Mean Latency of Response) showed positive significant association with Initial Hesitation and the verbal output variables, on both the picture and story telling tasks. Extraversion showed negative association with Silent Pause Ratio (SPR) ($p < .05$), which measures the frequency of pauses, positive with the Speech and Articulation Rate (SRW, SRS, AR) on the picture task, and positive with the verbal output variables (TVOW, TVOS) ($p < .05$) on the story task.

Speech breath activity differences between the conduct and anxiety disorder groups predicted in the hypothesis were not confirmed. The anxiety group did not show increased breathing activity either on the picture or the story telling task. Contrary, however, to the hypothesis, the conduct group showed decreased Output of Speech per Breath Syllables ($p < .05$) on both the initial and final counting (Tables 17 and 18) which was possibly associated with the slower overall counting in that group.

The predicted positive correlations between the speech breath activity and the anxiety measures were confirmed on the picture description task. Positive association was observed between Speech Breath Rate (SBR) and Neuroticism ($p < .05$) and between Ventilation Index Syllables (VIS) and Anxiety ($p < .05$). On the story telling task the correlation between the same variables were non-significant with the exception of the Ventilation Index measures (VIW, VIS), which showed a marginally significant association with Anxiety ($p < .052$).

To conclude, in the comparison between the groups, the conduct disorder group showed (a) slower counting, contrary to the hypothesis, possibly as a result of Sex and Verbal IQ differences, (b) significantly shorter initial relative hesitation on the picture description task, which was in line with the hypothesis, (c) no differences with the anxiety disorder group on the story telling task, which was contrary to the hypothesis. In the correlation analyses the measures of (a) conduct showed positive association with slower counting, (b) the measures of anxiety and reflection showed positive association with increased initial hesitation and overall pausing on both the picture description and story telling tasks, which was in line with the hypothesis, although the association did now show increased significance on the story task as it had been predicted.

No differences were observed between the conduct and anxiety disorder groups on the speech breath activity variables on both the picture description and story telling tasks. Significant correlations between the speech breath measures and measures of anxiety were observed on the picture task.

IV. FOLLOW-UP STUDY

A. Hypothesis

Improvement in subjects with conduct disorder will be associated with a change in those extralinguistic measures that are associated with reflection and cognitive planning. The change will be in the direction indicating increased reflection and cognitive planning. Subjects with anxiety disorder whose condition improves will show corresponding decrease in the frequency of the speech breathing activity.

B. Method

1. Subjects

(a) Clinical assessment

Ten out of the 18 Ss who participated in the main investigation (#4, 5, 6, 7, 8, 10, 11, 12, 13, 14) were involved in the follow-up study. Of the remaining eight, four failed to attend for the follow-up assessment and experiment and four were not considered for inclusion in the sample because their participation in the main experiment was recent and their treatment was still going on at the time of completion of the study. The mean length of time between the main investigation and follow-up experiment was 4.9 months (SD 1.2, range 3½ to 8 months). Five subjects belonged to the original conduct disorder and five to the anxiety disorder group.

The treatment offered to the Ss, from the first appointment at the Child Psychiatric Service till the follow-up assessment and

experiment which coincided with the termination of any active treatment, consisted of out-patient sessions of psychotherapy with the child and counselling with the parent(s). Two Ss (#10, 12) were also treated as in-patients at the Psychiatric Unit (17 and 23 days, respectively). The mean number of treatment sessions per subject was 6.2 (SD 1.8, range 3 to 9). No one was on medication at the time of the reassessment.

The clinical reassessment of the Ss involved first, an overall behavioural description made by the parents and filling the Macfarlane scale by the investigator, and second, observation of the Ss during the sessions with them.

Clinically, nearly all Ss showed improvement. In some, the improvement was considerable and in others it was limited. In the conduct disorder group, one subject (#4) showed impressive change of behaviour with only five sessions of psychotherapy and counselling. His relationship with his parents improved a great deal; he became cooperative both at home and school, stopped stealing and fighting with other boys and started to make friends. The other Ss in the conduct disorder group showed less impressive change. In the anxiety group the two Ss (#10, 12) who were hospitalized for a short period of time showed pronounced improvement. The girl (#10) with the conversion contracture of the left leg recovered completely and showed no other symptoms or signs of psychological disturbance on follow-up. The boy (#12) with the extreme anxiety, fears and peptic ulcer, was much less anxious, was free of excessive fears and had no symptoms of ulcer. Two other Ss (#11, 13) showed mediocre improvement and one (#14) did not show any. The mother of this last subject, declined further treatment (total number of sessions, three) because she

remained unconvinced that the 'back pain' of the child was of an emotional nature.

The Ss who did not participate in the follow-up study did not differ appreciably from those who participated, in terms of age and IQ (Table 29). They were three males and one female in the conduct disorder group and three females and one male in the anxiety disorder group. By the time this study was terminated most of them had shown improvement. In the conduct group, subject #1 was not presenting serious stealing problems at school as a report indicated; subject #2 was not any better; subject #3 did not present any more night terrors and sleepwalking episodes, but her social behaviour changed little. In the anxiety group, subject #17, the boy with school refusal, was back at school; subject #15 was being treated on another service and subjects #16 and 18 were still under treatment.

(b) Assessment on the Behaviour Problem Checklist (BPC) and the Junior Eysenck Personality Inventory JEPI). Comparison with the main investigation scores

All Ss were rated on the BPC by the same parent who had rated the subject on the main investigation assessment. All Ss answered the JEPI. The scores of each subject on both the BPC and JEPI are shown in Table 30 alongside the scores on the same measures in the main investigation assessment. The t-test between the scores of the main and follow-up assessment for each of the two clinical groups (Table 31) showed no significant differences in the conduct disorder group. In the anxiety disorder group the score of Anxiety was lower in the follow-up assessment but the difference did not become significant; a similar lowering in the Neuroticism score became marginally significant ($.10 > p > .05$). It is obvious from the comparison between the

Table 29

Sex, Age, and Full IQ of the Participating and Non-Participating Subjects in the Follow-Up Study

	Participating Ss				Non-Participating Ss			
	Subject #	Sex	Age in Months	Full IQ	Subject #	Sex	Age in Months	Full IQ
Conduct	4	M	141	96	1	M	106	118
	5	M	124	86	2	M	141	102
	6	M	119	108	3	F	127	95
	7	M	129	91	4	M	141	98
	8	M	130	105				
		$\bar{x}$	128.6	97.2		$\bar{x}$	128.7	103.2
		SD	7.3	8.3		SD	14.3	8.9
Anxiety	10	F	137	88	15	F	136	105
	11	F	137	102	16	F	152	-
	12	M	143	96	17	M	126	82
	13	M	125	100	18	F	137	99
	14	F	118	94				
		$\bar{x}$	132.0	96.0		$\bar{x}$	137.7	95.3
		SD	9.1	4.9		SD	9.3	9.7

TABLE 30

Scores on the Behaviour Problem Checklist and the JEPI of the 10 Ss
Main (M) and Follow-up (F) Assessment

Group	Subject #	Conduct M	Conduct F	Anxiety M	Anxiety F	Immaturity M	Immaturity F	Social del. M	Social del. F	Extraversion M	Extraversion F	Neuroticism M	Neuroticism F	Lie M	Lie F
Conduct	4	17	11	11	6	9	6	4	2	14	17	15	13	1	1
	5	29	24	6	10	6	1	1	2	17	17	18	22	4	4
	6	17	13	6	3	3	2	0	0	12	14	11	15	0	2
	7	17	21	7	7	2	6	0	0	16	20	16	14	6	3
	8	18	24	22	24	3	4	0	0	23	20	17	23	4	3
	$\bar{x}$	19.6	18.6	10.4	10.0	4.6	3.8	1.0	0.8	16.4	17.6	15.4	17.4	3.0	2.6
	SD	5.3	6.2	6.8	8.2	2.9	2.3	1.7	1.1	4.2	2.5	2.7	4.7	2.4	1.4
Anxiety	10	6	5	2	5	0	3	1	1	16	17	19	11	5	1
	11	14	5	19	18	6	3	0	0	5	4	14	12	0	3
	12	10	10	22	14	6	7	0	1	15	18	20	13	4	3
	13	9	4	19	13	6	4	0	0	12	11	19	6	2	5
	14	2	5	10	6	2	3	0	1	19	19	11	12	7	5
	$\bar{x}$	8.2	5.8	14.4	11.2	4.0	4.0	0.2	0.6	13.4	13.8	16.6	10.8	3.6	3.4
	SD	4.5	2.4	8.3	5.5	2.8	1.7	0.5	0.5	5.3	6.3	3.9	2.8	2.7	1.7

TABLE 31

Comparison between the Scores on the Main and Follow-up Assessment within the Groups, of the Behaviour and Personality Variables (t test; 10 Ss)

	Variable	Assessment	$\bar{x}$	SD	t value
Conduct	Conduct	Ma	19.60	5.27	.40
		Fo	18.60	6.19	
	Anxiety	Ma	10.40	6.80	.25
		Fo	10.00	8.22	
	Immaturity	Ma	4.60	2.88	.51
		Fo	3.80	2.28	
	Soc. delinq.	Ma	1.00	1.73	.41
		Fo	0.80	1.09	
	Extraversion	Ma	16.40	4.16	.97
		Fo	17.40	2.51	
	Neuroticism	Ma	15.40	2.70	1.20
		Fo	17.40	4.72	
	Lie	Ma	3.00	2.45	.49
		Fo	2.60	1.14	
Anxiety	Conduct	Ma	8.20	4.49	1.15
		Fo	5.80	2.39	
	Anxiety	Ma	14.40	8.26	1.65
		Fo	11.20	5.54	
	Immaturity	Ma	4.00	2.83	0.0
		Fo	4.00	1.73	
	Soc. delinq.	Ma	0.20	0.45	1.63
		Fo	0.60	0.55	
	Extraversion	Ma	13.40	5.32	.53
		Fo	13.80	6.30	
	Neuroticism	Ma	16.60	3.91	2.38
		Fo	10.80	2.70	(p <.076 two-tail
	Lie	Ma	3.60	2.77	.14
		Fo	3.40	1.67	

Levels of significance * .05 two-tail
** .01 " "

scores of the two assessments that the modest clinical improvement of the Ss in the conduct disorder group did not become apparent on the BPC and the JEPI measures except for subject #4 (Table 30), who was the subject who had shown considerable clinical improvement. The clinical improvement, however, of the anxiety disorder group was paralleled by the scores on the Anxiety measure of the BPC and Neuroticism of the JEPI.

The comparison between the scores of the five conduct and five anxiety disorder Ss on the main and follow-up assessments (Table 32), showed that the groups differed significantly ($p < .01$) on the Conduct measure in both assessments and on Neuroticism ($p < .05$) in the follow-up assessment. The Neuroticism scores dropped in the anxiety disorder group but remained high in the conduct disorder group.

2. Experimental Procedure

The experimental procedure was a repetition of the previous, main investigation procedure. It took place in the same room and under exactly the same conditions which prevailed in the main investigation experiment. The subject sat in the same chair and faced the investigator from the same angle. The subject was asked if he or she wouldn't mind if "we did once more the experiment" we had done a few months earlier. All children cooperated in the experiment. The requests to the subject were, in sequence, to count from 1 to 30, describe the content of the same three pictures (Coughran & Liles, 1976) (p. 37) presented in random order, tell a personal story (Gottschalk, 1975) (p. 41), and to count again from 1 to 30.

No subject was hesitant on the picture description task but on the story task only four Ss, out of 10, responded promptly to the

TABLE 32

Comparison between the Conduct and Anxiety Groups on the Behaviour and Personality Variables in the Main and Follow-up Assessment (t test; 10 Subjects)

		Main Assessment			Follow-up Assessment		
Variable	Group	$\bar{x}$	SD	t value	$\bar{x}$	SD	t value
Conduct	Cond.	19.60	5.27	3.68**	18.60	6.19	4.31**
	Anx.	8.20	4.49		5.80	2.39	
Anxiety	Cond.	10.40	6.80	.84	10.00	8.22	.27
	Anx.	14.40	8.26		11.20	5.54	
Immaturity	Cond.	4.60	2.88	.33	3.80	2.28	.16
	Anx.	4.00	2.83		4.00	1.73	
Soc. delinq.	Cond.	1.00	1.73	1.0	0.80	1.09	.37
	Anx.	0.20	0.45		0.60	0.55	
Extraversion	Cond.	16.40	4.16	.99	17.60	2.51	1.25
	Anx.	13.40	5.32		13.80	6.30	
Neuroticism	Cond.	15.40	2.70	.56	17.40	4.72	2.69*
	Anx.	16.60	3.91		10.80	2.77	
Lie	Cond.	3.00	2.45	.37	2.60	1.14	.88
	Anx.	3.60	2.70		3.40	1.67	

Levels of significance * .05 two-tail
** .01 " "

request for a personal story; five more Ss responded with a story after some encouragement, and one (#10) was unable to tell a story; this female subject had, also, the greatest difficulty in telling a story in the main investigation experiment. The Ss in the conduct disorder group had less difficulty in telling a story since three out of the five responded promptly; those of the anxiety disorder group had most difficulty; only one responded promptly to the request. Furthermore, the length of the story told by most Ss was shorter than in the main investigation experiment. The scores of each subject on the extra-linguistic and speech breath measures on both the picture description and story telling tasks are given in Appendix 11.

With the exception of a few (#5, 13, 14) the Ss appeared to feel comfortable during the experiment. Subject #4 was shy, relaxed and spoke in a leisurely fashion; this contrasted sharply with his behaviour in the main investigation experiment during which he was tense, spoke fast and in a staccato voice. This was the male subject who had shown the greatest clinical improvement among all Ss in the conduct disorder group. Subject #5 was as tense and fidgety as he had been in the main investigation experiment. Among the Ss of the anxiety disorder group the performance of Ss #10, 11, 12 was unremarkable, but the volume of the voice of subject #13 dropped, as it had done in the main investigation experiment, and subject #14 was also tense and fidgety.

C. Results

1. Introduction

The results of the follow-up study should be considered only as tentative because they are based on only 10 of the original Ss. All comparisons between the follow-up and main investigation measures, which will be reported, were carried out between the measures of the same 10 Ss on each experiment.

2. Description of Extralinguistic and Speech Breath Measures

The mean of the three pictures was used on all extralinguistic and speech breath measures, including the Initial Hesitation (IH), because there were no significant differences between the measures on each picture except of the IH in the anxiety disorder group (Figure 4). The amount of speech elicited on both the picture description and story tasks, measured in syllables, was very similar to that of the main investigation experiment and allowed reliable extralinguistic measurements. The mean number of syllables was 78 on the pictures and 132 on the story.

Table 33 shows the mean, standard deviation, variance, kurtosis and skew of all 20 variables (extralinguistic and speech breath activity) on the pictures task. The measures were normally distributed, as they had been in the main investigation experiment. At follow-up, however, fewer measures showed increased kurtosis and skew to the left (Average Length of Pauses, Ventilation Index Words). Table 34 shows the descriptive statistics of the measures on the story task. The measures were again normally distributed and increased kurtosis and skew to the left were observed on the Number of Pauses

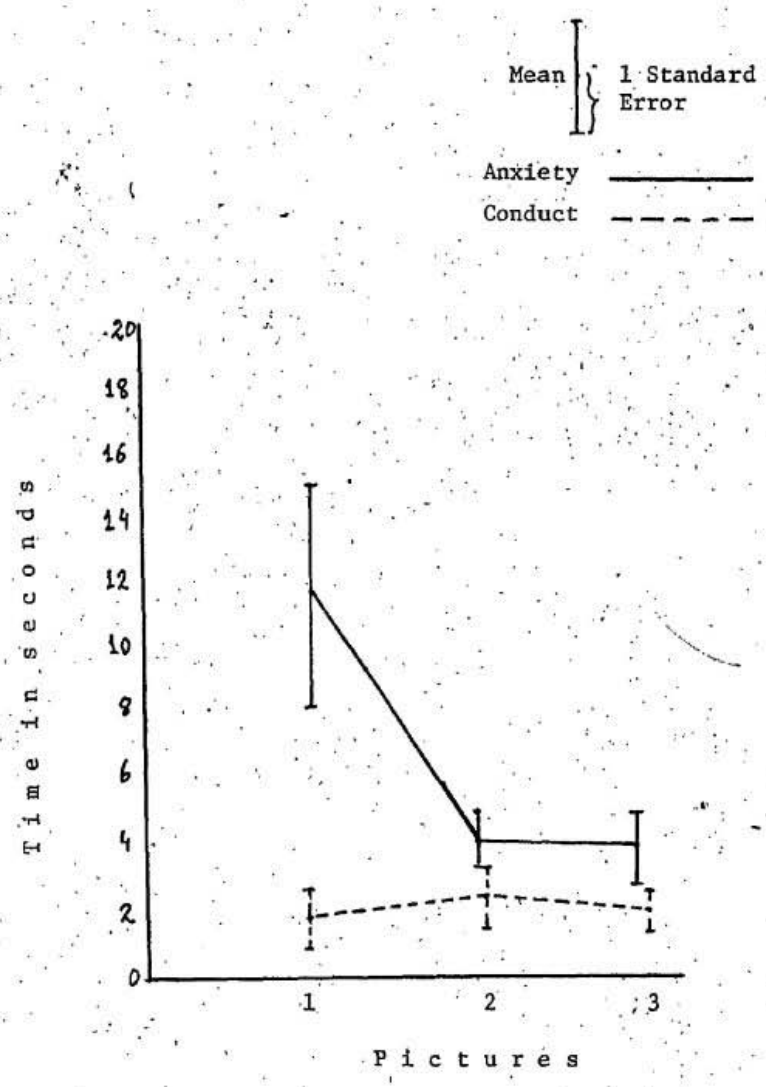

Figure 4. Initial Hesitation on the Three Pictures.
Conduct and Anxiety Disorder Groups.
Mean and Standard Error.
Follow-up Experiment.

TABLE 33

Extralinguistic and Speech Breath Variables: Pictures, Follow-up Experiment
Descriptive Statistics

Variable	Mean	SD	Variance	Kurtosis	Skewness
Duration of utterances in seconds	30.92	7.65	58.51	-0.89	-0.31
Total verbal output, words	60.47	17.34	300.78	-1.62	-0.34
Total verbal output, syllables	78.40	19.60	384.17	-1.31	-0.48
Number of pauses	15.82	4.96	24.58	0.83	0.91
Total pause time in seconds	13.92	5.27	27.77	0.10	0.37
Average length of pauses	0.88	0.30	0.09	6.87	2.43
Relative pause time	0.44	0.09	0.008	-0.17	0.72
Silent pause ratio	0.28	0.08	0.006	0.22	0.78
Initial hesitation in seconds	4.62	3.20	10.22	1.06	1.22
Initial relative hesitation	0.13	0.07	0.006	-1.32	0.68
Speech rate, words	2.01	0.53	0.28	-0.52	-0.15
Speech rate, syllables	2.60	0.60	0.37	-0.52	0.07
Articulation rate	4.66	0.62	0.39	-1.23	0.53
Number of inspirations	6.96	2.26	5.12	2.03	1.02
Frequency of inspirations	4.56	1.03	1.07	-0.09	0.71
Speech breath rate	0.23	0.05	0.002	-0.30	-0.71
Output of speech per breath, words	9.46	2.61	6.81	2.05	0.61
Output of speech per breath, syllables	12.26	2.91	8.44	1.24	0.48
Ventilation index, words	11.14	4.02	16.14	4.10	1.71
Ventilation index, syllables	8.75	2.27	5.16	1.66	1.03

TABLE 34

Extralinguistic and Speech Breath Variables: Story, Follow-up Experiment
Descriptive Statistics

Variable	Mean	SD	Variance	Kurtosis	Skewness
Duration of utterances in seconds	45.14	17.56	308.41	2.38	1.05
Total verbal output, words	109.51	38.92	1514.53	-0.01	0.88
Total verbal output, syllables	132.00	48.37	2340.00	0.44	0.96
Number of pauses	21.11	11.33	128.36	3.31	1.57
Total pause time in seconds	18.27	8.51	72.45	-0.13	0.33
Average length of pauses	0.93	0.40	0.16	-1.70	0.43
Relative pause time	0.40	0.10	0.01	-0.93	-0.10
Silent pause ratio	0.19	0.04	0.002	-0.87	0.16
Initial hesitation in seconds	18.55	11.93	142.22	-5.00	0.17
Initial relative hesitation	0.26	0.14	0.02	-2.02	0.71
Speech rate, words	2.51	0.53	0.28	-1.12	0.71
Speech rate, syllables	3.02	0.64	0.40	-0.99	0.18
Articulation rate	4.98	0.56	0.32	0.71	0.41
Number of inspirations	10.87	4.42	19.55	-0.64	0.47
Frequency of inspirations	4.37	1.52	2.31	0.439	0.72
Speech breath rate	0.25	0.09	0.007	-0.64	0.62
Output of speech per breath, words	1.08	0.28	0.08	5.48	2.23
Output of speech per breath, syllables	1.33	0.41	0.17	5.72	2.29
Ventilation index, words	0.97	0.18	0.03	2.53	-1.40
Ventilation index, syllables	0.80	0.17	0.03	2.58	-1.42

and all four output speech per breath variables (Output of Speech per Breath Words and Syllables, Ventilation Index Words and Syllables).

3. Follow-up and Main Investigation Measures Compared on all Three Verbal Tasks

Comparisons between the measures in the follow-up and the main investigation experiments were carried out in order to determine whether the group measures varied from the one experiment to the other.

(a) Conduct disorder group (5 subjects)

On the automatic speech task, the Total Time to count, on both the initial ($\bar{x}$ 14.2, SD 4.3) and final ($\bar{x}$ 13.3, SD 3.5) counting, was shorter on the corresponding tasks of the main investigation experiment (initial $\bar{x}$ 18.1, SD 1.6; final $\bar{x}$ 16.2, SD 3.1).

On the picture description task (Table 35) there were no significant differences between the main investigation and follow-up measures. An obvious trend, however, was observed towards speedier speech. The Duration of Utterances (DU) and the initial hesitation measures (Initial Hesitation IH, Initial Relative Hesitation IRH) were shorter, the Speech Rate Syllables (SRS) and the Articulation Rate (AR) were increased, the latter having become marginally significant ($p < .10$). The length (Average Length of Pauses ALP) and frequency of pauses (Silent Pause Ratio SPR) showed no appreciable change between the two experiments. Likewise, there were no differences on the speech breath measures.

On the story telling task (Table 36) there were no significant differences between the measures of the two experiments. The measures of verbal output were lower on follow-up (Duration of Utterances DU, Total Verbal Output Words TVOW, and Syllables TVOS). The length and

TABLE 35

Conduct Disorder Group
(Subjects #4, 5, 6, 7, 8)

Extralinguistic and Speech Breath Measures on the Main Investigation and Follow-up Assessment

Picture Description Task

Variable	Main Investigation		Follow-up		
	Mean	SD	Mean	SD	t value
DU	38.80	9.98	32.84	4.65	1.35
TVOW	80.38	25.40	72.08	7.88	.66
TVOS	99.06	25.28	92.00	8.01	.58
NP	19.06	5.55	16.64	3.27	.87
TPT	14.66	4.30	13.50	2.04	.54
ALP	0.80	0.22	0.81	0.11	.14
RPT	0.38	0.08	0.41	0.04	.74
SPR	0.25	0.04	0.23	0.05	.48
IH	4.20	1.87	2.54	1.09	1.58
IRH	0.11	0.05	0.07	0.02	1.23
SRW	2.06	0.17	2.22	0.38	.76
SRS	2.55	0.16	2.83	0.40	1.61
AR	4.33	0.90	4.82	0.71	2.09
NI	8.52	2.86	7.86	2.55	.42
FI	4.60	1.09	4.46	1.09	.33
SBR	0.23	0.05	0.23	0.05	.20
OSPBW	10.14	2.23	10.24	2.82	.08
OSPBS	12.66	2.86	12.92	3.24	.19
VIW	10.28	2.16	10.28	2.16	.0
VIS	8.14	1.76	8.14	1.77	.08

Levels of significance * 0.05 two-tail
** 0.01 " "

TABLE 36

Conduct Disorder Group
(Subjects #4, 5, 6, 7, 8)

Extralinguistic and Speech Breath Measures on the Main Investigation and Follow-up Assessments

Story Telling Task

Variable	Main Investigation		Follow-up		
	Mean	SD	Mean	SD	t value
DU	60.68	47.44	37.00	10.77	1.17
TVOW	153.20	92.71	105.00	35.11	1.10
TVOS	180.20	106.18	126.60	40.60	1.05
NP	32.40	32.65	17.60	7.13	1.07
TPT	23.10	22.77	12.78	4.95	1.08
ALP	0.74	0.11	0.79	0.43	.25
RPT	0.35	0.06	0.34	0.10	.23
SPR	0.18	0.06	0.17	0.04	.69
IH (2 Ss)	11.80	1.41	19.90	16.26	.77
IRH "	0.13	0.08	0.29	0.20	.80
SRW	2.73	0.35	2.86	0.45	.91
SRS	3.24	0.53	3.45	0.46	1.19
AR	5.00	0.61	5.00	0.61	.0
NI	17.00	14.19	10.40	5.03	1.01
FI	3.94	1.44	4.02	1.87	.07
SBR	0.27	0.08	0.28	0.10	.17
OSPBW	10.92	5.01	10.98	3.56	.02
OSPBS	13.12	6.57	13.48	5.41	.09
VIW	10.36	3.55	9.68	2.33	.40
VIS	8.84	3.27	8.08	2.23	.46

Levels of significance * 0.05 two-tail
** 0.01 " "

frequency of pauses (ALP, SPR) showed no change between the two experiments. No reliable assessment of the initial hesitation measures could be made. There were no differences on the speech breath measures.

To conclude, although there were no significant differences between the measures on the main investigation and follow-up experiments, a trend was observed in all three verbal tasks for faster speech and lower verbal output. On the picture description task measures of reflection (IH, IRH) were shortened but measures of cognitive planning (ALP, SPR) remained unchanged, and both the SRS and AR became faster. The overall variation of the measures, although non-significant, was in direction opposite to the predicted in the hypothesis.

Because the clinical improvement in the conduct disorder group was not great and perhaps this was the reason the results were not in favour of the hypothesis, the measures of subject #4, who showed the greatest clinical improvement, might provide some evidence about the direction the extralinguistic measures may vary in association with definite clinical improvement. Table 37 shows the measures of subject #4 on both experiments. It is obvious the measures of this subject followed the overall pattern of lower verbal output and faster speech and articulation rate. There was no change in the initial hesitation measures which remained short. The length of the pauses (ALP), however, became longer on both the picture description and story telling tasks on follow-up and their frequency dropped. Furthermore, the output of syllables per breath increased mainly in the story telling task. It may be concluded that the clinical improvement in this subject was associated with longer, as predicted in the hypothesis, but less frequent pauses.

TABLE 37

Extralinguistic and Speech Breath Measures on the Picture Description and Story Telling Tasks of Subject #4

Variable	Pictures		Story	
	Main invest.	Follow-up	Main invest.	Follow-up
DU	44.5	30.3	48	36
TVOW	80.3	75	128	86
TVOS	103	91	145	115
NP	22.3	14	23	11
TPT	20.3	13.6	17.7	17
ALP	0.89	0.97	0.77	1.54
RPT	0.45	0.45	0.37	0.47
SPR	0.29	0.19	0.18	0.13
IH	2.7	3.0	3.0	–
IRH	0.05	0.09	0.06	–
SRW	1.84	2.47	2.67	2.39
SRS	2.37	3.0	3.02	3.19
AR	4.24	5.45	4.78	6.05
NI	7.0	5.0	14	5
FI	5.4	6.1	3.4	7.2
SBR	0.18	0.16	0.29	0.14
OSPBW	12.6	15.0	9.1	17.2
OSPBS	16.0	18.2	10.3	23.0
VIW	7.9	6.7	10.9	5.8
VIS	6.2	5.5	9.6	4.3

(b) Anxiety disorder group (5 subjects)

On the automatic speech task, the Total Time to count did not differ between the initial ($\bar{x}$ 14.6, SD 0.8) and final ($\bar{x}$ 14.1, SD 2.6) counting (main investigation countings, initial $\bar{x}$ 16.5, SD 5.9, final $\bar{x}$ 14.9, SD 4.3).

On the picture description task (Table 38) no significant differences were observed between the follow-up and the main investigation measures. There were, however, some trends of change in the pausing, speech rate and output of speech per breath variables. The length of pauses (ALP) became shorter in the follow-up experiment, the speech rate (SRW, SRS) became faster and the Output of Speech per Breath Syllables (OSPBS) increased to become marginally significant ($.10 > p > .05$).

On the story telling task (Table 39) significant differences were observed on the output of speech per breath variables ($p < .05$) (OSPBS, VIS). This indicates that the output per breath was higher in the follow-up experiment. There was, also, a drop in the frequency of inspirations (FI, SBR). The frequency of pauses (Silent Pause Ratio SPR) decreased, but the difference did not become significant.

To conclude, the anxiety disorder group showed shorter pauses (ALP) on the picture description task and less frequent pauses (SPR) on the story telling task; none of these changes were significant though. The observed differences on the output of speech per breath variables were in line with the hypothesis which predicted that decrease will occur in the frequency of speech breath activity in association with clinical improvement. What in fact was observed was increase of speech output per breath rather than drop in the frequency of breathing.

TABLE 38

Anxiety Disorder Group
(Subjects #10, 11, 12, 13, 14)

Extralinguistic and Speech Breath Measures on the Main Investigation and Follow-up Assessments

Picture Description Task

Variable	Main Investigation		Follow-up		
	Mean	SD	Mean	SD	t value
DU	35.44	10.62	29.00	10.04	.96
TVOW	53.54	12.29	48.86	16.66	.48
TVOS	70.52	14.90	64.80	18.38	.47
NP	15.52	5.17	15.00	6.55	.16
TPT	19.24	9.98	14.34	7.61	1.00
ALP	1.31	0.78	0.95	0.43	2.00
RPT	0.51	0.13	0.47	0.11	1.23
SPR	0.30	0.04	0.32	0.09	.68
IH	9.56	11.06	6.70	3.31	.75
IRH	0.20	0.18	0.18	0.07	.31
SRW	1.59	0.43	1.81	0.61	1.90
SRS	2.09	0.55	2.38	0.74	1.96
AR	4.47	1.01	4.49	0.54	.04
NI	7.57	1.65	6.40	1.80	1.50
FI	4.87	0.99	4.95	1.01	.19
SBR	0.21	0.04	0.22	0.05	.26
OSPBW	7.30	2.52	8.20	2.51	1.33
OSPBS	9.50	2.93	11.02	2.77	2.77
VIW	16.47	7.88	16.47	7.88	.0
VIS	12.12	5.22	9.85	2.91	1.80

Levels of significance * 0.05 two-tail
** 0.01 " "

TABLE 39

Anxiety Disorder Group
(Subjects #11, 12, 13,14)

Extralinguistic and Speech Breath Measures on the Main Investigation and Follow-up Assessments

Story Telling Task

Variable	Main Investigation Mean	Main Investigation SD	Follow-up Mean	Follow-up SD	t value
DU	45.88	8.00	44.26	30.44	.13
TVOW	99.20	33.74	92.20	66.29	.19
TVOS	114.40	36.26	111.00	82.46	.08
NP	22.60	7.16	20.40	17.36	.33
TPT	21.08	12.31	20.10	12.73	.16
ALP	1.10	0.99	0.89	0.56	.48
RPT	0.44	0.17	0.37	0.21	.61
SPR	0.24	0.09	0.17	0.10	1.70
IH (1 subj.)	7.20		26.00		
IRH "	0.11		0.31		
SRW	2.25	0.85	1.65	0.93	.92
SRS	2.58	0.89	1.98	1.14	.81
AR	4.59	0.56	4.58	0.56	.0
NI (3 Ss)	11.33	1.55	11.67	4.04	.14
FI "	4.27	1.46	4.97	0.49	1.08
SBR "	0.25	0.07	0.20	0.02	1.39
OSPBW "	6.90	1.39	10.40	1.00	3.55
OSPBS "	8.20	1.15	12.93	1.17	6.36*
VIW "	14.97	3.41	9.67	1.00	2.55
VIS "	12.43	1.83	7.77	0.71	4.75*

Levels of significance * 0.05 two-tail
** 0.01 " "

4. Changes in the Extralinguistic and Speech Breath Measures Associated with the Clinical Improvement

The effect of the clinical change on the extralinguistic and speech breath variables could be studied in comparisons between the measures of the improved with the non-improved Ss in each of the conduct and anxiety disorder groups. However, because the number of Ss in each group was very small such comparisons between improved and non-improved Ss could not be made. Instead, other observations were attempted. First, the direction of change was observed from the main to the follow-up experiment on selected extralinguistic and speech breath measures. Aim of the observation was to determine whether there was any consistent pattern of change associated with clinical improvement. Second, the extralinguistic characteristics were briefly described of three selected Ss who appeared to present a distinct pattern of change in the extralinguistic measures from the main to the follow-up experiment. Aim of this observation was to point to the possibility of a variety of extralinguistic styles within each clinical group.

The observations in this part of the study should be considered only as hypotheses which could be tested in further studies.

(a) Direction of change in the measures

In order to identify possible changes in the extralinguistic and speech breath measures associated with clinical improvement, the following procedure was followed. First, the improvement of each subject was rated on a scale from 0 to 3 by combining the scores (Table 29) on the Behaviour Problem Checklist and the Junior EPI. Second, the scores on five extralinguistic and two speech breath measures of all

10 Ss, on both the main and follow-up experiments, were plotted on Tables 39, 40, and 41. The measures selected were those which were representative of groups of variables (Total Verbal Output Syllables (TVOS), Average Length of Pauses (ALP), Silent Pause Ratio (SPR), Initial Relative Hesitation (IRH), Articulation Rate (AR), and Frequency of Inspirations (FI), Output of Speech per Breath Syllables (OSPBS)).

Inspection of the Tables (40, 41, 42) showed that some measures presented a consistent pattern in the direction of change from the main to the follow-up experiment. The Articulation Rate (AR) was higher among most Ss on both verbal tasks and so was the Output of Speech per Breath Syllables (OSPBS) on the picture description task, in the follow-up experiment. The Average Length of Pauses (ALP) was longer in most Ss of the conduct disorder group and shorter in most Ss of the anxiety disorder group at follow-up. The direction of change in these measures did not appear to relate to the clinical improvement scores. It is suggested these changes were associated mainly with the repeat experiment itself. Perhaps, lower levels of test-anxiety experienced during the repeat experiment might have been responsible for the changes.

Other measures did not present a consistent pattern in their change except of the Initial Relative Hesitation (IRH) which showed increase on the picture description task at follow-up in the Ss who had an improvement score 2 or 3, with the exception of one subject (#13). The IRH in this subject (#13) was very long in the main experiment and dropped to the level of the other Ss in the same group at follow-up.

TABLE 40

Picture Description Task

Individual Scores on Selected Extralinguistic Variables on the Main Investigation (M) and Follow-up (F) Experiments

	Subject #	Improvement Score	Variables: TVOS M	TVOS F	ALP M	ALP F	SPR M	SPR F	IRH M	IRH F	AR M	AR F
Conduct	4	3	103	91	0.89	0.97	0.29	0.19	0.05	0.09	4.24	5.45
	5	1	77.7	90.3	1.14	0.76	0.22	0.19	0.17	0.05	5.85	5.66
	6	1	97.3	80	0.66	0.86	0.22	0.30	0.05	0.06	3.61	4.41
	7	1	73.7	100	0.60	0.66	0.30	0.28	0.15	0.10	3.67	3.96
	8	0	144.3	98.7	0.69	0.80	0.23	0.23	0.11	0.06	4.27	4.64
Anxiety	10	3	69.7	62.3	0.82	0.59	0.25	0.22	0.19	0.25	5.0	5.31
	11	2	64.3	61	0.88	0.82	0.33	0.26	0.19	0.24	3.15	3.98
	12	3	53.3	61	2.60	1.69	0.25	0.35	0.06	0.15	4.16	4.31
	13	2	71.3	95	0.75	0.79	0.33	0.34	0.50	0.20	4.22	4.74
	14	0	94	44.7	1.53	0.88	0.33	0.44	0.08	0.08	5.84	4.12

TABLE 41

Story Telling Task

Individual Scores on Selected Extralinguistic Variables on the Main Investigation (M) and Follow-up (F) Experiments

	Subject #	Improvement Score	Variables									
			TVOS		ALP		SPR		IRH		AR	
			M	F	M	F	M	F	M	F	M	F
Conduct	4	3	128	> 115	0.77	< 1.54	0.18	> 0.13	0.06	-	4.78	< 6.05
	5	1	68	< 75	0.92	> 0.54	0.13	< 0.14	-	-	5.94	> 5.24
	6	1	136	< 151	0.67	> 0.63	0.14	< 0.20	-	0.16	5.28	< 5.35
	7	1	122	< 181	0.63	> 0.50	0.17	> 0.14	0.19	> 0.15	4.50	< 5.08
	8	0	312	> 111	0.70	< 0.72	0.29	> 0.22	0.08	< 0.44	4.51	< 4.62
Anxiety	10	3	114	-	0.68	-	0.21	-	-	-	4.96	-
	11	2	92	< 95	0.74	< 1.21	0.21	> 0.19	0.15	-	4.40	< 5.11
	12	3	53	< 140	2.87	> 1.17	0.28	> 0.22	0.11	< 0.31	4.42	< 4.79
	13	2	145	> 93	0.72	< 1.39	0.14	< 0.18	-	-	5.30	> 4.11
	14	0	92	< 227	0.50	< 0.68	0.37	> 0.26	-	-	3.85	< 4.50

TABLE 42

Individual Scores on Selected Speech Breath Measures on the Main Investigation (M) and Follow-up (F) Experiments

	Subject #	Improvement Score	Picture Description Task FI M	FI F	OSPBS M	OSPBS F	Story Telling Task FI M	FI F	OSPBS M	OSPBS F
Conduct	4	3	5.4	< 6.1	16.0	< 18.2	3.4	< 7.2	10.3	< 23.0
	5	1	3.9	> 3.8	11.1	< 12.2	3.8	> 2.7	14.2	> 10.7
	6	1	6.1	> 4.5	15.5	> 10.6	6.4	> 3.7	24.1	> 12.6
	7	1	3.6	> 3.2	9.9	< 10.0	2.6	= 2.6	8.2	< 10.0
	8	0	4.0	< 4.7	10.8	< 13.2	3.5	< 3.9	8.8	< 11.1
Anxiety	10	3	-	3.5	-	13.9	-	-	-	-
	11	2	5.1	> 4.1	9.8	< 10.2	3.1	< 4.4	8.6	< 11.9
	12	3	3.6	< 4.5	5.3	< 7.5	5.9	> 5.3	6.9	< 12.7
	13	2	4.8	= 4.8	11.0	< 13.7	3.9	-	14.1	-
	14	0	6.0	< 6.4	11.9	< 12.7	3.8	< 5.2	9.1	< 14.2

(b) Extralinguistic characteristics of selected subjects

Three Ss (#4, 12, 13) who presented substantial clinical improvement and showed a distinct pattern of change in the extralinguistic characteristics will be discussed briefly.

The clinical improvement of subject #4 was reported in earlier sections of the follow-up study. He was a boy, 12 years of age, with longstanding unsocialized disturbance of conduct. The improvement this subject showed during the treatment period was very good. In the main investigation experiment his responses to the requests of the investigator were brisk and his Initial Hesitation on both the pictures and the story were short; the length of his pauses (ALP) was average but their frequency was high on the pictures task. His story, which was about an accident he had witnessed, was told with shorter and fewer pauses. In the follow-up experiment, on the pictures task, the IRH was longer, the verbal output lower, and the pauses longer and fewer. When he was asked to tell a story he could not think of any for a while, but when he told his story he spoke with longer and fewer pauses again. The output of speech per breath (OSPBS) was increased in the follow-up experiment, particularly on the story. This subject was obviously reflecting more before responding and was using longer pauses in the course of his responses. The changes shown by this subject fitted in well with the hypothesis of the follow-up study.

The second subject (#12) was a very anxious and fearful boy, 12 years of age, who improved a lot during the course of in- and out-patient treatment. In the main experiment, on the pictures task, his Initial Relative Hesitation (IRH) was short. The verbal output was low on both verbal tasks and his pauses were excessively long, longer than

in any other subject. In the follow-up experiment the IRH and the verbal output increased. The pauses became shorter. The output of speech per breath (OSPBS) increased on both verbal tasks but remained overall low; the low OSPBS was possibly related to the slow speech rate (SRS). The case of this subject seems to contradict at least one aspect of the hypothesis. Long pauses, which have been considered as evidence of increased cognitive planning, were present during the time his anxiety disorder was severe. Furthermore, the long pauses were not associated with increased verbal output as it would have been expected if long pauses were serving only cognitive planning and reflection. Instead, shorter pauses for him, but still long compared with the pauses of other Ss, were associated with clinical improvement on the follow-up experiment. Furthermore, the IRH was increased on both verbal tasks at follow-up, which indicates increased reflection. To conclude, the excessively long pauses in this subject during the first experiment did not indicate increased cognitive planning. It is suggested these long pauses were signs of anxious hesitation.

The third subject (#13) was a boy, age 10½ years, with severe anxiety disorder. He showed moderate improvement with treatment. In the main experiment he showed very long Initial Relative Hesitation (IRH), longer than any other subject, on the pictures, and could not think of any story for a while. When he started, however, either to describe the pictures or tell his story he spoke with relatively short and frequent pauses. At follow-up, the IRH on the pictures decreased to a level similar to that of the other Ss in the anxiety disorder group and the pauses became longer. It is suggested the excessively long IRH in the main experiment was anxious hesitation rather than increased reflection.

To conclude, it appears there may be more than one pattern of extralinguistic characteristics in children with conduct and anxiety disorder and the change which is associated with clinical improvement may take different form in each pattern.

D. Summary of Results

In the hypothesis it was suggested that Ss with conduct disorder who showed clinical improvement would show change in the extralinguistic measures which are associated with reflection and cognitive planning, in the direction which indicates increased reflection and cognitive planning. It was, also, suggested that Ss with anxiety disorder whose condition improved would show a corresponding decrease in the frequency of the speech breath activity measures.

Ten out of the initial 18 Ss were included in the follow-up study. The period of time between the main and follow-up experiment ranged from 3½ to 8 months ($\bar{x}$ 4.9, SD 1.2). Five Ss belonged to the original conduct disorder and 5 to the anxiety disorder group. The date of the follow-up assessment and experiment coincided with the termination of any active treatment of the Ss at the Psychiatric Service. From the first to the last session of therapy at the Psychiatric Service, 8 Ss and their parents were seen as out-patients for psychotherapy and counselling respectively, and 2 were treated both as out- and in-patients. Clinically, nearly all Ss showed improvement by the time the treatment was terminated. The improvement, however, varied among them. In the conduct group only one subject (#4) showed substantial improvement. In the anxiety group most Ss improved considerably except one (#14). The repeat measures on the Behaviour

Problem Checklist and the Junior EPI (Table 30) showed limited change in the scores of the conduct disorder group as compared to the main investigation scores (Table 31). The same measures showed considerable drop in the anxiety disorder group. The differences between the groups were significant on Conduct ($p < .01$) and Neuroticism ($p < .05$) (Table 32); the scores in both measures were lower in the anxiety disorder group.

The differences between each individual subject's measures at the main experiment and at follow-up were examined in the two diagnostic groups. No significant differences were observed for those subjects in the conduct disorder group. There was, however, a trend towards shorter initial hesitation measures and increased Speech and Articulation Rate on all speech tasks at follow-up. There were no significant differences in the anxiety disorder group either, but a trend towards faster speech by making shorter and fewer pauses were also observed. These changes were not in line with the hypothesis. On the speech breath activity measures only the anxiety disorder group showed differences between the two experiments. The Output of Speech per Breath in Syllables (OSPBS) increased at follow-up; the increase almost approached level of significance ($p < .10$) on the pictures (Table 38) and was significant ($p < .05$) (Table 39) on the story task. This change in OSPBS measure was in line with the hypothesis.

Observation of the direction of change in selected extra-linguistic and speech breath activity measures (Total Verbal Output in Syllables TVOS, Average Length of Pauses ALP, Silent Pause Ratio SPR, Initial Relative Hesitation IRH, Articulation Rate AR, Frequency of Inspiration FI, Output of Speech per Breath in Syllables OSPBS)

Tables 40, 41, 42) indicated that the increase of the IRH at follow-up was possibly associated with clinical improvement in Ss with either conduct or anxiety disorder. Higher scores were observed on the AR and OSPBS in most Ss at follow-up and the ALP was longer in most Ss in the conduct and shorter in the anxiety disorder group. The direction of change in these variables did not appear to be associated primarily with the clinical change.

Observations on three Ss who had shown considerable clinical improvement (one with conduct disorder #4, and two with anxiety disorder #12, 13) suggested that children with different extralinguistic styles may present different patterns of change in association with clinical improvement. The subject #4 who had shown substantial clinical improvement showed changes of the extralinguistic temporal measures in line with the hypothesis which suggested that clinical improvement will be associated with longer initial hesitation measures and longer pauses. The same subject showed also changes in the speech breath measures similar to those observed in the anxiety disorder group; the output of speech per breath increased in both the pictures and story telling tasks (Table 37). It is apparent the clinical improvement in this subject was associated with increased reflection and lower anxiety.

V. DISCUSSION

In this discussion the important problems which emerged in the preliminary investigation will be considered. These will then be followed by a discussion of the results of the main and follow-up studies and the conclusions which can be drawn from them. The methodology used in the study will be critically examined and suggestions made for further research. Finally, the possible clinical applications of this work will be discussed.

A. Preliminary Study

The major problem encountered in the preliminary study was that of eliciting spontaneous speech in children, sufficient for extra-linguistic analysis. This required considerable experimentation before the conditions of the clinical experiment could be finalized. The children consistently spoke less than anticipated. The expectation of higher verbal output was attributable to a study by Levin and Silverman (1965), whose subjects were more eloquent than those in this study (p. 38). It is possible that the educational level of the parents determines to some extent the proxility of their children. Presumably, they encourage verbal expression in their offspring by example and incitement. The parents of the children in the Levin and Silverman study were highly educated, while those in this study were probably not as most came from low socioeconomic levels.

The measurement of pausing variables, which was achieved by transforming the speech signal into a tracing on the polygraph, required

extensive experimentation before it was finalized. The technique of interposing a speech activated switch between the output of the tape recorder and a polygraph, which was suggested by Dr. Mellor, had not been described previously in the literature at the time it was developed.

Measuring the extralinguistic and speech breath variables is a time consuming and cumbersome task. This limited the number of subjects that could be included in the study and makes the application of extralinguistic measures in clinical practice tedious. Other more efficient methods, perhaps by direct computer analysis of the speech records are required.

B. Main Investigation

1. Conduct and Anxiety Groups Compared with Each Other

The hypothesis was developed that children with conduct disorder will show lower frequencies of measures which are attributable to cognitive planning and reflection than children with anxiety disorder. It was further suggested that the differences will be least on tasks which require minimum cognitive planning, such as counting, and largest on tasks of increased cognitive complexity such as picture description and story telling. Two groups of extralinguistic variables, namely the initial hesitation and the pausing variables, which were identified in the study, were the most likely variables to show the differences in cognitive planning and reflection.

The expected differences were confirmed partially by the results of the study. Significant differences were observed only in the picture description. Initial Relative Hesitation (IRH) was shorter in the conduct disorder group; IRH is the length of the initial hesitation as a proportion of the time of the total response, which extends from the

presentation of the stimulus to the last utterance. Furthermore, discriminant function analysis distinguished the two groups on the IRH and the Average Length of Pauses (ALP). The differences between the two groups were in the predicted direction. The conduct group hesitated less in starting verbal responses to describe the pictures. There was no evidence that Age, Sex and IQ could account for the observed differences.

In the automatic speech (counting), contrary to the hypothesis, children with conduct disorder showed increased pausing which led to slower Speech Rate, marginally significant drop in the Articulation Rate and longer Total Time in the initial counting. The evidence indicated that the results were confounded by Sex and Verbal IQ differences; male Sex and low Verbal IQ were associated with longer Total counting Time. At the final counting however, the same children paused less and the Total counting Time became shorter.

Another hypothesis suggested that there would be increased frequency of speech breath activity in children with anxiety disorder. This was not confirmed. There were no significant differences between the children with conduct and anxiety disorder in their breath activity measures.

Four questions may be raised at this point in relation to those hypotheses which were not confirmed. First, why did the children with conduct disorder show less pausing and shorter overall time to count in the final counting task as compared to the initial counting, despite the possible confounding effect of Sex and Verbal IQ differences? Second, why did the pausing measures not show consistent differences between the groups in the picture description? Third, why did the extralinguistic differences not become more pronounced in the story

telling task which was considered a cognitive task of increased cognitive complexity? Fourth, why were there no differences between the two clinical groups on speech breath measures? Possible explanations for each of these questions will be considered in turn.

First, the slow-down in the counting rate at the beginning of the experiment and the variation between initial and final counting was probably associated with variation of test-anxiety. Increased levels of test-anxiety during the opening stage of the experiment may have led to higher frequency of pauses and to a marginally significant drop in the Articulation Rate. As test-anxiety was abating at the concluding phase of the experiment, the counting rate sped up again. Why test-anxiety should affect predominantly the children with conduct disorder is not clear. It may be suggested that although all subjects may have experienced test-anxiety, those of the conduct disorder group showed increased alterations of muscular tone which affected the articulatory organs and led to slower counting rate. The particular task itself, counting, may evoke unpleasant association of performance in school, perhaps more tension producing in the conduct disorder child than with anxiety. These hypotheses could be further pursued in a replication study; in such a study the variables Sex and Verbal IQ, which confounded the differences between the two clinical groups could be controlled, and test-anxiety should be monitored by physiological means such as muscle potentials.

Some comments about test-anxiety at this point may be pertinent. Anxiety experienced during an experiment (state or situational anxiety) is a regularly observed phenomenon. The level of anxiety depends on the trait-anxiety (dispositional), the stress resulting from the environmental conditions and the demands of the test or experiment.

Higher trait-anxiety, unfamiliar environment and/or highly demanding conditions of the experiment are associated with higher levels of anxiety (Spielberger et al., 1978; Wine, 1979). In the present study, it is suggested that all subjects experienced test-anxiety the level of which varied only according to the dispositional or trait-anxiety since the experimental conditions were uniform for all children. Test-anxiety may have been low because the subjects were familiar with the environment and the requests of the experiment were not very demanding. On the other hand the conditions of the experiment were novel and the child had to speak into a microphone which in itself may arouse anxiety (Sauer & Marcuse, 1957). Anxiety may interfere with verbal performance on two levels; first, centrally on the cognitive processes, and second, peripherally in the speech execution organs (articulatory organs) which are affected by the concomitant alterations of muscular tone.

Returning to the second question posed by the results of inconsistency in the pausing differences between the conduct and anxiety disorder groups in the picture description tasks, the Average Length of Pauses (ALP) was not long, as it had been predicted, across all subjects in the anxiety disorder group. Furthermore, pausing differences did not become evident in more than one variable (ALP). The question that may be raised at this point is whether pausing varied at all in relation to the dimension reflection-impulsivity, which according to the hypothesis distinguished the two clinical groups from each other, and whether initial hesitation and pausing both varied in association with the same cognitive, behaviour and personality measures. These are issues which will be examined in the discussion of the correlation analysis between behaviour, personality and extralinguistic variables which follows.

Third, it is not evident why the extralinguistic differences between the two clinical groups did not become more pronounced in the story telling task. Two possible explanations may be suggested. Telling a personal story is perhaps not as complex a cognitive task for a child as was postulated. It should be noted that the frequency of pauses was lower ($p < .01$) and the speech rate in syllables higher ($p < .05$) in the story task than picture description. It is also possible that the absence of differences was due to the experimental procedure. In the experiment, telling a story always followed the picture description. In a replication study, the order of administration of the two tasks could be varied in order to examine the interaction effect between order and task upon test-anxiety.

The fourth question is that of no significant differences between the two clinical groups in the speech breath activity measures. The most obvious explanation is that there were no differences between the two clinical groups in the levels of anxiety experienced during the experiment. The two groups did not in fact differ from each other on measures of anxiety (Anxiety, Neuroticism) derived from the two questionnaires (Behaviour Problem Checklist, Junior EPI). The measures of the questionnaires showed that the conduct and anxiety disorder groups differed significantly from each other on disturbance of conduct measures (Conduct, Socialized Delinquency) but not on anxiety measures (Anxiety, Neuroticism). This indicates that both groups were equally anxious and that the conduct group in addition to being anxious showed also behaviour disturbance. This evidence stands against the assumption made in the hypotheses that anxiety is a characteristic specific to anxiety disorders. Anxiety symptoms in behaviourally disordered

children has been reported in the literature (Robins, 1966) and the most recent classification schemes such as ICD-9 (WHO, 1977) and DSM-111 (APA, 1980) provide for the diagnosis of mixed disorders of conduct and emotions. Most child psychiatric literature, however, deals with these two clinical disorder groups as if they were dichotomous (Rutter, 1977; Quay, 1979; Schwartz & Johnson, 1981).

2. Conclusions Emerging from the Comparison between the Groups

The children with conduct disorder were significantly more impulsive, as measured by temporal extralinguistic measures on the cognitive-verbal task of picture description. Shorter Initial Relative Hesitation (IRH) consistently distinguished the conduct from the anxiety group. In addition, shorter Average Length of Pause (ALP) were shown by the discriminant analysis to differentiate the conduct from the anxiety group. The differences on the automatic speech-counting were inconclusive and there were no significant differences on the story telling task.

The absence of differences between the children with conduct and anxiety disorder on speech breath measures suggests that both groups experienced similar levels of anxiety during the experiment. Independent measures of anxiety also suggested that the two groups of children did not differ from each other on trait or dispositional anxiety.

Those parts of the hypotheses which were not confirmed have raised a number of questions. Some of them could be pursued further in a replication study which should incorporate modifications of the experimental procedure. Some other questions, such as those about the relationship between initial hesitation and pausing variables and the behaviour and personality characteristics, will be pursued further

in the discussion of the correlation analysis which follows.

3. Correlation Between Behaviour, Personality and Extralinguistic Variables

The hypothesis suggested that the measures of behaviour and personality that distinguish between conduct and anxiety disorders would be significantly correlated with the extralinguistic measures which are associated with reflection and cognitive planning, and that the correlations will be the lowest or non-significant on tasks of minimum cognitive complexity, e.g. counting, and will be higher on tasks of increased complexity, e.g. story telling. The measures distinguishing between conduct and anxiety disorders, according to the hypothesis, were those of reflection-impulsivity (Mean Latency of Response) and disturbance of conduct (Conduct, Socialized Delinquency). The extralinguistic measures which were expected to show significant correlations were those of pausing and initial hesitation.

The observed correlations and their levels of significance were in keeping with the hypothesis, with certain exceptions. In line with the hypothesis were the significant correlations between the behaviour and personality variables and the initial hesitation measures in both verbal tasks. As predicted, reflection (Mean Latency of Response) showed a positive correlation with the Initial Hesitation (IH) which was significant (at the .05 level) both in the picture description and (.01) in the story telling task. The converse is that increased impulsivity (polar opposite of reflection) is associated with short Initial Hesitation. Furthermore, reflection showed positive correlation with the verbal output variables (Duration of Utterances, Total Verbal Output in Words and Syllables) of equal significance in both verbal tasks. Although this association had not been predicted specifically, it was

consistent with the hypothesis. Impulsivity was obviously associated with low verbal output.

In line with the hypothesis also, the conduct score had significant negative correlation with IH and IRH on the story telling task. Similar negative correlations were also found on the picture description task but did not reach statistical significance. It is obvious that the requirement for reflection on a task of increased cognitive complexity does not lead to proportional increase in reflection in the presence of high Conduct score. Increased reflection on the story task would have lowered or even reversed the correlation between conduct and initial hesitation variables.

The parts of the hypotheses which were not confirmed involved, first, automatic speech and, second, the pausing variables. In the automatic speech (counting), the measures of disturbance of conduct (Conduct, Socialized Delinquency) showed a positive correlation with the Total Time to count and negative correlation with the Speech and Articulation Rate (SRS, AR); most of these correlations were either diminished or became non-significant in the final counting. The correlations were in keeping with the differences observed between the conduct and anxiety disorder groups on measures of the counting task which were discussed earlier; as it has already been suggested the differences were confounded by Sex and Verbal IQ differences. The possible effect of test-anxiety on the variation of the extralinguistic measures on the counting task has been discussed.

The pausing variables, which measure the frequency and length of pauses as well as the relative pause time (SRS, ALP, RPT), in both the picture description and story telling task, did not vary in association with the measures of impulsivity (Mean Latency of Response) and

disturbance of conduct (Conduct, Socialized Delinquency). In fact none of these three pausing variables (SPR, ALP, RPT) varied in association with any of the nine behaviour and personality variables (with the exception of Extraversion in the picture description and Errors in the story task). The hypothesis in relation to the pausing, therefore, has not been confirmed.

The absence of significant associations between the pausing variables and the measures both of impulsivity and anxiety, in the two verbal tasks of varying cognitive complexity, suggests that pausing was independent of the personal attributes measured by the questionnaires and tests. This explains, at least partially, the absence of consistent differences between the conduct and anxiety disorder groups which were discussed in the previous section.

In light of the results of the correlation analysis, it can be concluded that the observed differences in the Average Length of Pauses (ALP) between the two clinical groups resulted from the longer pausing in a few subjects in the anxiety group. Why this did not show up in the independent measures of anxiety (Anxiety, Neuroticism) is not clear. It is suggested that another emotional condition, that is depression which was not measured, could account for the differences. As was mentioned in the introduction, depression has been found to increase the length of pauses in adults. It is obviously a measure of depression, e.g. Childhood Depression Inventory (Kovacs & Beck, 1977) should be included in the assessment of the subjects in a replication study.

Some additional significant correlations besides those predicted, were also observed. Extraversion showed significant correlations with measures from both verbal tasks. In the picture description,

Extraversion showed a negative correlation with the frequency of pauses (SPR) and positive correlation with the speech and articulation rate, and in the story telling task showed positive correlation with the verbal output variables (Total Verbal Output - Words, Syllables (TVOW, TVOS)). These relationships are compatible but not identical with the results of studies in adults which showed that in North American subjects Extraversion may be associated with shorter pauses (Siegman, 1978).

The significance of some isolated correlations involving the anxiety measures (Anxiety, Neuroticism) in either of the two verbal tasks are difficult to interpret. For example, in the picture description one measure of anxiety (Anxiety) showed a positive correlation with the Initial Hesitation (IH) and the other (Neuroticism) showed a negative correlation with the Duration of Utterances (DU). In the story telling task Anxiety was associated with increased Duration of Utterances, Number of Pauses and Total Pause Time, and Neuroticism was associated with lower Initial Relative Hesitation (IRH). These findings are inconsistent and there are only two explanations. The first being that the story telling task differed in its capacity to evoke affect from the picture description task. In resolving this question in future studies, a content analysis of the verbal responses might be helpful, i.e. the story in patients with anxiety had content related to their anxious pre-occupations. The second explanation is that although statistically significant it is probably due to chance, because of the large number of correlations.

To conclude, the measures of impulsivity and conduct, which according to the hypothesis distinguished between conduct and anxiety disorders, were associated with short Initial Hesitation and/or Initial Relative Hesitation and lower verbal output. The associations between

these sets of variables became more pronounced in the more demanding verbal task of telling a personal story. On the other hand, the pausing variables did not vary with measures distinguishing the present groups and, therefore, appear to be unrelated to the characteristics which were assessed. It could be the case that the pausing variables covary with some unassessed characteristic of the subject such as depression. Further research will be necessary to examine that possibility.

4. Correlation Between Behaviour, Personality and Speech Breath Activity Measures

The predicted significant correlations between these two sets of variables were confirmed on the picture description task only. The two anxiety measures Neuroticism and Anxiety were associated with increased Speech Breath Rate (SBR) and higher proportions of air spent per syllable (Ventilation Index, VIS), respectively.

The absence of similar significant associations on the story telling task suggests further that test-anxiety, which was probably high only during the early stage of the testing could explain the presence of significant correlations in the picture description and the absence of significant correlations in the story telling. This hypothesis assumes that the increase of test-anxiety was proportional to the levels of Neuroticism and Anxiety. This would also refute the proposition stated above re the affective content on story telling.

5. Impulsivity Identified in Extralinguistic Measures

The study has shown that the initial hesitation measures varied consistently in association with either conduct disorder or characteristics of disturbance of conduct and impulsivity. On the other hand,

the study failed to show consistent association between the pausing variables and characteristics of disturbance of conduct and impulsivity. Furthermore, the initial hesitation and pausing variables did not show any significant association with each other in either the picture or story telling tasks (Appendices 7, 8). It is obvious the two sets of variables were independent of each other and varied probably in association with different cognitive and/or linguistic phenomena. The significant correlations between the initial hesitation variables and reflection-impulsivity, as was measured by the Mean Latency of Response of the Matching Familiar Figures Test, suggest that the initial hesitation variables are reliable measures of reflection. A similar clarification about the function of the pauses has not become apparent.

The identification of the initial hesitation variables as reliable measures of reflection or impulsivity opens the way for the use of these measures in the assessment and management of children with behaviour disorders. Unlike the pausing variables the measurement of which is tedious, the initial hesitation variables are relatively easy to measure and may be included in a routine clinical assessment. Measurement of impulsivity in the initial assessment and at follow-up may be valuable in monitoring the development of reflection occurring in association with certain therapies, e.g. cognitive behaviour therapies.

The finding that reflection occurs predominantly before the child embarks on a response, suggests that the training to reflect should aim at the development of reflective attitude which should be time specific; it should apply predominantly to the time interval between the presentation of the stimulus and the beginning of the verbal or behavioural response.

However, before the present results could become useful in clinical practice, the study should be replicated in a larger sample of patients. The replication study should also include a control group of non-clinic children. It is important that, first, the reliability and validity of the present findings are tested and, second, the specificity or non-specificity of the short initial hesitation measures in conduct disorders is established.

C. Follow-up Study

According to the original hypothesis, clinical improvement should have been associated, first, with higher values in extra-linguistic measures which indicate increased reflection and, second, with speech breath measures which indicate lower levels of anxiety. The main study showed that initial hesitation measures varied with reflection, and speech breath rate varied with anxiety. Increased initial hesitation, therefore, was expected in those subjects with conduct disorder who had improved clinically, and lower speech breath rate among those with anxiety disorder who had also improved.

Substantial clinical improvement was observed in one subject only among those with conduct disorder while most subjects with anxiety disorder had improved markedly. The comparison of behaviour and personality measures between the conduct and the anxiety disorder groups showed significant differences on the Conduct and Neuroticism measures; both were lower in the anxiety group. Furthermore, comparison of the behaviour and personality measures between the main and follow-up study showed no change in the subjects with conduct disorder while there was a drop in most scores in the anxiety disorder group; the drop of the Neuroticism score approached significance. Considering then

these clinical measures, the hypothesis could be restated as follows: there should be no increase in the measures of reflection among those with conduct disorder--with the exception of one subject (#4)--and there will be a drop in the speech breath rate in those with anxiety disorder.

The numbers of the subjects involved in the follow-up study were small (5 in each of the conduct and anxiety groups) and, therefore, the results are only tentative and should be interpreted with caution.

The comparison between the measures, both extralinguistic and speech breath, of the main and follow-up study showed no significant differences in the conduct disorder group--with the exception of subject #4; a trend, however, was noted towards shorter initial hesitation and increased speech and articulation rate in the picture description task. In the anxiety disorder group a trend was observed towards shorter pauses and increased verbal output per breath; the latter was significant in the story telling task. These results were in keeping with the hypothesis as this was restated in light of the clinical reassessment. It should be noted that the speech breath variable which showed significant change was not the speech breath rate but the output of syllables per breath, which suggests that perhaps lower levels of anxiety, as this was assessed clinically, were associated with more effective use of air during speech.

The shorter counting time in the conduct group, as compared to the main study, as well as the trend towards shorter initial hesitation and faster speech and articulation rate, suggest the presence of lower levels of test-anxiety during the follow-up experiment. Perhaps the trend towards shorter pauses and faster speech and articulation rate in the anxiety group also reflected lower test-anxiety.

Change in the value of the extralinguistic and speech breath measures was evident in the one subject of the conduct disorder group who showed substantial clinical improvement (#4). He showed the same changes observed in the other subjects of the same group (e.g., lower verbal output, faster speech and articulation rate) which may be explained as being related to lower test-anxiety, but he also showed increased length of pauses, drop in the frequency of pauses, longer initial relative hesitation, and increase in the output of syllables per breath, particularly in the story telling task. The latter was a change similar to that observed in the anxiety disorder group and was considered as evidence of lower level of anxiety. The scores of this subject on the independent measures of anxiety (Anxiety, Neuroticism Table 30)) were lower at the follow-up reassessment. It may be suggested that the clinical improvement of this subject was associated with the changes in the extralinguistic measures postulated in the hypothesis and with the changes in the speech breath measures associated with lower levels of anxiety.

In view of the significant association of the initial hesitation with the reflection measure, as this was shown in the main study, some comments are warranted on the differences between the initial hesitation of the conduct and anxiety groups at follow-up. The differences between the groups became distinct when the values on each of the three pictures were considered separately (Figure 4). In the conduct group there was hardly any difference between the initial hesitation in the first and the two pictures that followed. In the anxiety disorder group the initial hesitation was longer in the first picture as compared to the subsequent two. Furthermore, the initial hesitation in each picture was consistently longer in the anxiety group. These differences

suggest that the conduct disorder group reflected significantly less for all pictures and did not show a propensity to reflect longer with the first picture as became evident in the anxiety disorder group.

The variation of the initial hesitation during the follow-up experiment was probably affected less by test-anxiety than it was in the main experiment. The initial hesitation differences at follow-up substantiate further the results of the main study which suggested that the subjects with conduct disorder were less reflective than those with anxiety disorder. The overall drop in the values of Initial Hesitation in both the conduct and anxiety disorder groups at follow-up suggests also that the longer Initial Hesitation in the main study was the combined effect of both reflection and test-anxiety; under test-anxiety then, even the conduct group hesitated a little longer in the first picture. At follow-up however, and probably in the absence of test-anxiety, the conduct disorder group did not show the longer Initial Hesitation in the first picture.

D. Conclusions

This study has shown that recordings of spontaneous speech, on which the extralinguistic measures of speech could be made, is possible in a child psychiatric clinic. These measures have meaningful associations with the clinical characteristics of certain child psychiatric disorders. The following specific conclusions could be drawn.

1. As predicted, disturbance of conduct was associated with short initial hesitation measures. This was shown in the comparison between the conduct and anxiety disorder groups and in the correlation between conduct characteristics and the initial hesitation measures.

The initial hesitation variables are probably measures of reflection and cognitive planning. In children with disturbance of conduct, reflection and cognitive planning remain short even when the cognitive task at hand is a demanding one. This suggests the possibility that children with disturbance of conduct may reflect and plan their actions as little as they do verbal tasks. If their inner speech, it may be argued, is habitually brief, then it is not surprising that these children fail often to select a more appropriate behaviour.

2. Pausing during speech was not found to vary with any of the independent measures of the study. It varied only with the verbal task, being shorter on story telling. The measures of conduct and impulsivity-reflection did not show the predicted associations with the pausing measures. Furthermore, the initial hesitation and pausing variables were independent of each other. Anxiety, on the other hand, was not consistently associated with longer pausing. A number of subjects with anxiety disorder showed longer pausing but none of the other measures of anxiety taken showed any significant association with pausing. This finding raised the question of the contribution depression possibly made on pausing in the performance of the anxiety disorder group; no independent measures of depression were taken.

3. As predicted, anxiety, across subjects, was associated with increased speech breath rate and lower output of speech per breath, the latter being probably more sensitive measure of anxiety than the former. The conduct and anxiety disorder groups were not distinguished from each other on speech breath measures. Independent measures of anxiety also showed that children with conduct disorder were as anxious as those with anxiety disorder. At follow-up those with conduct disorder continued to be just as anxious, unlike those

with anxiety disorder who were less so. This finding suggests that children with disturbance of conduct may require treatment for anxiety as well as disordered behaviour.

4. The evidence from this study suggests that short reflection and cognitive planning (increased impulsivity), as they are measured by the initial hesitation measures, are characteristics of disturbance of conduct while anxiety is not specific to anxiety disorders.

5. Another personality characteristic, that is extraversion, was associated with either faster speech rate, or increased verbal output on different verbal tasks.

6. The verbal task of automatic speech, that is counting, yielded contradictory results. This was an unexpected finding which requires further exploration.

E. Criticism and Further Studies

A number of constraints and deficits may be identified in the design and the execution of the present study. A number of suggestions can now be made for an improved study design.

1. The number of subjects may be considered relatively small. Twenty-seven children participated in both the preliminary and main studies. The limiting factor was the considerable amount of time required for determining the extralinguistic measures. It should be noted that in Goldman-Eisler's studies (1968) the number of subjects was never higher than fifteen. However, it is desirable to extend this work to children with other psychiatric conditions. This may be achieved with improved and more efficient techniques for the extra-linguistic measurements.

2. The absence of a control group limits the conclusions that can be drawn about child psychiatric patients as a group. The use of a normal control group was not considered feasible at this juncture for two main reasons. The first was the practical difficulty in finding a group of normal children who would be availabe for such an extensive investigation. The major obstacle, however, was the absence of any previous studies that identified the variables which should be controlled for, in the selection of a 'normal control group'. For these reasons, therefore, the strategy of looking for 'within-group differences' in a sample of child psychiatric patients was adopted as the one most likely to generate significant findings, given limited resources. The study of extralinguistic variables in normal children is of obvious interest, but will require a team of investigators.

3. It is apparent, with hindsight, that a measure of depression should have been included in the study. The absence of such a measure was an oversight in the design. When the research protocol was drawn up a literature review did not suggest that pausing might vary with depression with the exception of one study (Szabadi et al., 1976) which examined counting rate in depression.

4. No independent measures of anxiety were taken during the experiment, e.g. muscle potentials, GSR. The absence of independent measures of anxiety makes it difficult to assess the possible effect of test-anxiety (state-anxiety) on extralinguistic and speech breath measures during the experiment. The inclusion of such measures was considered but the decision was taken not to use them, because it was intended that the experiment should be similar to the normal clinical interview, without any physical constraints upon the child.

Psychophysiological measures of anxiety, however, should be taken in other experiments. The muscle potentials are particularly relevant in the study of extralinguistic and speech breath phenomena because of the importance of muscular activity in the production of speech. Alterations in the muscular tone associated with anxiety may be an important source of variation for the extralinguistic and speech breath measures. A study which investigates the association between these two sets of variables should preferably use older subjects who will be less discomfited by the apparatus.

Although the specific points of criticsm made in the previous paragraphs should be considered when further studies are being prepared, what is needed at this stage is a replication study. The replication study will not require extensive revision, but a depression measure should be included in it, such as the Childhood Depression Inventory (Kovacs & Beck, 1977).

Furthermore, the extralinguistic analysis in association with the content analysis of the personal story, as this has been developed by Gottschalk and his associates (Gottschalk et al., 1979) may offer a very interesting combination of data useful in the assessment and management of child psychiatric disorders.

This investigation has, properly, avoided all reference to the content of the spontaneous speech, as it was concerned with only extralinguistic speech variables. However, the personal story, which has been employed in the study, was developed by Gottschalk and Uliana (1979) as a method of developing psychological insights into the child's emotional development using content analysis. The possibility of combining content analysis in this type with a simultaneous analysis

of extralinguistic variables could provide a sophisticated technique for clinical assessment, the potential of which should be explored.

F. Application of this Work to Clinical Setting

The results of the present work may find a number of useful applications in clinical settings, provided they are confirmed in replication studies. Some broad areas of application will be considered here.

First, the initial hesitation, which has been identified as a probable measure of reflection and cognitive planning, may be useful in the assessment and management of children with disturbance of conduct. Measuring the initial hesitation in the first and follow-up assessments may be valuable in monitoring the development of reflection resulting from therapeutic interventions. Furthermore, therapies which have as a goal the development of reflective attitude and inner speech in impulsive children should train the child to be reflective at the moments between the presentation of a stimulus and the beginning of the response.

Secondly, the speech breath rate and the output of speech per breath are useful for the measurement of anxiety in diagnostic interviews and in psychotherapy. These measures of anxiety, it has been shown, can be taken unobtrusively.

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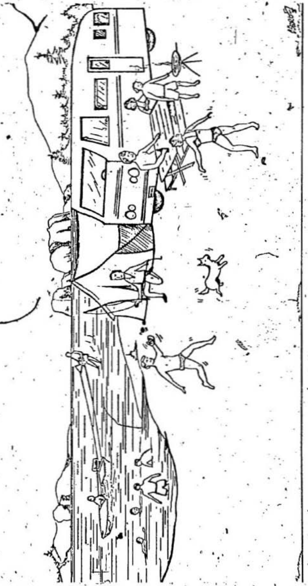
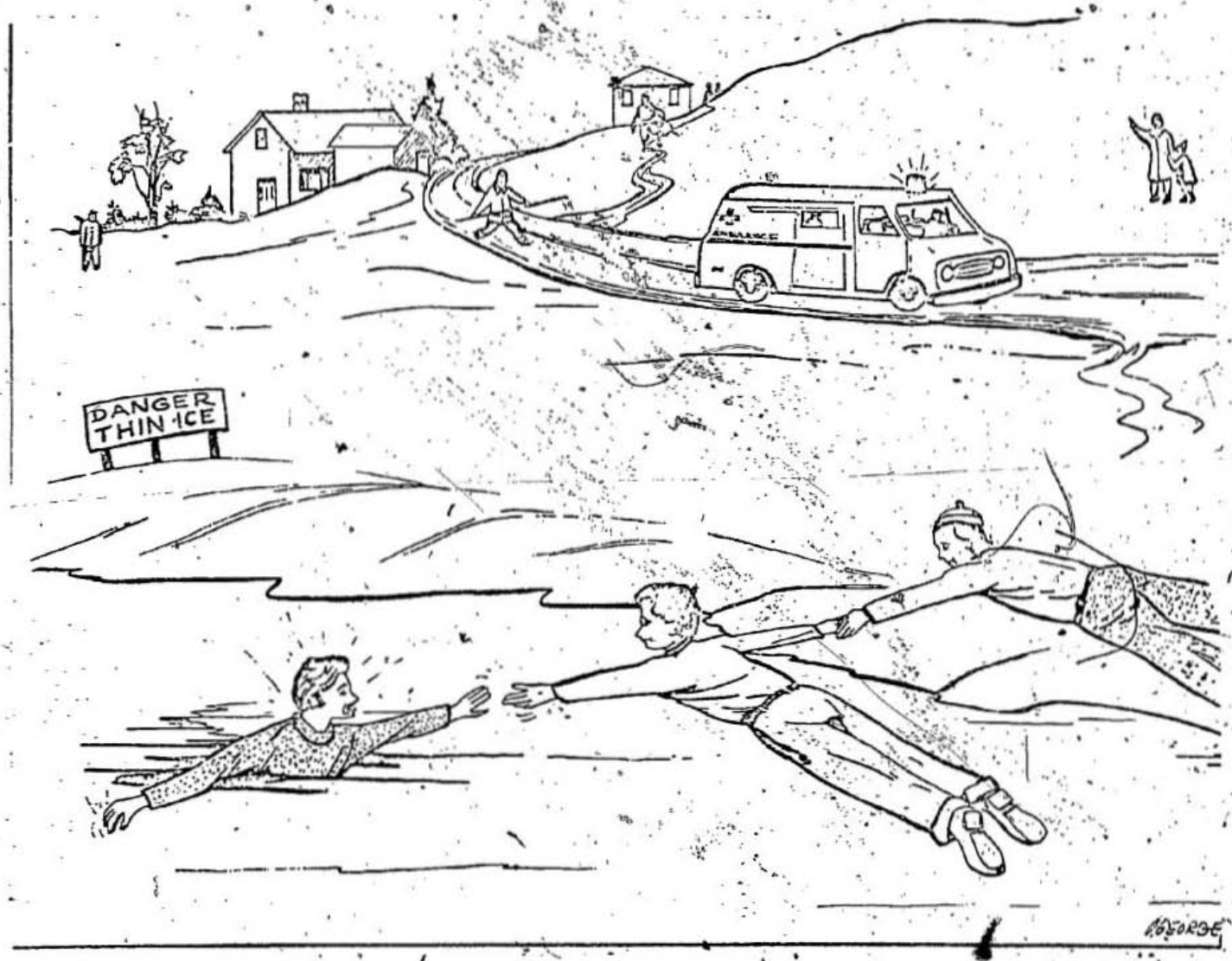
APPENDIX 1

Pictures Specifically Drawn for the Experiment

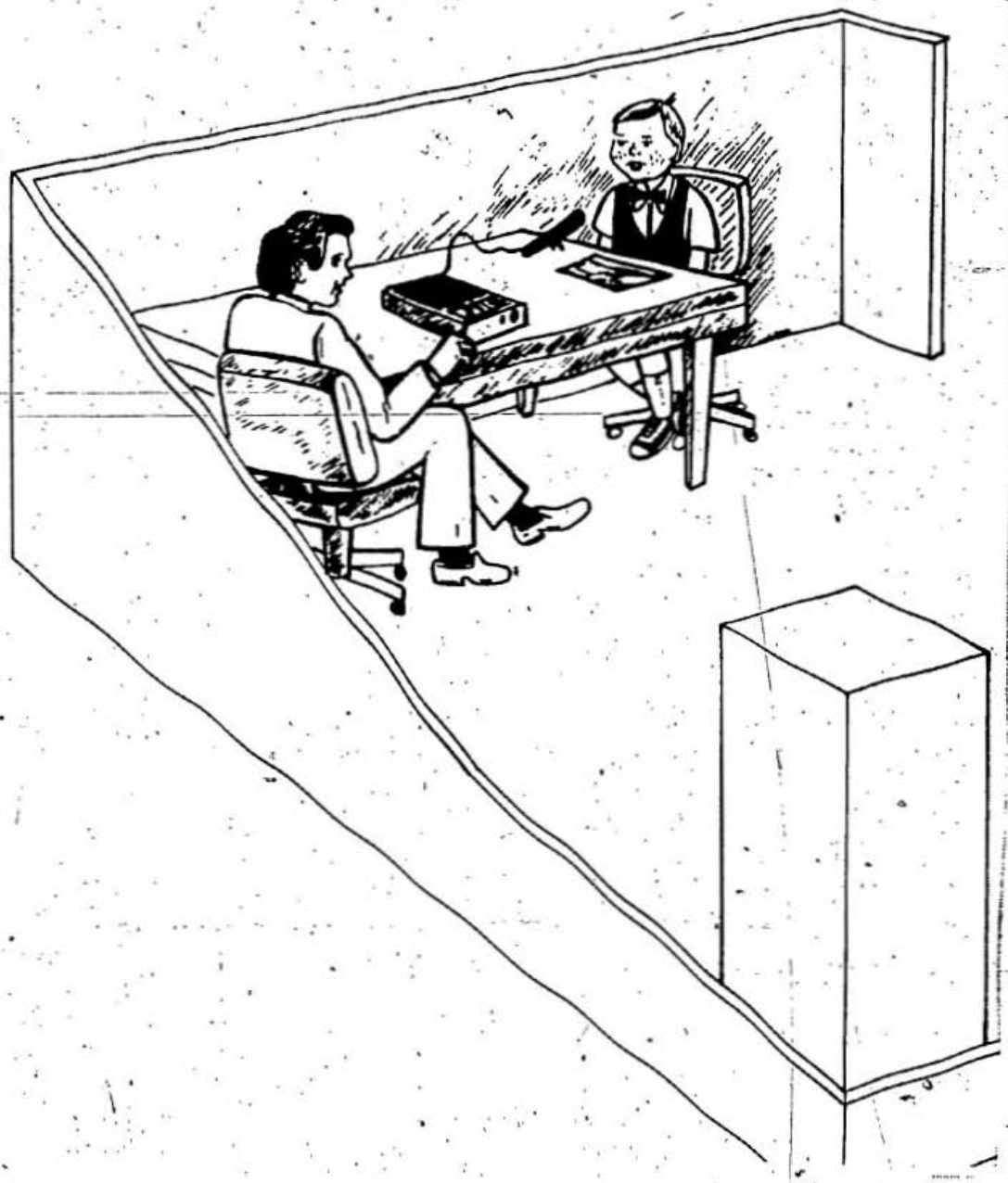



DANGER
THIN ICE
AMBULANCE

APPENDIX 2

Setting of the Experiment

(An Artist's Impression)



APPENDIX 3

CASE SUMMARIES

CONDUCT DISORDER GROUP

Subject #1

This 9-year-old boy was referred by a Child Welfare Worker for an assessment. He was about to appear in Court having been charged for breaking and entering. He had a two-year history of stealing money from stores, peers at school and his teacher; also, he stole the lunches of several children at school, which he gulped. He was in Grade 4 and was a good student. He had no friends and the other children seemed to mistrust him. He was living with his mother, stepfather and an older stepbrother. His family of origin broke up four years earlier when the mother walked off leaving the two children, including the patient, under the care of the father who suffered of manic-depressive illness. The father subsequently requested that the children be taken into care. Both children were then placed in a foster home. The patient joined the mother's new family a year-and-a-half prior to the present referral. Following the assessment he was seen by the psychiatrist irregularly a few times before he discontinued through lack of interest on the part of his mother. He was a quiet child and with the psychiatrist he was distant and reserved.

Diagnosis (ICD-9): Compulsive conduct disorder 312.2

Subject #2

This 10-year-old boy was brought to the Emergency Clinic of the hospital in what was described as a state of "blackout." Organic pathology was ruled out at the time and the diagnosis of conversion reaction was made. This boy had been seen at the Psychiatric Service

a few years earlier for behavioural problems but there was no effective follow-up because of lack of interest by his parents. At the time of the emergency referral, he was totally beyond control, was associating with delinquent older boys, was stealing, smoking marijuana, vandalizing public and private property, provoking other children and fighting with them. At school he had been restless, disruptive and underachieving although he was of normal intelligence. Also, he got into tempers at home, was afraid of the dark and complained of abdominal pain on and off. The parents of this child were inadequate and over-indulging. The mother had, from a previous marriage, six children, all of whom had shown either antisocial behaviour or drunkeness; the girls had illegitimate pregnancies. Nearly all of them spent time in the Boys' or the Girls' Home and one of the boys was in jail at the time of the referral of the patient.

Diagnosis (ICD-9): Mixed disturbance of conduct and emotions 312.3.

Subject #3

The referral of this 11-year-old girl was initiated by the mother who had noted that her daughter was getting increasingly more frequent episodes of night terrors and sleepwalking. The girl was irritable most of the time, disobedient and oppositional to the mother. She was staying out late, was roaming the downtown streets with other youngsters and was shoplifting. At school she was doing poorly and was in Grade 5. She came from a one-parent family which was on social assistance and consisted of the mother, the patient and two younger stepbrothers. She and her mother were seen by the psychiatrist only three times. They appeared to had lost interest for further follow-up

since the sleep disturbances were controlled with Tofranil 25 mg. hs. The girl spoke little, was distant and non-involved during the sessions with the psychiatrist. There was no evidence of apprehension or anxiety during these sessions.

Diagnosis (ICD-9): Unsocialized disturbance of conduct 312.0.

Subject #4

This 11-year old boy was referred at the request of his mother. He had had a history of stealing money from home, which he spent on junk food. In defence of himself, when he was caught stealing, he was able to tell convincing lies. He was a lonely boy who could not make friends. He fought a lot with other boys and returned home often with torn clothes. At home he was constantly in trouble with his mother whom he antagonized continuously. He was in Grade 6 and was considered a serious discipline problem at school. The boy was born out of wedlock and was kept in foster care till he was 13 months of age. At that time, he was taken back by his mother who had been married in the meantime. The mother's husband adopted the child and over the years a better relationship developed between the stepfather and the child, rather than between the mother and the child. The boy appeared shy and avoided eye to eye contact with the psychiatrist at first. In subsequent sessions he felt more at ease but he never did become eloquent. He and his parents were seen six times for psychotherapy and counselling, respectively. The improvement observed in his behaviour and the relationship with his mother was remarkable.

Diagnosis (ICD-9): Unsocialized disturbance of conduct 312.0

Subject #5

This 10-year-old boy had a long history of disordered behaviour. He often got into fights with other boys, broke windows of houses and cars, was accused of killing a cat, started fires in the bushes, blackmailed his mother, threatening he was going to kill himself if she did not give him one dollar, which he immediately spent on cigarettes. At school he was very disruptive, restless and inattentive. He was in Grade 4. At home he was fighting with his older sister, could not sleep alone because he was frightened of ghosts and was very restless during sleep. Both his parents were skid-row alcoholics till about four years before the referral. This child was in fact raised by the older sister who, at the time of the referral, had a one-year old illegitimate child. The boy developed a positive relationship with the psychiatrist and showed considerable improvement during the follow-up period.

Diagnosis (ICD-9): Unsocialized disturbance of conduct 312.0

Subject #6

This 9-year-old boy was seen on the request of his mother who feared his behaviour problems were serious. Apparently, she found it difficult to discipline him. He could easily get into temper, become aggressive and destructive. With other children he was bossy. At school he was restless and disinterested in work. Also, the boy complained of abdominal pain and had sleep problems on and off. The family had two more younger sons who did not present any behaviour problems. The mother was the person who applied discipline at home, since the

father was absent working long hours, but he at times could be quite harsh with this boy. On assessment, the problems of the child were not considered serious and in fact, following a few sessions of psychotherapy with him and counselling with the mother, considerable improvement was observed.

Diagnosis (ICD-9): Mild unsocialized disturbance of conduct 312.0.

Subject #7

This 10-year-old boy was referred for assessment by his school. Apparently he was aggressive to younger children and used to steal money and food from his peers. In the classroom he was disruptive. Academically he was doing very poorly. At home he was disobedient and irritable most of the time, complained of headache on and off and banged his head during sleep. The boy was born out of wedlock and was initially destined for adoption, but shortly afterwards he was taken back by his mother who had been married in the meantime and was finally adopted by the mother's husband. During the following months, the child was severely battered, allegedly by the stepfather and was treated in hospital. The parents had had a younger son who had never presented psychological problems. Life in this family was not happy. The parents separated a few times, they moved to Toronto and back to St. John's, and the stepfather was unemployed at the time of the referral. The mother was aggressive, unhappy, and the stepfather was quiet and passive. This boy was seen several times by the psychiatrist and improved considerably in his behaviour although he made little, if any, progress academically.

Diagnosis (ICD-9): Unsocialized disturbance of conduct 312.0.

Subject #8

This 11-year-old boy was referred because his mother found it increasingly difficult to cope with him since he had moved into her home a few months earlier. The parents had already separated and the mother was living with their second child, an 8-year-old son. The patient had lived with his grandparents for a number of years. The boy was moody, stubborn and bossy, trying to rule the mother's life as she put it. Also, he was viciously aggressive to his younger brother who had Perthe's disease; at times, he might pull his affected leg or take his crutches away and lock him up in a room. He might, also, get into fierce fights with other children around his home and school. Otherwise, he was a competent boy doing well academically, keeping a busy paper route and helping run the house. He refused consistently any involvement with the psychiatrist whose intervention was finally limited to counselling the mother.

Diagnosis (ICD-9): Unsocialized disturbance of conduct 312.0

Subject #9

This 10-year-old boy was referred by a Child Welfare Worker. Apparently he was wandering in the streets a lot, used to get into fights with his younger brother and other children, and often got into tempers during which he might throw rocks, rip the walls and break the windows of his own house. Also, he was restless and irritable most of the time, was biting his nails continuously and wetted his bed at night. He was disinterested in school work. He came from a broken and disorganized family, and following his referral to the Child Psychiatric Service he was taken into care and placed in a foster home.

Diagnosis (ICD-9): Mixed disturbance of conduct and emotions 312.3

ANXIETY DISORDER GROUP

Subject #10

This 11-year-old girl was referred by an Orthopedic Surgeon who was first to see her. On referral she was walking on crutches. Her right leg was apparently non-functional, being held up in a constructed position for nearly two months. The onset of the disorder was sudden, having occurred while the girl was in a meeting with other cadet girls. She said she felt pain in the leg which became stiff. Ever since then, her right foot had not touched the ground, until she received psychiatric care. No other psychiatric symptomatology was present in the patient. She was a shy but pleasant child, who talked little and conformed readily with the ward rules during her short in-patient psychiatric care. She recovered fully the function of her leg within two weeks. Follow-up one-and-a-half years later showed that she was free of any psychiatric symptoms. She came from a small town. She was the eldest among the four girls of the family. No family psychopathology was evident on assessment.

Diagnosis (ICD-9): Neurotic disorder, hysteria 300.1.

Subject #11

This 12-year-old girl was seen as an emergency case. A few days earlier she had become aphonic, apparently immediately after she had been threatened and chased by an older girl. In the interview she could only whisper to the doctor. A few days later, during school exams, her right arm became stiff, extended and non-functional. This symptom lasted about one week. The girl was the only child of her

elderly parents. She was very dependent on her mother. At the time of the referral, she was missing several days of school because of mild colds and other minor ailments. At home, she was spending a lot of time watching TV. Also, frequently, she used to get into tempers, screaming to the mother if she did not comply to her demands promptly. She and her mother were seen irregularly over a period of seven months during which time she showed some progress in that the conversion symptoms did not recur. Her school attendance continued to be irregular and both she and her mother remained very dependent on each other.

Diagnosis (ICD-9): Neurotic disorder, hysteria 300.1
Dependent personality traits

Subject #12

This 12-year-old boy was referred by a paediatrician who was treating him for peptic ulcer. The boy had apparently been very anxious and phobic for a long period of time. He could not cope with darkness and being left alone. He needed a companion most of the time, and particularly at night. His mother or younger brother had to turn the light on before he entered a room, and either she or the brother had to sleep with the patient. He could not even use the bathroom unless the mother was standing by the door. If she did not go along with his counterphobic demands, he might get into a panic which in turn upset the mother a lot. If he was out playing with other children he would give up the play to return home before darkness. He was tense and apprehensive most of the time. He was a sociable and likeable boy and participated in sport activities. In his early years he had experienced breath holding spells which came to an end by the time he

entered school. This boy came from a broken family. The parents were separated and divorced three years earlier. The father was a violent man and on and off he continued to threaten his former wife. The mother was an anxious person and, at the time of the referral, she was on "nerve pills." The patient was in Grade 6 and was an average student. He was treated first as an in-patient for nearly one month and then as an outpatient. By the time the follow-up was discontinued he was free of excessive anxiety and phobic preoccupations.

Diagnosis (ICD-9): Neurotic disorder, anxiety state 300.0
Phobic symptoms also present

Subject #13

The referral of this 10-year-old boy was initiated by his mother who was worried about his excessive reactions of fright when his stepfather shouted, with whom nevertheless the boy had a good relationship. Also, he got frightened at school if the teacher raised the volume of his voice. The boy always avoided aggressive children and competitive situations and mixed little with other boys. At school he was doing poorly. When seen by the psychiatrist he was at first shaking and fidgeting and avoided eye to eye contact, but it did not take long before he started to express a variety of fears of bodily injuries he might get in a possible accident. Also, he readily recalled in detail an automobile accident he had experienced at the age of five years. His mother appeared to be an anxious person herself. She divorced her first husband who was the boy's father when the child was nine months of age and soon married the present husband. The couple had a son who presented no emotional problems. The child was seen on

psychotherapy and the mother received counselling. During this period of time he showed appreciable change in that he got frightened less both at home and school, and started to mix with other boys.

Diagnosis (ICD-9): Neurotic disorder, anxiety state 300.0

Subject #14

This 9-year-old girl was first seen while she was in the Orthopaedic Ward of the Hospital. She was admitted for investigation of a recurrent pain located in the upper region of her back. The investigation ruled out any possible physical cause for the pain and, in fact, the girl felt no more pain while in hospital. The girl was an apprehensive and worried child at home, competing with some other girls for high marks at school. Her intellectual endowment was average and she had to work hard to keep up with the competition. She was sensitive and might easily get upset if someone at home or her teacher shouted. Her mother had experienced episodes of psychotic depression and herself had recurrent "back pain"; she used to become very worried and rushed the girl to the doctor when she complained of "back pain." The follow-up of this patient was irregular and came to an early end, first because of the distance between the place of residence of the family and the hospital and, second, because the mother never did become fully convinced that there was nothing wrong with the child's "back."

Diagnosis (ICD-9): Neurotic disorder, anxiety state 300.0

Subject #15

The referral of this 11-year-old girl was precipitated by her refusal to attend school. In the morning she might get very anxious and refused to go to school. If the parents forced her and gave her a

ride to school she might get into a state of panic and run after the parent screaming. She was in Grade 6 and was a good student. At home, she kept following her mother around lest she walked out and left her alone. At bedtime, she demanded that either the mother or the father slept with her, and if the parent who was in bed with her tried to get out she might get up in a state of acute anxiety. The mother, in the meantime, was increasingly getting worried about her daughter's condition and she either overindulged her or shouted at her. On the other hand, the girl was worried about the mother, fearing she might die although she was of good health. The family was not a happy one. The parents had frequent arguments between themselves, and threats of separation had been thrown at each other. The second child of the family, a 5-year-old girl, was not showing any signs of emotional disturbance. A few sessions of counselling with the parents and psychotherapy, plus medication for the child, did not lead to appreciable results. Follow-up was discontinued because the parents requested referral to another service.

Diagnosis (ICD-9): Neurotic disorder, anxiety state 300.0
(Separation anxiety)

Subject #16

This 12-year-old girl was first seen on consultation in another ward of the hospital where she had been admitted for investigation. She complained on and off during a period of several months of recurrent abdominal pain, headache, backache and urgency and dysuria. Also, she complained of feeling discomfort in her vagina. At the same time, she was constantly apprehensive and might easily get very upset and burst

into tears. She might privately express guilt about a sexual contact she experienced with an older cousin a few years earlier, but at the same time she was seductive to the boys in the ward. She was transferred to the psychiatric ward but she was soon discharged by her parents who were worried about the gossip in their small town if it became known that the child was under psychiatric attention. The girl was in Grade 6 and was doing well academically. She came from a family which did not present any obvious psychopathology. The mother had rather strong religious beliefs and expected the girl to read a passage from the Bible before going to sleep every night.

Diagnosis (ICD-9): Neurotic disorder, anxiety state 300.0
(Somatization of anxiety)

Subject #17

This 11-year-old boy was referred by the Family Doctor because he had missed several days of school. He was refusing to attend and when his mother forced him to school he ran away and returned home. During the same period of time he was irritable, getting into tempers, shouting, swearing and cursing. Also, he had given up various sports which he liked. His mother, who had always been very fond of this child, got very upset when he was upset, and responded to the child's problem by keeping him indoors and close to herself as much as possible. Prior to the onset of the emotional problem the boy was an even tempered and cooperative child. At the time of the referral he was in Grade 5 which he was failing. This was the youngest among the four children of the family, and unlike the others he had a history of several hospitalizations up to the age of 9 years. Over the years, he was treated for

inguinal hernia, upper respiratory infections and nephrotic syndrome most recently. Since his refusal to attend school had become chronic he was admitted for inpatient psychiatric care. In the ward he was stubborn and oppositional at first and at times he could get into a temper, but it did not take him long to become friendly, cooperative and confident in the classroom.

Diagnosis (ICD-9): Neurotic disorder, anxiety state (Separation anxiety) 300.0

Subject #18

This 11-year-old girl was referred for fainting episodes of recent onset. Apparently she fainted when she visited doctors' offices and saw "needles" or anatomy pictures hanging on the walls. Also, she had recently been irritating her mother by her increasing indecisiveness about what clothes to put on and whether or not she had kissed the mother when leaving for school or for her room at bedtime. The "goodbye" or "goodnight" kiss might have to be repeated several times before the mother stopped it by shouting. Also, the girl was becoming increasingly preoccupied with cleaniness and kept washing her hands frequently. At school her performance had dropped sharply during the last few months. It appeared that her failure at school was related to increasing doubts whether or not an answer was correct, which left her at the end with most of her work not done. This was an adopted child who had become very dependent on her mother who, in turn, appeared very dependent on the child. A few months before the onset of the anxiety state of the girl, the mother developed melanoma on her left leg which was removed, but the possibility of her dying or having her leg amputated was discussed in the family.

The girl became preoccupied with the fear of the death of either her mother or herself since then. The girl was under active treatment at the time this report was being written.

Diagnosis (ICD-9): Neurotic disorder, anxiety state 300.0
(with obsessive-compulsive features)

APPENDIX 4, a

Behaviour Problem Checklist

Group	Subject #	Conduct	Anxiety	Immaturity	Social. del.
Conduct	1	5	11	3	2
	2	30	9	11	8
	3	19	14	6	6
	4	17	11	9	4
	5	29	6	6	1
	6	17	6	3	0
	7	17	7	2	0
	8	18	22	3	0
	9	15	8	3	4
Anxiety	10	6	2	0	1
	11	14	19	6	0
	12	10	22	6	0
	13	9	19	6	0
	14	2	10	2	0
	15	11	13	2	0
	16	7	9	1	0
	17	7	2	0	3
	18	6	19	5	0

APPENDIX 4, b

Junior Eysenck Personality Inventory

Group	Subject #	Extraversion	Neuroticism	Lie
Conduct	1	13	13	8
	2	12	18	3
	3	16	14	1
	4	14	15	1
	5	17	18	4
	6	12	11	0
	7	16	16	6
	8	23	17	4
	9	13	14	5
Anxiety	10	16	19	5
	11	5	14	0
	12	15	20	4
	13	12	19	2
	14	19	11	7
	15	21	18	8
	16	14	18	5
	17	18	12	3

APPENXID 4, c

Matching Familiar Figures Test

Group	Subject #	Mean latency	Errors
Conduct	1	–	–
	2	–	–
	3	–	–
	4	18.4	8
	5	7.9	15
	6	8.1	11
	7	14.1	11
	8	35.4	6
	9	13.0	12
Anxiety	10	14.0	2
	11	22.0	4
	12	14.0	7
	13	17.2	11
	14	15.6	5
	15	11.1	6
	16	33.3	7
	17	22.7	9
	18	70.7	0

Variable Abbreviations
Applying to Appendices 5, 6, 7, 8, 9, 10, 11

DU	Duration of Utterances
TVOW	Total Verbal Output in Words
TVOS	Total Verbal Output in Syllables
NP	Number of Pauses
TPT	Total Pause Time
ALP	Average Length of Pauses
RPT	Relative Pause Time
SPR	Silent Pause Ratio
IH	Initial Hesitation
IRH	Initial Relative Hesitation
SRW	Speech Rate in Words
SRS	Speech Rate in Syllables
AR	Articulation Rate
NI	Number of Inspirations
FI	Frequency of Inspirations
SPR	Silent Pause Ratio
OSPBW	Output of Speech per Breath in Words
OSPBS	Output of Speech per Breath in Syllables
VIW	Ventilation Index in Words
VIS	Ventilation Index in Syllables

APPENDIX 5, a

Extralinguistic and Speech Breath Measures

Mean of Three Pictures

Group	Subject #	Variables									
		DU	TVOW	TVOS	NP	TPT	ALP	RPT	SPR	IH	IRH
Conduct	1	42.4	70.0	87.0	18.3	18.1	1.0	0.43	0.26	1.9	0.04
	2	38.3	74.3	101.3	21.3	13.1	0.63	0.34	0.29	4.3	0.10
	3	24.9	44.0	57.7	12.0	11.2	0.92	0.44	0.27	3.0	0.11
	4	44.5	80.3	103.9	22.3	20.3	0.89	0.45	0.29	2.7	0.05
	5	26.9	56.7	77.7	11.7	12.6	1.14	0.48	0.22	5.2	0.17
	6	38.6	78.3	97.3	16.7	11.3	0.66	0.29	0.22	2.0	0.05
	7	31.9	64.3	73.7	18.3	10.9	0.60	0.34	0.30	4.5	0.15
	8	52.1	122.3	144.3	26.3	18.2	0.69	0.35	0.23	6.6	0.11
	9	30.8	51.3	66.3	15.0	13.5	0.98	0.43	0.28	4.9	0.12
Anxiety	10	23.6	51.7	69.7	12.3	10.1	0.82	0.44	0.25	5.1	0.19
	11	35.7	51.0	64.3	16.3	15.2	0.88	0.40	0.33	7.6	0.19
	12	37.6	37.7	53.3	9.3	24.4	2.60	0.64	0.25	1.8	0.06
	13	28.7	55.3	71.3	16.7	12.3	0.75	0.43	0.33	29.0	0.50
	14	51.6	72.0	94.0	23.0	34.2	1.53	0.67	0.33	4.3	0.08
	15	15.0	54.0	67.7	5.3	2.2	0.50	0.14	0.09	11.1	0.40
	16	27.7	51.0	70.3	13.0	10.5	0.84	0.38	0.27	7.2	0.20
	17	34.4	63.7	90.3	13.0	14.3	1.08	0.40	0.22	4.9	0.13
	18	68.3	94.7	120.3	28.3	35.7	1.29	0.52	0.31	25.3	0.23

APPENDIX 5, b

Group	Subject #	Variables								
		SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIM	VIS
Conduct	1	1.65	2.05	3.64	10.3	4.1	0.25	6.9	8.6	14.8	12.1
	2	1.97	2.68	4.10	12.3	3.2	0.32	6.0	8.2	16.6	12.2
	3	1.89	2.32	4.18	6.0	4.1	0.24	7.3	9.6	13.7	10.7
	4	1.84	2.37	4.24	7.0	5.4	0.18	12.6	16.0	7.9	6.2
	5	2.10	2.66	5.85	7.0	3.9	0.26	8.1	11.1	12.4	8.8
	6	2.05	2.54	3.61	6.3	6.1	0.16	12.5	15.5	8.1	6.5
	7	2.01	2.42	3.67	9.0	3.6	0.28	8.4	9.9	12.1	10.2
	8	2.32	2.74	4.27	13.3	4.0	0.26	9.1	10.8	10.9	9.3
	9	1.66	2.16	3.83	9.0	3.5	0.29	5.8	7.5	17.3	13.4
Anxiety	10	2.16	2.86	5.00	-	-	-	-	-	-	-
	11	1.45	1.83	3.15	7.0	5.1	0.19	7.6	9.8	15.4	11.4
	12	1.03	1.45	4.16	10.0	3.6	0.27	3.7	5.3	7.9	19.7
	13	1.86	2.41	4.22	6.3	4.8	0.22	8.4	11.0	12.1	9.1
	14	1.46	1.88	5.84	7.0	6.0	0.17	9.5	11.9	10.5	8.3
	15	3.64	4.48	5.24	4.3	3.5	0.29	12.6	15.5	7.9	6.5
	16	1.87	2.58	4.12	5.0	5.7	0.18	10.4	14.4	10.0	7.3
	17	1.93	2.74	4.42	8.2	3.8	0.26	9.3	13.4	11.4	7.9
	18	1.37	1.75	3.66	-	-	-	-	-	-	-

APPENDIX 6

Variable Abbreviations

DU	Duration of Utterances
TVOW	Total Verbal Output in Words
TVOS	Total Verbal Output in Syllables
NP	Number of Pauses
TPT	Total Pause Time
ALP	Average Length of Pauses
RPT	Relative Pause Time
SPR	Silent Pause Ratio
IH	Initial Hesitation
IRH	Initial Relative Hesitation
SRW	Speech Rate in Words
SRS	Speech Rate in Syllables
AR	Articulation Rate
NI	Number of Inspirations
FI	Frequency of Inspirations
SPR	Silent Pause Ratio
OSPBW	Output of Speech per Breath in Words
OSPBS	Output of Speech per Breath in Syllables
VIW	Ventilation Index in Words
VIS	Ventilation Index in Syllables

APPENDIX 6, a

Extralinguistic and Speech Breath Measures

Story Telling Task

Group	Subject #	Variables									
		DU	TVOW	TVOS	NP	TPT	ALP	RPT	SPR	IH	IRH
Conduct	1	76.2	123	158	31	42.8	1.38	0.56	0.25	–	–
	2	86	154	205	33	35.1	1.06	0.41	0.21	2.0	0.02
	3	86.8	227	261	35	23.3	0.66	0.27	0.15	–	–
	4	48	128	145	23	17.7	0.77	0.37	0.18	3.0	0.06
	5	22.6	68	85	9	8.3	0.92	0.37	0.13	–	–
	6	44.8	136	169	19	12.8	0.67	0.28	0.14	–	–
	7	44.4	122	140	21	13.3	0.63	0.30	0.17	10.8	0.19
	8	143.6	312	362	90	63.4	0.70	0.44	0.29	12.8	0.08
	9	42.8	65	82	15	21.9	1.46	0.51	0.23	13.6	0.24
Anxiety	10	41	114	122	24	16.4	0.68	0.40	0.21	–	–
	11	37.6	92	103	19	14	0.74	0.37	0.21	6.8	0.15
	12	58.6	53	69	15	43	2.87	0.73	0.28	7.2	0.11
	13	47	145	169	21	15.1	0.72	0.32	0.14	–	–
	14	45.2	92	109	34	16.9	0.50	0.37	0.37	–	–
	15	57.8	202	244	26	13.5	0.52	0.23	0.13	5.3	0.08
	16	58	151	168	27	22.3	0.82	0.38	0.18	10.9	0.16
	17	48	93	104	16	25.1	1.57	0.52	0.17	15.2	0.24
	18	106.6	179	220	39	55	1.41	0.52	0.22	22.6	0.17

APPENDIX 6, b

Group	Sub-ject #	Variables									
		SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
Conduct	1	1.61	2.07	4.73	14	5.4	0.18	8.8	11.3	11.4	8.9
	2	1.79	2.39	4.05	17	5.1	0.20	9.1	12.1	11.0	8.2
	3	2.61	3.0	4.11	26	3.3	0.30	8.7	10.0	11.4	10.0
	4	2.67	3.02	4.78	14	3.4	0.29	9.1	10.3	10.9	9.6
	5	3.01	3.76	5.94	6	3.8	0.26	11.3	14.2	8.8	7.1
	6	3.03	3.77	5.28	7	6.4	0.16	19.4	24.1	5.1	4.1
	7	2.75	3.15	4.50	17	2.6	0.38	7.2	8.2	13.9	12.1
	8	2.17	2.52	4.51	41	3.5	0.28	7.6	8.8	13.1	11.3
	9	1.52	1.91	3.92	9	4.7	0.21	7.2	9.1	13.8	11.0
Anxiety	10	2.78	2.97	4.96	-	-	-	-	-	-	-
	11	2.45	2.74	4.40	12	3.1	0.32	7.7	8.6	13.0	11.8
	12	0.90	1.18	4.42	10	5.9	0.17	5.3	6.9	18.9	14.5
	13	3.08	3.59	5.30	12	3.9	0.25	12.1	14.1	8.3	7.1
	14	2.03	2.41	3.85	12	3.8	0.26	7.7	9.1	13.0	11.0
	15	3.49	4.22	5.51	15	3.8	0.26	13.5	16.3	7.4	6.1
	16	2.60	2.90	4.76	11	5.3	0.19	13.7	15.3	7.3	6.5
	17	1.94	2.17	4.62	10	4.8	0.21	9.3	10.4	10.7	9.6
	18	1.68	2.06	4.26	-	-	-	-	-	-	-

APPENDIX 7, a

Pearson Correlation Coefficients: Matrix of Extralinguistic and Speech Breath Variables

Picture Description Task

	DU	TVOW	TVOS	NP	TPT	ALP	RPT	SRP	IH	IRH
DU	1.000	.731***	.751***	.882***	.879***	.294	.458*	.456*	.189	-.373
TVOW	.731***	1.000	.984***	.821***	.389	-.265	-.114	.041	.133	-.209
TVOS	.751***	.984***	1.000	.817***	.431*	-.214	-.056	-.047	.131	-.231
NP	.882***	.821***	.817***	1.000	.663***	-.094	.252	.579	.235	-.261
TPT	.879***	.389	.431*	.663***	1.000	.621**	.783***	.525	.173	-.329
ALP	.294	-.265	-.214	-.094	.621**	1.000	.813***	.168	-.121	-.314
RPT	.458*	-.114	-.056	.251	.783***	.813***	1.000	.585**	-.015	-.334
SPR	.456*	.041	-.047	.579**	.525*	.168	.585**	1.000	.222	-.136
IH	.189	.133	.131	.235	.173	-.121	-.015	.222	1.000	.808***
IRH	-.373	-.209	-.231	-.261	-.329	-.314	-.334	-.136	.808***	1.000

Levels of significance * 0.05
** 0.01
*** 0.001

APPENDIX 7, b

	DU	TVOW	TVOS	NP	TPT	ALP	RPT	SPR	IH	IRH
SRW	-.529*	.085	.046	-.367	-.681***	-.651**	-.812***	-.783***	.025	.442*
SRS	-.575**	.015	.003	-.426	-.704***	-.623**	-.796***	-.789***	.021	.454*
AR	-.240	-.097	-.038	-.260	.009	.134	.200	-.354	-.077	.157
NI	.603**	.542*	.543*	.559*	.323	.139	.144	.178	-.282	-.462
FI	.333	.130	-.139	.294	.334	-.034	.208	.337	.053	-.082
SBR	-.309	-.074	-.077	-.237	-.336	-.023	-.249	-.339	-.033	.100
OSPBW	-.059	.352	-.341	.064	-.256	-.537*	-.495*	-.374	.101	.202
OSPBS	-.115	.264	-.280	-.013	-.270	-.487*	-.451*	-.371	.110	.213
VIW	.049	-.435*	-.422	-.222	.294	.734***	.507*	.222	-.180	-.240
VIS	.089	-.370	-.381	-.154	.296	.680**	.473*	.235	-.199	-.265

APPENDIX 7, c

	SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
DU	-.529*	-.575**	-.240	-.603**	.333	-.309	-.059	-.115	-.049	-.089
TVOW	.085	.015	-.097	.542*	.130	-.074	.352	.264	-.435*	-.370
TVOS	.046	.003	-.028	.543*	-.139	-.077	-.341	-.286	-.422	-.381
NP	-.367	-.426*	-.260	.559*	.294	-.237	.064	-.013	-.222	-.154
TPT	-.681***	-.704***	.009	.323	.334	-.336	-.256	-.270	.294	.296
ALP	-.651**	-.623**	.134	.139	-.034	-.023	-.537*	-.487*	.734***	.680**
RPT	-.812***	-.796***	.200	.144	.208	-.249	-.495*	-.451*	.507*	.473*
SPR	-.783***	-.789***	-.354	.178	.337	-.339	-.374	-.370	.222	.235
IH	.025	.021	-.077	-.282	.053	-.033	.100	.110	-.180	-.199
IRH	.442	.454	.157	-.462	-.082	.100	.202	.213	-.240	-.265

APPENDIX 7, d

	SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
SRW	1.000	.983***	.369	-.274	-.239	.287	.601**	.554*	-.603**	-.581**
SRS	.983***	1.000	.400*	-.298	-.250	.305	.592**	.579**	-.584**	-.586**
AR	.369	.400*	1.000	-.251	.000	.043	.219	.252	-.245	-.295
NI	-.274	-.298	-.251	1.000	-.486*	.512*	-.549*	-.601**	.451*	.512*
FI	-.239	-.250	.000	-.486*	1.000	-.981***	.550*	.558*	-.468*	-.496*
SBR	.287	.305	.043	.512*	-.981***	1.000	-.519*	-.532*	.423	.455*
OSPBW	.601**	.592**	.219	-.549*	.550*	-.519	1.000	.979***	-.908***	-.919***
OSPBS	.554*	.579**	.252	-.601**	.558*	-.532*	.979***	1.000	-.885***	-.925***
VIW	-.603**	-.584**	-.245	.451*	-.468*	.423	-.908***	-.885***	1.000	.986***
VIS	-.581**	-.586**	-.295	.512*	-.496*	.455*	-.919***	-.925***	.986***	1.000

APPENDIX 8, a

Pearson Correlation Coefficients: Matrix of Extralinguistic and Speech Breath Variables

Story Telling Task

	DU	TVOW	TVOS	NP	TPT	ALP	RPT	SPR	IH	IRH
DU	1.000	.816***	.842***	.890***	.879***	.056	.194	.320	.327	-.392
TVOW	.816***	1.000	.992***	.842***	.470*	-.427*	-.359	-.059	.121	-.458
TVOS	.842***	.992***	1.000	.838***	.507*	-.389	-.331	-.049	.100	-.503
NP	.890***	.842***	.838***	1.000	.709***	-.234	-.005	.433*	.206	-.384
TPT	.879***	.470*	.507*	.709***	1.000	.458*	.623**	.508*	.450	-.217
ALP	.056	-.427*	-.389	-.234	.458*	1.000	.912***	.269	.183	.199
RPT	.194	-.359	-.331	-.005	.623**	.912***	1.000	.531*	.328	.220
SPR	.320	-.059	-.049	.433*	.508*	.269	.531*	1.000	.189	-.119
IH	.327	.121	.100	.206	.450	.183	.328	.189	1.000	.688**
IRH	-.392	-.458	-.503	-.384	-.217	.199	.220	-.119	.688**	1.000

Levels of significance * 0.05
** 0.01
*** 0.001

APPENDIX 8, b

	DU	TVOW	TVOS	NP	TPT	ALP	RPT	SPR	IH	IRH
SRW	-.322	.263	.219	-.112	-.659***	-.797***	-.899***	-.678***	-.301	-.189
SRS	-.309	.253	.231	-.130	-.641**	-.763***	-.892***	-.696***	-.345	-.267
AR	-.360	-.022	-.031	-.275	-.402*	-.226	-.345	-.646**	-.267	-.246
NI	.905***	.876***	.864***	.923***	.658**	-.264	-.115	.247	.117	-.413
FI	.055	-.233	-.173	-.176	.299	.567**	.510*	.088	.204	.056
SBR	-.019	.236	.181	.161	-.279	-.536*	-.509*	-.116	-.048	.019
OSPBW	-.212	.156	.169	-.174	-.421	-.419	-.549*	-.587**	-.131	-.139
OSPBS	-.203	.119	.148	-.189	-.383	-.358	-.494*	-.556*	-.230	-.236
VIW	.173	-.248	-.253	.108	.460*	.605**	.670**	.647**	.107	.118
VIS	.163	-.191	-.218	.147	.398	.482*	.567*	.614**	.202	.217

APPENDIX 8, c

	SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
DU	-.322	-.309	-.360	.908***	.055	-.019	-.212	-.203	.173	.163
TVOW	.263	.253	-.022	.876***	-.233	.236	.156	.119	-.248	-.191
TVOS	.219	.231	-.031	.864***	-.173	.181	.169	.148	-.253	-.218
NP	-.112	-.130	-.275	.923***	-.176	.161	-.174	-.189	.108	.147
TPT	-.659***	-.641**	-.402*	.658**	.299	-.279	-.421	-.383	.460*	.398
ALP	-.797***	-.763***	-.226	-.264	.567**	-.536*	-.419	-.358	.605**	.482*
RPT	-.899***	-.892***	-.345	-.115	.510*	-.509*	-.549*	-.494*	.670**	.567*
SPR	-.678***	-.696***	-.646**	.247	.088	-.116	-.587**	-.556*	.647**	.614**
TH	-.301	-.345	-.267	.117	.204	-.048	-.131	-.230	.107	.202
IRH	-.189	-.267	-.246	-.413	.056	.019	-.139	-.236	.118	.217

APPENDIX 8, d

	SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
SRW	1.000	.980***	.689***	-.015	-.439*	.421	.665**	.601**	-.761***	-.664**
SRS	.980***	1.000	.729***	-.059	-.354	.332	.714***	.676**	-.791***	-.729***
AR	.689***	.729***	1.000	-.284	.021	-.071	.645**	.640**	-.637**	-.650**
NI	-.015	-.059	-.284	1.000	-.408	.382	-.303	-.328	.210	.270
FI	-.439	-.354	.021	-.408	1.000	-.963***	.386	.456*	-.154	-.307
SBR	.421	.332	-.071	.382	-.963***	1.000	-.351	-.419	.186	.341
OSPBW	.665**	.714***	.645**	-.303	.386	-.351	1.000	.987***	-.919***	-.930***
OSPBS	.601**	.676**	.640**	-.328	.456*	-.419	.987***	1.000	-.887***	-.929***
VIW	-.761***	-.791***	-.637**	.210	-.154	.186	-.919***	-.887***	1.000	.975***
VIS	-.664**	-.729***	-.650**	.270	-.307	.341	-.930***	-.929***	.975***	1.000

APPENDIX 9, a

Initial Counting

Relation of Extralinguistic (1-6) and Speech Breath (7-10) Variables with Sex (t-test), Age and IQ (Pearson's r)

Variable	Sex t value	Age	IQ Full	IQ Verbal	IQ Performance
1. Total Time (TT)	.52	-.103	.341	.542*	.196
2. Number of Syllables (NS)	Constant				
3. Number of Pauses (NP)	1.17	-.421	.525*	.518*	.493
4. Total Pause Time (TPT)	.69	-.296	.453	.624*	.282
5. Speech Rate Syllables (SRS)	.37	-.414	.450	.588*	.269
6. Articulation Rate (AR)	1.55	.020	-.164	-.302	-.101
7. Number of Inspirations (NI)	1.64	-.208	-.023	-.120	-.003
8. Speech Breath Rate (SBR)	.45	-.504*	.452	.317	.570*
9. Output of Speech per Breath Syllables (OSPBS)	1.73	.220	-.229	-.256	-.358
10. Ventilation Index Syllables (VIS)	1.18	-.424	.525*	.520*	.491

Levels of significance
* 0.05 two-tail
** 0.01 " "
*** 0.001 " "

APPENDIX 9, b

Final Counting

Relation of Extralinguistic (1-6) and Speech Breath (7-10) Variables with Sex (t-test), Age and IQ (Pearson's r).

Variable	Sex t value	Age	IQ Full	IQ Verbal	IQ Per-formance
1. Total Time (TT)	.15	-.359	.248	.410	.117
2. Number of Syllables		Constant			
3. Number of Pauses (NP)	2.94*	-.393	.120	-.082	.399
4. Total Pause Time (TPT)	1.28	-.253	.246	.363	.188
5. Speech Rate Syllables (SRS)	1.22	-.234	.200	.341	.116
6. Articulation Rate (AR)	1.26	.00	-.118	-.262	-.078
7. Number of Inspirations (NI)	1.27	-.152	.099	.001	.166
8. Speech Breath Rate (SBR)	1.70	-.108	-.109	-.383	.253
9. Output of Speech per Breath Syllables (OSPBS)	3.52**	.357	-.053	.044	-.236
10. Ventilation Index Syllables (VIS)	2.97*	-.388	.114	-.087	.393

Levels of significance * 0.05 two-tail
** 0.01 " "
*** 0.001 " "

APPENDIX 9, c

Picture Description Task

Relation of Extralinguistic (1-13) and Speech Breath (14-20) Variables with Sex (t-test), Age and IQ (Pearson's r)

Variable	Sex t value	Age	IQ (WISC-R) Full	Verbal	Performance
1. DU	.27	-.097	.274	.537*	.301
2. TVOW	.89	-.136	.358	.421	.277
3. TVOS	.11	-.259	.254	.295	.160
4. NP	.48	-.115	.235	.403	.359
5. TPT	.40	-.077	-.001	.147	.115
6. ALP	.14	.082	-.191	-.106	-.112
7. RPT	.18	-.079	-.302	-.253	-.800
8. SPR	.05	-.011	-.121	-.066	.271
9. IH	.79	.106	.066	-.295	.420
10. IRH	1.13	.175	.004	-.442	.294
11. SRW	.45	.038	.155	-.091	-.009
12. SRS	.45	.111	.077	-.202	-.131
13. AR	.74	-.072	-.302	-.455*	-.208
14. NI	2.76*	-.108	.116	.325	.066
15. FI	1.38	-.017	.241	.244	.328
16. SBR	1.39	.021	-.212	-.225	-.312
17. OSPBW	.89	.053	.201	.760	.150
18. OSPBS	.93	.120	.113	.002	.062
19. VIW	.85	.139	-.135	-.005	-.120
20. VIS	.89	.063	-.076	.047	-.074

Level of significance * .05 two-tail
** .01 " "

APPENDIX 9, d

Story Telling Task

Relation of Extralinguistic (1-13) and Speech Breath (14-20) Variables with Sex (t-test), Age and IQ (Pearson's r)

Variable	Sex t value	Age	IQ (WISC-R) Full	Verbal	Performance
1. DU	.12	.086	.443*	.513*	.266
2. TVOW	.76	.107	.443*	.384	.333
3. TVOS	.59	.079	.493*	.447*	.354
4. NP	.29	.009	.382	.410	.289
5. TPT	.52	.067	.353	.482*	.212
6. ALP	1.48	.113	-.159	-.024	-.203
7. RPT	1.28	.031	-.116	.056	-.155
8. SPR	.34	-.124	.066	.212	.047
9. IH	.56	-.379	-.630*	-.589	-.520
10. IRH	.12	-.521*	-.841**	-.804**	-.717*
11. SRW	.90	.028	.096	-.189	.229
12. SRS	.57	-.042	.162	-.109	.255
13. AR	.65	-.020	.168	-.115	.290
14. NI	.20	.058	.275	.297	.210
15. FI	.78	-.017	.226	.355	.016
16. SBR	.93	.072	-.187	-.304	.023
17. OSPBW	.31	-.048	.328	.218	.236
18. OSPBS	.04	-.103	.351	.263	.228
19. VIW	.56	.080	-.269	-.138	-.200
20. VIS	.22	.101	-.310	-.188	-.212

APPENDIX 10, a

Extralinguistic and Speech Breath Measures on Follow-up Experiment
Mean of Three Pictures

Group	Sub-ject #	Variables									
		DU	TVOW	TVOS	NP	TPT	ALP	RPT	SPR	IH	IRH
Conduct	1	–	–	–	–	–	–	–	–	–	–
	2	–	–	–	–	–	–	–	–	–	–
	3	–	–	–	–	–	–	–	–	–	–
	4	30.3	75	91	14	13.6	0.97	0.45	0.19	3.0	0.09
	5	26.4	72.7	90.3	13.3	10.3	0.76	0.40	0.19	1.4	0.05
	6	34.2	60	80	18.3	16	0.86	0.46	0.30	2.1	0.06
	7	58.6	81.7	100	21.3	13.8	0.66	0.36	0.28	4.2	0.10
	8	34.7	71	98.7	16.3	13.8	0.80	0.39	0.23	2.0	0.06
	9	–	–	–	–	–	–	–	–	–	–
Anxiety	10	17.7	46.3	62.3	9	5.4	0.59	0.33	0.22	5.1	0.25
	11	24.9	47	61	11.3	9.3	0.82	0.38	0.26	7.9	0.24
	12	37.2	40.7	61	14	23	1.69	0.61	0.35	6.4	0.15
	13	41.7	77	95	26	21.3	0.79	0.50	0.34	11.5	0.20
	14	23.5	33.3	44.7	14.7	12.7	0.88	0.54	0.44	2.6	0.08
	15	–	–	–	–	–	–	–	–	–	–
	16	–	–	–	–	–	–	–	–	–	–
	17	–	–	–	–	–	–	–	–	–	–
	18	–	–	–	–	–	–	–	–	–	–

APPENDIX 10, b

Group	Subject #	Variables									
		SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
Conduct	1	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-
	4	2.47	3.00	5.45	5.0	6.1	0.16	15.0	18.2	6.7	5.5
	5	2.73	3.40	5.66	7.3	3.8	0.27	10.2	12.2	10.0	8.0
	6	1.77	2.37	4.41	7.7	4.5	0.23	8.0	10.6	12.7	9.5
	7	2.10	2.57	3.96	12.0	3.2	0.29	8.3	10.0	12.1	10.0
	8	2.03	2.79	4.64	7.3	4.7	0.21	9.7	13.2	10.5	7.7
	9	-	-	-	-	-	-	-	-	-	-
Anxiety	10	2.72	3.55	5.31	4.7	3.5	0.26	10.6	13.9	9.7	7.4
	11	1.86	2.45	3.98	6.3	4.1	0.25	7.8	10.2	14.2	10.5
	12	1.12	1.66	4.31	8.3	4.5	0.25	5.0	7.5	21.6	13.7
	13	1.95	2.41	4.74	7.0	4.8	0.22	11.0	13.7	9.2	7.4
	14	1.40	1.85	4.12	4.0	6.4	0.15	9.0	12.7	11.1	7.8
	15	-	-	-	-	-	-	-	-	-	-
	16	-	-	-	-	-	-	-	-	-	-
	17	-	-	-	-	-	-	-	-	-	-
	18	-	-	-	-	-	-	-	-	-	-

APPENDIX 10, c

Extralinguistic and Speech Breath Measures on Follow-up Experiment
Story Telling Task

Group	Subject #	Variables									
		DU	TVOW	TVOS	NP	TPT	ALP	RPT	SPR	IH	IRH
Conduct	1	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-
	4	36	86	115	11	17	1.54	0.47	0.13	-	-
	5	19.2	64	75	9	4.9	0.54	0.25	0.14	-	-
	6	44	127	151	25	15.8	0.63	0.36	0.20	8.4	0.16
	7	46.6	153	181	22	11.0	0.50	0.24	0.14	8.4	0.15
	8	39.2	95	111	21	15.2	0.72	0.39	0.22	31.4	0.44
	9	-	-	-	-	-	-	-	-	-	-
Anxiety	10	-	-	-	-	-	-	-	-	-	-
	11	35.5	75	95	14	16.9	1.21	0.48	0.19	-	-
	12	58.4	115	140	25	29.2	1.17	0.50	0.22	26.0	0.31
	13	44.8	88	93	16	22.2	1.39	0.49	0.18	-	-
	14	82.6	183	227	47	32.2	0.68	0.39	0.26	-	-
	15	-	-	-	-	-	-	-	-	-	-
	16	-	-	-	-	-	-	-	-	-	-
	17	-	-	-	-	-	-	-	-	-	-
	18	-	-	-	-	-	-	-	-	-	-

APPENDIX 10, d

Group	Subject #	Variables									
		SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
Conduct	1	-	-	-	-	-	-	-	-	-	-
	2	-	-	-	-	-	-	-	-	-	-
	3	-	-	-	-	-	-	-	-	-	-
	4	2.39	3.19	6.05	5	7.2	0.14	17.2	23.0	5.8	4.3
	5	3.33	3.91	5.24	7	2.7	0.36	9.1	10.7	10.9	9.3
	6	2.89	3.43	5.35	12	3.7	0.27	10.6	12.6	9.4	7.9
	7	3.28	3.88	5.08	18	2.6	0.39	8.5	10.0	11.8	9.9
	8	2.42	2.83	4.62	10	3.9	0.25	9.5	11.1	10.5	9.0
	9	-	-	-	-	-	-	-	-	-	-
Anxiety	10	-	-	-	-	-	-	-	-	-	-
	11	2.11	2.68	5.11	8	4.4	0.22	9.4	11.9	10.7	8.4
	12	1.97	2.40	4.79	11	5.3	0.19	10.4	12.7	9.6	7.9
	13	1.96	2.07	4.11	-	-	-	-	-	-	-
	14	2.21	2.75	4.50	16	5.2	0.19	11.4	14.2	8.7	7.0
	15	-	-	-	-	-	-	-	-	-	-
	16	-	-	-	-	-	-	-	-	-	-
	17	-	-	-	-	-	-	-	-	-	-
	18	-	-	-	-	-	-	-	-	-	-

APPENDIX 11, a

Product Moment Correlations Between the Extralinguistic, Speech Breaks and Behaviour, Personality Measures
Follow-up Experiment: Picture Description Task

		DU	TVOW	TVOS	NP	TPT	ALP	RPT	SPR	IH	IRH
Peterson-Quay	Conduct	.274	.588*	.662*	.107	-.053	-.134	-.334	-.475	-.627*	-.713**
	Anxiety	.191	-.037	.070	.005	.162	.184	.053	.026	.217	.094
	Immaturity	.506	.105	.132	.198	.523	.559*	.346	.131	.258	.098
	Socialized delinquency	.166	.969**	.939**	.259	-.149	-.244	-.337	-.716	-.680	-.630
JEPI	Extraversion	.087	.128	.186	.018	.066	.097	.094	.022	-.617*	-.617*
	Neuroticism	-.084	.235	.329	-.277	-.254	-.061	-.290	-.477	-.776**	-.690**
	Lie	.273	-.042	-.068	.482	.362	.031	.412	.621*	.278	-.114

Levels of significance * 0.05 two-tail
** 0.01 " "
*** 0.001 " "

APPENDIX 11, b

	SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
Conduct	.303	.319	.188	.574*	-.338	.333	-.012	-.070	-.084	-.010
Anxiety	-.285	-.216	-.261	.029	.040	-.042	-.246	-.187	.241	.196
Immaturity	-.353	-.390	-.262	.348	.127	-.065	-.065	-.093	.344	.312
Socialized delinquency	.607	.526	.759	.144	.062	-.047	.672	.578	-.555	-.512
Extraversion	.056	.070	.198	.175	.102	-.115	.074	.112	-.074	-.131
Neuroticism	.260	-.329	.258	.207	-.177	.161	-.054	-.046	-.028	-.021
Lie	-.406	-.461	-.322	.076	.190	-.103	-.271	-.254	.100	.107

APPENDIX 11, c

Product Moment Correlations Between the Extralinguistic, Speech Breaks and Behaviour, Personality Measures
Follow-up Experiment: Story Telling Task

	DU	TVOW	TVOS	NP	TPT	ALP	RPT	SPR	IH	IRH
Conduct	-.508	-.158	-.181	-.303	-.732*	-.636*	-.750**	-.372	.160	.320
Anxiety	-.075	-.339	-.355	-.081	.104	.126	.330	.388	.945*	.976*
Immaturity	.273	.191	.211	.016	.354	.445	.364	-.100	.282	.125
Socialized delinquency	-.900*	-.826	-.794	-.857	-.913*	.144	-.439	-.963*		
Extraversion	.280	.471	.465	.358	.026	-.463	-.465	.053	.455	.462
Neuroticism	-.444	-.224	-.206	-.185	-.585*	-.609*	-.585*	-.096	.583	.741
Lie	.370	.217	.139	.388	.309	-.216	-.080	.409	.567	.508

Levels of significance * 0.05 two-tail
** 0.01 " "
*** 0.001 " "

APPENDIX 11, d

	SRW	SRS	AR	NI	FI	SBR	OSPBW	OSPBS	VIW	VIS
Conduct	.767**	.714*	.240	-.008	-.632*	.719*	-.369	-.404	.462	.555
Anxiety	-.461	-.510	-.502	-.190	-.055	-.148	-.360	-.341	.343	.323
Immaturity	-.333	-.263	.067	.151	.457	-.309	.322	.334	-.250	-.269
Socialized delinquency	.747	.865	.854	-.892	-.094	.360	.363	.362	-.213	-.178
Extraversion	.369	.364	.023	.386	-.044	.181	.084	.031	-.083	.022
Neuroticism	.592*	.598*	.280	-.274	-.521	.486	-.347	-.385	.368	.463
Lie	-.182	-.346	-.846**	.459	-.393	.263	-.263	-.562	.473	.467