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Vocal Emotion Recognition of Children
With and Without Attention Deficit Hyperactivity Disorder
as a Function of
Their Mothers' Emotion Portrayals

by

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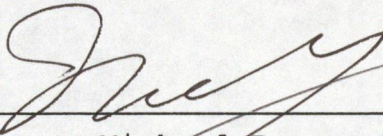
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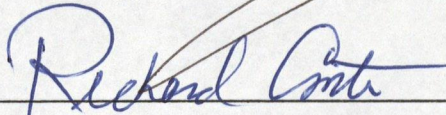
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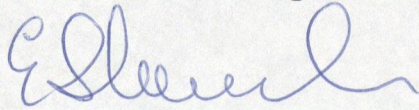
The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies for acceptance, a thesis entitled "Vocal Emotion Recognition of Children With and Without Attention Deficit Hyperactivity Disorder as a Function of Their Mothers' Emotion Portrayals" submitted by Sandra F. Large in partial fulfilment of the requirements for the degree of Master of Science.



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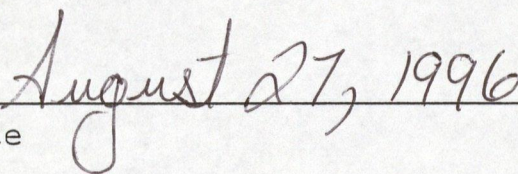
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Abstract

Thirty-two mothers and their children (with and without Attention Deficit Hyperactivity Disorder (ADHD)) participated in a study examining: 1) vocal emotion recognition of the children, and 2) clarity of emotion portrayals in the mothers. The children judged an audiotape of a woman speaking in happy, angry, and neutral emotional tones of voice. These emotions were expressed in one of two ways: as if the speaker was feeling strong emotion (extreme), or a more moderate emotion (moderate). In addition, mothers provided examples of the way they express moderate and extreme happiness, anger, and neutral emotion. The clarity of these portrayals was subsequently judged by independent raters. ADHD children recognized emotion less well than their peers, especially happiness and extreme emotion. However, there was no difference between mothers of ADHD children and their peers in emotion portrayal clarity. The correlation between emotion recognition and social skills was not significant.

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Of course, all the errors are my own.

Dedication

To John

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Vocal Emotion Recognition of Children
With and Without Attention Deficit Hyperactivity Disorder
as a Function of
Their Mothers' Emotion Portrayals

The research described below will look at the ability of children with attention deficit hyperactivity disorder¹ (ADD) to recognize vocal emotion. ADD is a disorder characterized by difficulties with impulse control and in maintaining attention to tasks, or as stated by Douglas (1972) a deficiency in being able to "stop, look and listen" (p.258). Children with ADD are also more likely than children without ADD to have a diagnosis of conduct disorder, oppositional defiant disorder, mood disorders, and learning disorders (Biederman, Newcorn, & Sprich, 1991).

The American Psychiatric Association (APA: 1987) has stated that ADD, as described in their third Diagnostic and Statistical Manual and as defined herein, is "common; it may occur in as many as 3% of children" (p. 51). However, estimates of prevalence vary (Barkley, 1989; Biederman, et al., 1991; McArdle, O'Brien, & Kolvin, 1995). For example, one study (Cohen, et al., 1993) interviewed 776 children and their mothers from upstate New York using a standardized interview; they found that 8.5% of girls and 17.1% of boys in the 10 to 13 year age group had enough symptoms to be diagnosed with ADD. One factor which affects the prevalence estimate is the definition of ADD used in the study. For example, by using different definitions of ADD (symptom of

¹ Throughout this thesis attention deficit hyperactivity disorder will be called ADD. This is for ease of description and because the term ADD is commonly used for describing these children in many areas. Therefore, children diagnosed as having attention deficit hyperactivity disorder will be described as children with ADD, ADD children, or target group children. Children without a diagnosis of ADD will be described as children without ADD, non-ADD children, or comparison group children.

hyperactivity versus hyperactivity plus disorder) and examining two age groups (7 or 8 year-old versus 11 or 12 year-old children), McArdle and colleagues found prevalence estimates varying from 3.1% to 41.9% when examining 4,340 children from the North of England.

Children with ADD are also at high risk for peer rejection (Landau & Moore, 1991; Whalen & Henker, 1992). This, in turn, places them at higher risk for later difficulties: including criminality, dropping out of school, and psychiatric problems (Parker & Asher, 1987). There are several factors which relate to peer rejection. This study will be concerned with only one of these. Many studies have shown that children who have been rejected or neglected by their peers recognize facial emotion less well than their accepted peers (Edwards, Manstead, & MacDonald, 1984; Kafer, 1981; Monfries & Kafer, 1987; Spence, 1987; Vosk, Forehand, & Figueroa, 1983). In particular, Spence found that skill in emotion recognition was significantly correlated with negative sociometric nominations in kindergarten children. This study will compare the emotion recognition of children with ADD to the emotion recognition of their normal peers.

Emotion recognition is also presumed to be related to overall social skills (Demorest, 1992; Crick & Dodge, 1994). Custrini and Feldman (1989) found that girls (but not boys) (n=33; aged 9 to 12) with above-average social competence were better than their less socially competent peers at recognizing and portraying emotion. The present study will assess the relationship between social skills and emotion recognition for children with and without ADD. It is hypothesized that there will be a relationship.

Although I could find no studies explicitly dealing with emotion recognition in children with ADD, a study by Shapiro, Hughes, August, and Bloomquist (1993) examined closely related abilities. These researchers examined overall emotional processing in children with ADD. Among various aspects of

emotional processing which were assessed, children with and without ADD were asked to perform two tasks related to vocal emotion recognition. First, participants were asked to listen to utterances where the words and intonation had either congruent or incongruent emotional messages. Children were asked to indicate whether the messages matched or did not. Second, participants listened to neutral content sentences spoken with emotional intonation. Eight seconds later a face was shown and participants were to indicate whether or not the face matched the sentence. While ADD children did not differ from other children when performing tasks assessing visual or situational emotional processing, they displayed more difficulty than their peers on the two tasks described above. Shapiro et al. suggest that "deficits in auditory processing of emotional information may be present" (p. 222).

Social Interactions of Children with ADD

In addition, there is evidence from the social interactions of children with ADD which indicates that vocal emotion recognition may be a fruitful line of investigation. As compared to children without ADD, the peer interactions of children with ADD tend to be more negative (i.e. they involve more criticism and disagreement) and less interactive (i.e. involving less interaction). A study by Grenell, Glass, and Katz (1987) found that when telling a peer how to put together a puzzle, children with ADD were more critical and were rated as less desirable partners by their peers. Whalen and colleagues (Whalen, Henker, Collins, McAuliffe, & Vaux, 1979) found that children with ADD were more likely than normal children to disagree with their partner (who did not have ADD) when they were expected to follow the instructions of that partner. A similar study found that children with ADD were seen by their peers as more negative than were active but non-ADD children (King & Young, 1981). Finally, a study of the sibling interactions of children with and without ADD (Mash & Johnston, 1983b) found that there was more conflict in sibling

dyads containing an ADD child than there was in other sibling dyads, with this being especially true when the dyad contained a younger ADD child.

This pattern of increased negativity is also seen in mother-child interactions; when interacting with their ADD children mothers have generally been found to express more negativity (Barkley, Karlsson, & Pollard, 1985; Mash & Johnston, 1982), and sometimes to express less positivity (i.e. provide less praise; Cunningham & Barkley, 1979) than do mothers of children without ADD. In addition, when interacting with their mothers children with ADD express more negativity (Barkley et al., 1985; Mash & Johnston, 1982; Tallmadge & Barkley, 1983).

Another aspect of the social interactions of children with ADD which may relate to both emotion recognition and peer rejection is that they seem to be less interactive than those of children without ADD. Hubbard and Newcomb (1991) videotaped play interactions of dyads containing ADD/non-ADD boys and non-ADD/non-ADD boys; the dyads containing a child with ADD engaged in less mutual play and more separate play. Perhaps as a result of this limited interaction the dyads containing a child with ADD produced fewer positive and fewer negative exclamations than the other dyads. Mothers of children with ADD initiated fewer interactions with their children than did mothers of children without ADD and responded less to their child's initiations of interactions (Barkley et al., 1985; Cunningham & Barkley, 1979; Mash & Johnston, 1982). Thus, there is evidence that both mother-child and peer interactions are less interactive when involving a child with ADD.

Even though social interactions involving children with ADD are less interactive, Grenell et al. (1987) found no difference between children with and without ADD as to initiating and rejecting initiations when in a free play situation with a non-ADD peer. Nor is there any difference in

their relational goals (Melnick & Hinshaw, 1996). In addition, when interacting with their mothers, children with ADD have been found to initiate either as many interactions as do children without ADD (Cunningham & Barkley, 1979; Mash & Johnston, 1982) or to initiate more (Barkley et al., 1985; Tallmadge & Barkley, 1983). They have normally been found to respond as much to their mothers' initiations as do their peers in both free play and structured task situations (Barkley et al., 1985; Cunningham & Barkley, 1978; Tallmadge & Barkley). The only exception was in the Mash and Johnston (1982) study when performing a structured task. Children with ADD were also found to initiate more interactions with their siblings than their siblings did with them in a structured task situation (Mash & Johnston, 1983b). Mash and Johnston suggested that there was evidence of the sibling without ADD showing an avoidant behaviour pattern with their ADD sibling. Finally, children with ADD have been found to initiate more interactions with their teachers than did their peers (Whalen, Henker, & Dotemoto, 1981). Taken together, these findings suggest a pattern of attempted interaction on the part of the ADD child which is not being responded to by many of the child's significant companions.

It may be that people interacting with ADD children are reacting to the behaviour of these children. Landau and Milich (1988) found that when interacting with children with ADD, peer partners interacted in a manner less conducive to achieving the goals set out for them when compared to their behaviour with non-ADD children. These researchers suggested that this deterioration in partner behaviour was a response to inappropriate behaviour of the ADD partner (e.g. ADD children answered questions they could not know the answer to). Mothers of children with ADD also seem to be responding to the behaviour of their children. This is suggested by studies which show that when the child's behaviour improves through the use of stimulant medications, the behaviour of their

mother becomes more similar to that of mothers of children without ADD (Barkley, 1989; Barkley, Karlsson, Strzelecki, & Murphy, 1984; Cunningham & Barkley, 1978; Humphries, Kinsbourne, & Swanson, 1978). This is in accord with studies involving teachers of children with ADD; when ADD children take methylphenidate and their behaviour improves, the behaviour of teachers is "normalized", becoming less intense and less controlling (Whalen, Henker, & Dotemoto, 1980; Whalen, Henker, & Dotemoto, 1981). The data described above provides strong reason to be concerned that children with ADD will experience a pattern of rejection. As noted above, rejected children have been found to show deficient emotion recognition (Custrini & Feldman, 1989; Edwards et al., 1984; Kafer, 1981; Monfries & Kafer, 1987; Vosk et al., 1983).

Responsivity to Stimuli of Children with ADD

Children with ADD could have difficulty recognizing vocal emotion if they do not respond to changing intonation in the voice. Evidence suggests that children with ADD show less response to stimuli in certain situations. Much of the evidence pertaining to this is found in studies of the event-related potential (ERP) of children with ADD. ERPs are electroencephalogram readings of electrical activity in the brain: the electrical activity having been evoked by the presentation of a stimulus. The measurement of ERPs allows one to examine responses to target versus nontarget stimuli, attended versus nonattended stimuli, and active versus passive responding. According to Loveless the ERP reflects "the processes involved in shifts of attention" (Donchin et al., p. 45).

The aspect of ERPs of interest here, the amplitude of P300, is believed to reflect the amount of attention allocated to the stimulus (Klorman, 1991). This interpretation is reflected in the findings that P300 amplitude increases as more attention is allocated to a stimulus. When children are asked to attend (Loiselle, Stamm, Maitinsky, & Whipple, 1980;

Zambelli, Stamm, Maitinsky, & Loisel, 1977), to target (vs. nontarget) stimuli (Holcomb, Ackerman, & Dykman, 1985; Klorman, Salzman, & Borgstedt, 1988), and when an active response such as pushing a button is required (Callaway, Halliday, & Naylor, 1983) P300 amplitude increases. P300 is a positive wave that occurs between 300 and 800 ms after stimulus presentation. This measure is of particular interest in this research because of what it tells us about the way ADD children use their attention. Again, if children with ADD do not, or can not, attend to the changes in the voice which accompany emotion, they may not recognize vocal emotion when it is present.

Relative to their normal peers children with ADD show less physiological response to stimuli in certain situations. They also show less increase in physiological indices of their attention in response to increases of task demands. In three separate studies examining the ERPs of ADD and non-ADD children Klorman and colleagues (1988) asked 126 children (mean age approximately 9 years) to actively respond to visual continuous performance tests of varying difficulty. The late positive component of ERPs (according to Klorman et al. this is "essentially synonymous" with P300 (p. 74)) was smaller not only for ADD versus non-ADD children, but also for ADD children taking placebo versus those taking methylphenidate. This, presumably, indicates less attention being allocated to the task. Similar results were described by Holcomb et al. (1985), when using an active-response auditory vigilance task. The P300 amplitude of ADD children (with and without hyperactivity), children with reading disabilities, and normal controls (Total n=93, 8- to 12-years old) increased in response to target (vs. non-target) stimuli, although the increase was larger in the control group than in the other groups.

In a dichotically presented (i.e. different information presented simultaneously in each ear) auditory vigilance task,

Loiselle et al. (1980) examined the ERPs of 12-year-old children (n=27, with and without ADD) who were asked to attend to one ear or the other. They found no difference between groups in response to the non-attended stimuli; in response to the attended stimuli the P300 amplitude of comparison children was larger than that of children with ADD. In addition, comparison children (but not children with ADD) had significantly larger P300 amplitudes to target stimuli than to nontarget stimuli. Finally, Prichep and colleagues (Prichep, Sutton, & Hakerem, 1976) examined the ERPs of ADD and normal children in conditions where they: a) were asked to guess whether or not a click was coming (a 50/50 probability: uncertain condition) or b) were told whether or not the click was coming (50/50 probability: certain condition). It would be expected that P300s (in this study P295) would decrease in the certain condition (Prichep et al.) as less attention is required. However, the P300s of children with ADD were larger in the certain condition. Prichep et al. said of children with ADD that this finding "suggests that they are responding inappropriately to task demands" (p. 422).

Taken together, these studies indicate that children with ADD show smaller P300 amplitude to stimuli they are expected to attend to than do their normal peers, at least when required to actively respond. This, in turn, suggests that children with ADD allocate their attention less effectively than do their peers (See Klorman, 1991). A deficient response to stimuli could lead to a deficit in vocal emotion recognition if it means ADD children do not respond to the changing vocal cues which indicate vocal emotion.

According to Klorman (1991) a smaller P300 amplitude is found in several continuous performance test studies of moderate or greater difficulty, suggesting that the difficulty of the task may be an important variable. Klorman further suggests that several studies which did not find reduced P300 amplitude in ADD children were easier, and that this could

explain these unexpected findings. However, in each of the studies cited there are other potential explanations for failure to find the expected deficits in P300 amplitude.

The present study will compare the results of emotion recognition by children when listening to moderate and extreme emotion². It is assumed that extreme emotion will be more obvious, thus easier to recognize. Recognition of extreme emotion, if Klorman's (1991) contention is correct, will presumably be less likely to evoke the attentional deficiencies shown by ADD children. Therefore, it seems likely that ADD children will recognize extreme emotion as accurately as comparison children, but will recognize moderate emotion less accurately than comparison children.

Maternal Emotion Portrayal and Their Child's Emotion Recognition

Another group of studies which points to deficiencies in emotion recognition associated with ADD is described below. Camras (1985) suggests that children may develop a concept of a particular emotion as a result of viewing various exemplars of that emotion in different situations. Thus, a child could be exposed to various examples of, for example, anger when s/he or someone else is being disciplined. This child may come to develop a concept of anger as occurring when a person is being disciplined. This concept would be further refined with the experience of more examples. Camras describes this process of concept development as being similar to the development of semantic understanding. A second possibility described by Camras is emotional development through empathic

² This study manipulates a variable I will call emotion strength. I have found no studies which have manipulated this variable before this and it, therefore, does not have a clear operational definition. However, when I speak of emotion strength, I speak of the intensity of the emotion felt by the speaker (i.e. an emotion felt strongly or an emotion felt at a moderate level, analogous to the difference between fury and anger).

response to others' emotions, with the child's feeling and the emotional expression becoming linked in the child's mind. Both of these hypothesized processes place a strong emphasis on the child's experience of others' emotion portrayals and either could occur separately or in combination with the other (Camras).

Camras and others examined the relationship of maternal emotion portrayals to children's emotion recognition. The studies by Camras and colleagues (Camras et al., 1990; Camras et al., 1988) looked at the relationship between mothers' emotion portrayals and their child's emotion recognition in abusive and non-abusive mothers and their children. It was assessed in several ways. Camras et al. (1988) asked mothers (n=40, mean age of children: 4 years 11 months) to portray six facial emotions after practising them in front of a mirror for as long as they chose; the photographs of these posed emotions (if approved by the mother) were then coded as to emotion portrayed. Camras et al. (1990) coded the videotapes of laboratory play sessions of the same mothers and children. In addition, the frequency of mothers' portrayal of various facial emotions was counted in seven home observations of each of the participants. The children's emotion recognition was assessed by asking each child to choose the emotional term which described pictures of various emotions. These pictures were of children who were instructed to pose the six emotions used in the study. Daly and colleagues (Daly, Abramovitch, & Pliner, 1980) videotaped middle class mothers while they were viewing slides designed to elicit one of three emotions. These videotapes were then judged by university students who were asked to consider which type of slide the mothers were watching when videotaped. The children of these women (n=20 dyads; mean age of children: 67 months) judged the videotapes of their own and two other mothers. Finally, Denham and Grout (1992) employed several methods of gathering information on mothers' emotions (emotion diaries, semi-structured

interviews, and in-home observations) as well as children's emotion knowledge (facial emotion labelling and knowledge of situational influence on emotion). In concert, these studies show that the clarity of mothers' facial expressions significantly correlates with the accuracy of their child's recognition of facial expressions for abusive and comparison mothers (Camras et al., 1988) and middle class mothers (Daly et al.). The mothers' clarity of expression explained 25% of the variance in children's decoding scores (Daly et al.). In addition, the frequency with which the mothers expressed sadness, anger, tension, and happiness related to their child's emotion recognition (Camras, et al. 1990; Denham & Grout, 1992). The present research follows a format similar to that of Camras et al. (1988), while looking at vocal emotion with the participation of mothers and their children with or without ADD.

The findings of Camras and colleagues are of interest in the present study because Bugental and her colleagues conducted a series of observational studies (judgements of videotaped family interactions) which indicated that disturbed children (children with emotional or behavioural difficulties, aged 8-12) receive from their mothers more conflicting messages or messages difficult to understand (Bugental & Love, 1975; Bugental, Love, Kaswan, & April, 1971). In the first study (Bugental et al.) the observers judged the "evaluative content" (p. 6) of parental communication to their children in 30 of the 117 families videotaped; these communications were judged on each of three communication channels: 1) verbal (typescript of message), 2) vocal (tone of voice), and 3) visual (facial expressions, gestures, etc.). It was found that mothers in the "disturbed" group conveyed more conflicting messages. Using 40 of the same 117 families Bugental and Love assessed the affective quality and assertiveness of parental comments to their children: approving, disapproving and neutral. They found that mothers

of disturbed children used less assertive intonation when expressing either approval or disapproval than they did when making neutral comments. This would presumably make these emotions less clear.

Taken together, these studies indicate that a) disturbed children observe maternal emotion portrayals which are less clear, and b) maternal emotion portrayals which are less clear are related to less accurate emotion recognition by their children. It should be noted at this point that the Bugental studies addressed vocal emotion while the Camras studies addressed facial emotion. Thus, although it seems reasonable to assume there would be a relationship between facial and vocal emotion, it is unclear to what extent. Nevertheless, given these findings it is hypothesized that mothers of children with ADD (as mothers of "disturbed" children) will portray emotion less clearly than mothers of children without ADD, that children with ADD will recognize emotion less well than their peers without ADD, and that the accuracy of emotion recognition by children will be significantly correlated with the clarity of emotion portrayal by their mothers. None of these hypotheses have yet been tested with children with ADD, although the findings of Shapiro et al. (1993) are indicative of vocal emotion recognition deficiencies in these children. However, other groups of "disturbed" children have shown emotion recognition deficiencies, including emotionally disturbed children (Walker, 1981; Zabel, 1979). This provides indirect support for the findings by Bugental and colleagues.

Children's Recognition of Emotion

Thus, the present study will focus on two issues: 1) the ability of children with and without ADD to recognize vocal emotion; and 2) the relationship of these children's emotion recognition to their own social skills and their mothers' clarity of vocal emotion portrayal. One question which would be of interest is whether average children of the age used in this study recognize vocal emotion. If they do not the

present study is less likely to provide useful information.

Average children of the age used in this study will normally recognize vocal emotion, although with some errors (Dimitrovsky, 1964; Gates, 1927). Even children younger than those used in this study recognize vocal emotion; Baltaxe (1991) asked 10 children (aged 39 to 48 months) to judge the emotion expressed in verbal messages. She used sentences which carried no affective valence in the verbal content (e.g. Look at this ball). Four emotions were portrayed and pretested: angry, happy, neutral, and sad. Children correctly identified all of the emotions more than 1/2 of the time. Gates performed the most comprehensive study in the area. 627 children from grades 3 to 8 were asked to identify the emotion expressed by a female student while she was reciting the alphabet. The author concluded that with increased "age, grade and school experience" (p. 175) children improved their ability to understand emotion expressed in neutral content speech. However, according to a personal communication from Gates to Dimitrovsky (cited by Dimitrovsky) the actual study data was destroyed so the only information available is the abstract. This abstract does not inform us about the proportion of correct responses. Dimitrovsky assessed the recognition of 224 children (5 to 12:4 years of age) of four vocal emotions: happiness, sadness, anger and love. Her findings supported Gates's, in that the accuracy of emotion recognition improved with the age of the child. She also states that all ages of children identified emotion above chance (values ranged between 1/3 and 2/3 correct) and that the slope of improvement with age is "relatively smooth" (p. 73). Thus, there is evidence that non-ADD children in the age range of children participating in the present study can recognize vocal emotion.

This study will extend Camras's work while looking at the vocal emotion recognition of children with ADD. In addition to this it will look at the effect emotion strength has on

emotion recognition. Finally, it will examine the relationship of emotion recognition to a measure of social competency.

Hypotheses

1. Children with ADD will recognize emotion less well than their peers without ADD.
2. Accuracy of emotion recognition will be significantly related to a measure of social competence.
3. Children with ADD will recognize high intensity emotion as well as comparison children, but will recognize low intensity emotion less well than comparison children.
4. The accuracy of emotion recognition by children with ADD will be significantly correlated with the clarity of emotion portrayal by their mothers.
5. Mothers of children with ADD will portray emotion less clearly than mothers of children without ADD.

Method

This study consisted of two experiments. The first examined the ability of children with and without ADD to recognize emotion (Emotion Recognition Experiment)³. The second examined their mothers' clarity of emotion portrayal (Emotion Portrayal Experiment). These two experiments will be described separately,

Emotion Recognition Experiment

To examine children's emotion recognition an audiotape of a female actor speaking in different emotional tones of voice

³ Some studies which have looked at the relationship between mothers' emotion portrayal and their child's emotion recognition have asked children to rate their own mother's voice. However, those studies were assessing facial emotion. Thus, an instant picture could have been judged by the children. Judgement of voices is somewhat more complex, in that it generally requires the creation of an audiotape to be judged. Thus, having children judge their own mothers' voices would have necessitated that participants make a second visit to the University of Calgary. Time pressures made this impossible.

was developed. Adults were asked to judge the actor's emotions to provide a standard against which to measure the children's emotion recognition. After the adults had judged the tape children were asked to listen to the tape and to tell the researcher how they thought the actor felt.

Participants

Adults

Adult participants were recruited through use of a pool of names and phone numbers at the University of Calgary Psychology Department. Interested students in psychology classes had supplied their names and phone numbers to the Psychology Department to be contacted about participating in psychological studies. The researcher contacted students by phone, told them about the study, and asked for their participation. Students were promised no benefit for participating. The course of these conversations is shown in Appendix A.

The 13 students who came for the research session all completed the tasks asked of them. These participants were between the ages of 17 and 33 ($M = 22.85$). There was an approximately equal number of males ($n=6$) and females ($n=7$). Participants named 8 different academic departments as their major area of study, with four participants naming psychology. Two of the participants majored in General Studies. No two of the other participants had the same major.

Children

There were 32 child participants in the emotion recognition experiment. Their mothers completed questionnaires and brought their children to the University of Calgary for the research session. Information on the mothers can be found in the description of the emotion portrayal task. These mother-child dyads belong to two groups according to whether or not the child was diagnosed as having ADD. Not all of the 42 mother-child dyads who volunteered completed the study for a variety of reasons as follows: several children (2

with ADD and 4 without) were not matched with another child of the same age and sex, one target dyad and one comparison dyad dropped out, and two of the children (one from each group) did not meet the selection criteria described below. Thus, in total 4 children with ADD and 6 children without ADD did not complete the study. The data for the noncompleting mother-child dyads are not included in the research analyses.

Many avenues of communication with potential participants were employed, as shown in Table 1. First, the researcher was interviewed on a radio show about the study. The researcher's phone number was given and interested participants phoned for information. Eight of the participants were reached in this manner. A second means of communication with potential participants was a notice published in a city-wide community newspaper that asked interested mothers to phone the researcher. This notice can be seen in Appendix B. Another 5 of the participants phoned the researcher after reading this notice. In addition, many organizations were asked to provide information about the study to their members or employees. This resulted in 11 other participants becoming involved. These organizations included large corporations, places where children congregate such as pools and after-school care, The Learning Centre (an organization which provides services to people with learning difficulties), and a support group for parents of children with ADD. Several (n=5) of the participants were friends of either the researcher or of other participants. Finally, as the method of contacting potential participants was not consistently recorded the researcher can not conclusively state how 3 of the participants were informed about the study. However, it is believed these participants were contacted through the media.

Children with ADD met criteria adapted from those suggested by Barkley (1990): 1) Diagnosis of ADD according to the Diagnostic and Statistical Manual, Third Edition - Revised (DSM-III-R; APA, 1987; criteria shown in Appendix C) as

assessed by a physician or mental health professional; 2) 8 or more symptoms rated by their mother as being "Pretty much" or "Very much" representative of their child on the ADD Rating Scale (ADHDRS: Barkley & DuPaul, 1990)⁴; 3) I.Q. greater than 80 as estimated by the Peabody Picture Vocabulary Test - Revised⁵ (PPVT-R; Dunn & Dunn, 1981); and 4) no significant language delays, sensory handicaps, seizures, or psychosis. Some of the children had a history of such problems, but according to mothers the current difficulties were small or nonexistent.

In addition, mothers were asked to ensure that their children had not received any stimulant medication in the 12 hours prior to the tasks being performed. This period of time was felt to be sufficient as stimulants (the most common being dextroamphetamine and methylphenidate) have a short active duration. Methylphenidate is effective for approximately three to six hours while dextroamphetamine is effective for approximately four to six hours (Maxmen & Ward, 1995).

The comparison children were matched on age ($\pm$ 6 months) and sex to a child in the target group. They were also

⁴ The ADHDRS is a questionnaire which asks parents to rate their children on the extent to which they display the 14 symptoms of ADD according to the DSM-III-R (APA, 1987). As such, it has excellent face validity. However, I have found no information on the reliability of this scale. According to Barkley and DuPaul (1990) "(a) score of 8 or more exceeds the DSM-III-R cutoff for diagnosis of ADHD" (p. 45).

⁵ The PPVT-R is commonly used in research as an estimate of IQ. It is a nationally standardized measure with adequate reliability (approximately .80 for internal consistency and test-retest) and validity. It measures an important aspect of vocabulary: receptive vocabulary (Dunn & Dunn, 1981). This, in turn, can provide an estimate of IQ. However, although the "IQ greater than 80" criterion will be confirmed, the PPVT-R scores will be described by standard scores as these are easily understood and less susceptible to misinterpretation (Dunn & Dunn, 1981).

required to have: 1) no diagnosis of ADD; 2) less than 8 symptoms of ADD rated by their mother as being "Pretty much" or "Very much" representative of their child on the ADD Rating Scale (Barkley & DuPaul, 1990); 3) I.Q. greater than 80 as estimated by the PPVT-R (Dunn & Dunn, 1981); and 4) no significant language delays, sensory handicaps, seizures, or psychosis.

The children who participated in the emotion recognition experiment were between the age of 89 months and 136 months as shown in Table 2 ($\bar{M}$ = 110 months). The two groups were approximately equal in age ($\bar{M}_T$ = 109 months; $\bar{M}_C$ = 111 months) and equal in sex ratio (there were 14 males and 2 females in each group). Analysis of the scores on the ADD Rating Scale (Barkley & DuPaul, 1990) indicated that children in the target group had a mean score of 12.4 (Range = 9 to 14) while children in the comparison group had a mean score of 0.75 (Range = 0 to 5). Most (12/16) of the comparison children were rated by their mothers as not having any symptoms of ADD.

Receptive vocabulary as measured by the PPVT-R (Dunn & Dunn, 1981) was in the average range and did not differentiate the two groups ($\bar{M}_T$ = 108; $\bar{M}_C$ = 116) as assessed using a Oneway ANOVA, $F(1,30) = 3.02$, $p = .093$. This indicates a receptive vocabulary of average or better for their age for both groups and reflects the fact that each child met the criterion of having an IQ greater than 80 as estimated by the PPVT-R (Dunn & Dunn, 1981).

Materials and Procedures

Development of the emotion recognition audiotape

The first step of the study was to develop an audiotape to test the children's ability to recognize emotion. To limit the time and cost of the experiment it was decided to use only one speaker on the emotion recognition tape. This tape was developed to examine emotion recognition as a function of two variables: type of emotion expressed (happy, angry, or neutral emotion) and strength of emotion expressed (moderate emotion

and extreme emotion). As described above the term emotion strength refers herein to the speaker's intensity of feeling the emotion.

The emotion recognition tape consisted of one female actor (a drama student recommended by a drama professor at the University of Calgary) saying neutral content sentences in various emotional tones of voice. The actor was originally recorded in a 72" by 76" booth. This booth was sound-proof and sound-treated to decrease the ambient noise and the interference of echoes. The ambient noise level in this room was 25 dBA. This is approximately the noise level of a quiet home in the country (Considine & Considine, 1995). This recording was made using a Bruel & Kjaer condenser microphone (Model 4134) amplified by a microphone preamplifier (Bruel & Kjaer Type 2660) and connected to a Sony Digital Audio Tape Recorder (Model DTC-75ES). This equipment was chosen both for pragmatic reasons (it was currently available) and because it was felt to be suitable to the task (i.e. introducing little distortion while providing an accurate copy of the speaker's voice). The actor's voice was then rerecorded on Sony UX Pro 60 audio cassette tapes using a Revox MK11 microcomputer controlled audio cassette recorder. These tapes became test tapes which participants listened to using Sony MDR-V200 stereo headphones.

The actor was asked to say 12 neutral content sentences. The use of neutral content stimuli was in accordance with previous research (e.g. Baltaxe, 1991; Dimitrovsky, 1964; Gates, 1927). Each sentence was said in a predetermined emotion prior to saying the same sentences in different emotional tones of voice. The 12 sentences included the example sentence "That is a blue ball" and 11 other sentences. All of the 11 experimental sentences were of the form: 1) a demonstrative pronoun (i.e. this, that, these, or those), 2) a variation of the verb "to be" (i.e. is or are), 3) when the case was singular the article "a" (e.g. a dog, a cat), 4) an

adjective of size, colour or number, and 5) a noun. This created sentences of the form "Those are big trucks." All of the nouns used are approximately matched on imagery, concreteness, and meaningfulness according to the judgements reported by Paivio, Yuille, and Madigan (1968).

Prior to the original recording stories were developed to evoke for the actor the various levels of emotion used in this study. These stories (which can be seen in Appendix D) were based on the theorizing of Dix (1991), who suggested that parents show stronger emotional reactions when they interpret their child's inappropriate behaviour as intentional (versus accidental or unintentional) and when they believe that their child has interfered with their own pursuit of important (versus unimportant) goals. The stories were designed to manipulate the extent to which the child's behaviour was interpreted a) as intentional - unintentional and b) as interfering with important - unimportant goals.

During the original recording there was an attempt to have at least two good examples, as judged by the researcher and the actor, of every sentence in every emotion by emotion strength category. "Good" examples were then judged, first by the researcher and then by 5 adults as described below, as to the emotion portrayed. The results of these judgements were compared to preset criteria. In establishing these criteria information from 2 studies (Johnson, Emde, Scherer, & Klinnert, 1986; Lieberman & Michaels, 1962) and 2 review articles (Frick, 1985; Scherer, 1986) was employed. While accuracy in judging emotion is commonly greater than 85% (Frick; Johnson et al.; Lieberman & Michaels) Scherer found an average of 60% accuracy over 28 studies. However, the Johnson et al. and the Lieberman and Michaels studies, using stimuli similar to those in this study, found high rates of recognition accuracy by university students (over 85%). Nevertheless, it should be noted that none of the studies reviewed by the researcher manipulated a variable similar to

emotion strength. Therefore, while a 75% cut off seemed liberal but well within the range of the accuracy level found by other studies (which presumably used stimuli similar to the extreme emotion in this study) there is no data to advise a cutoff for the moderate emotion stimuli. As no information could be found as to how moderate emotion is recognized the cut-off score for the recognition of these utterances was set lower, at 65%. Thus, the acceptance criteria were: Extreme Anger (scored at -4 or -3 seventy-five percent of the time), Moderate Anger (scored at -2 or -3 sixty-five percent of the time), Neutral (two chosen, scored at -1, 0, or +1 seventy-five percent of the time), Moderate Happiness (scored at +2 or +3 sixty-five percent of the time), and Extreme Happiness (scored at +3 or +4 seventy-five percent of the time).

The judgements which would determine whether or not utterances met the above criteria were acquired as follows. The two or three examples of each of the 12 sentences which were judged by the researcher as most appropriate were recorded on to a Sony UX Pro audio cassette using the Revox audio cassette recorder. They were then rated by five adults as to the emotion portrayed and the realism of the portrayal. All of the utterances were rated once by each of the raters. These adults were graduate students or teachers of psychology. The responses of one adult were discarded because they were at marked variance with those of the other raters. The ratings of the other four adults were compiled with the researcher's and examined. The utterances put on this final tape were those considered highest in realism and quality which fit the pretest criteria when averaged across raters. Based on these judgements five sentences (in addition to the example sentence) had at least one portrayal of each emotion by emotion strength category which met the basic criteria of the study. Two of these five sentences had similar content so one of the two was dropped at random. This left 4 sentences to be transferred to the emotion recognition tape. These sentences

and the imagery, concreteness, and meaningfulness ratings of the nouns from the Paivio et al. (1968) study are shown in Table 3.

The four experimental sentences and the single example sentence were then rerecorded from the DAT on to Sony UX Pro 60 audio cassettes using a Revox tape recorder. Two tapes were made: an example tape and the experimental tape. The example tape was recorded containing the sentence "That is a blue ball" played 6 times in a random order: 1) twice in a neutral tone of voice, 2) once in a negative/angry voice of moderate emotional strength, 3) once in a negative/angry voice of extreme emotional strength, 4) once in a positive/happy voice of moderate emotional strength, and 5) once in a positive/happy voice of extreme emotional strength.

The experimental tape consisted of the actor saying each of the four sentences in the emotional categories described above. This made 24 separate utterances. Each of these utterances was played six times, making a total of 144 stimuli. These stimuli were played in random-ordered blocks of 24 (one play of each utterance). Each utterance was followed by 4 seconds of silence and then a ping to signal the next utterance. This ping was followed by one more second of silence. No three sentences of the same category or content were heard together. The experimental tape was approximately 21 minutes long.

Adult ratings

The emotion recognition tape was then judged by a group of 13 adult university students (as described above) to provide a standard against which to compare the children's ratings. This was done because the various utterances in each cell (e.g. the four utterances expressing moderate anger) varied in the extent to which each portrayed the specified emotion at the specified emotion strength level. Because of this it was felt necessary to provide some standard against which to compare the children's ratings.

When participants arrived to perform their tasks the researcher introduced herself and reiterated to the participants the point of the study, what they would be asked to do and the length of time their participation would be expected to take. Those participants who still chose to participate (all who came) read and signed the informed consent form. All adult participants performed their tasks separately or with one other person in a quiet room used by the University of Calgary Psychology Department. The emotion recognition tape was played on the Revox audio cassette recorder and was listened to on headphones. When two people were together they were asked not to talk to each other about the tape; the use of headphones made discussion between participants difficult. The complete procedures for speaking to adult participants can be seen in Appendix E.

The hearing of all participants was screened using a Maico Model MA-19 audiometer which assesses pure tone threshold hearing without masking⁶. The output increases from hearing threshold level in 5 dB steps (dB scale not given) and ranges in frequency from 250 to 8000 Hz, inclusive. Participants' hearing was assessed at 250 Hz, 1000 Hz, 2000 Hz, 4000 Hz and 6000 Hz. According to the Operating Instructions (n.d.) of this audiometer "(b)ecause the double earphones of the audiometer help reduce the effect of room noises, satisfactory testing can usually be done (in a quiet room)" (p. 14). The room in which the adults' hearing was screened had an ambient noise level of 34.9 dBA. This ambient noise level was slightly quieter than is normally present in

⁶ This instrument was not professionally calibrated prior to use but was found to agree with a recently calibrated Bruel & Kjaer 7100 audiometer, as determined by testing one person's hearing (the researcher's) on the Maico and then immediately retesting it using the Bruel & Kjaer.

an average city apartment (Considine & Considine, 1995).⁷ Participants were given the Maico double headphones and asked to raise their hands when they heard a sound. They were asked to raise the hand corresponding to the ear in which the sound was heard. They were further asked to lower their hand when the sound was no longer heard. Each participant responded to each frequency 6 times: three times as the loudness was increasing and three times as the loudness was decreasing. Both ears were tested. Averages were calculated separately for each ear at each frequency. If any of these averages indicated that the participant's hearing was outside the normal range the participant was not asked to go on. No participant failed the hearing screening. The results from this screening can be found in Appendix F.

The scales used in rating the actor's emotion were explained in the context of some examples. These explanations can also be found in Appendix E. Participants were told that they were to rate the actor's voice on a 9 point continuum from extremely negative or angry (-4) to extremely positive or happy (+4). A continuous scale was used to match the continuous variable (emotion strength). Participants were also told that "If you listen to the voice and you think that it does not express either positive or negative emotion you would mark zero." Finally, they were asked to indicate how confident they felt about their judgements on a scale of 0 to

⁷ According to Wilber (1985) an ambient noise level of 23.0 will allow the tester to "test to levels of 0 dB" SPL (p. 145) at 250 Hz while higher ambient noise levels (29.5 - 1000 Hz, 34.5 - 2000 Hz, 42.0 - 4000 Hz) will allow reliable testing to 0 dB at higher frequencies. The acceptable level for testing 6000 Hz is not listed; however, it is presumed to be similar or higher than that for 4000 Hz (as 8000 Hz is 45.0 dB). Only 250 Hz and 1000 Hz require a much quieter room than the one used for reliably testing very quiet tones. Thus, for these frequencies adults were tested at a more stringent level (as some of the signals may have been masked by ambient noise) and reaching 0 dB could not be expected.

6, with a rating of 0 meaning that they had no confidence in their judgement while a rating of +6 meant that they felt certain that their judgement was correct. In addition, some of the participants were asked to rate the utterances as to how loud they were. However, only the ratings from the first scale (negative/angry to positive/happy) were used in this study as only they could provide the information necessary to make a standard against which to compare the children's ratings.

Participants were then asked to rate the six examples on the example tape. Any questions or concerns they had were addressed at this time. The emotion recognition tape was started and participants rated it. While the participants were rating the emotion recognition tape, the researcher was in the next room, available to address any concerns which might arise. The rating of the tape took approximately 21 minutes. Due to practical difficulties the utterances were not numbered on the tape. Participants were told that if they missed an utterance they should go on to the next one without attempting to listen again to the utterance they missed. They were also told that if they got to the end of a page and were marking in the wrong spot they should simply go on to the next page without trying to figure out where they went wrong. This procedure worked well. Few participants missed any utterances and only two participants re-rated segments of the tape to rectify missing an utterance.

Participants rating the emotion recognition tape were free to turn off the tape and take a break if they chose to do so. They were also shown the volume control so they could adjust the volume as they chose. When they were finished rating, participants were thanked for their participation and asked if they had any questions or concerns. These were addressed and the session was over. The entire session took less than one hour.

Receipt of questionnaires

After the emotion recognition tape was completed and rated by adult participants the central part of the study, the participation of mothers and children, could be initiated. The receipt of questionnaires was the first participatory step for mother and child participants. A copy of the package received by mothers can be seen in Appendix G. Study questionnaires were delivered to mothers for completion. Mothers were asked to complete the questionnaires in the order in which they appeared in the package. This meant that they were asked to complete questionnaires in the following order: Subject Information Form, and then the ADD Rating Scale (Barkley & DuPaul, 1990). In addition, there was one questionnaire which mothers completed during the research session. The Social Skills Rating System (SSRS: Gresham & Elliott, 1990) was filled out by mothers at the university when the dyads came in. The SSRS is a 55-item questionnaire with adequate internal consistency and test-retest reliabilities (all reliability coefficients of the social skills and problem behaviours scales were greater than .84) as well as adequate face and criterion-related validity. The decision to have mothers fill in one questionnaire while their children were completing their tasks was made to limit the amount of time required for the study.

Instructions in the questionnaire package told mothers to first read the description of the study which was included in the package and then to read the informed consent form. If they still chose to participate they were told to sign and date the informed consent form. Early in the study, mothers were told to mail the questionnaires back to the researcher in an enclosed self-addressed envelope. After receipt of the questionnaires, a time was set for the mother and child to perform the research tasks at the University of Calgary. One of the children whose mother mailed back questionnaires prior to the research session was rejected. Although diagnosed as having ADD by a physician specializing in ADD, the mother

rated the child as having few symptoms on the ADHD Rating Scale (Barkley & DuPaul, 1990). The mother was phoned and the researcher explained to her that her child was not sufficiently like the other children to participate in this study. The mother was told that she and her child would not need to come in to the university and thanked for her willingness to participate and her help. Having mothers send questionnaires back caused significant delays in the study because questionnaires were often not sent back promptly. Thus, later participant mothers were asked to bring the questionnaires to the University of Calgary at the time appointed for their research session. This time was determined during the initial conversations with the mothers. This change meant that the questionnaires were not scored prior to participation. One comparison child was rejected as having too many symptoms of ADD according to the ADHD Rating Scale (Barkley & DuPaul, 1990) despite having no diagnosis of ADD. The data from this dyad were discarded.

Children's ratings

The emotion recognition task was one of three tasks children were asked to complete at the research session held at the University of Calgary. The other two were the PPVT-R (Dunn & Dunn, 1981) and a hearing screening. First, the researcher introduced herself and then described the plan for the session. Specifically, the children were told what they would be asked to do and then asked if they were willing to perform these tasks. The children were told that there were three things for them to do. The PPVT-R (Dunn & Dunn, 1981), the hearing screening and the emotion recognition task were then described to them in simple language. For example, in describing the hearing screening the researcher would say something like "Then I'll play some sounds for you and you just tell me if you can hear them". After the description was given, the researcher would ask the children how they felt about this. Prior to proceeding, each child gave verbal

consent to do so.

After the introduction to the session the children were taken individually to a room next to the one they had been in. The one-way mirror was explained to both mothers and children to help them feel comfortable with their separation. Throughout the session the researcher attempted to maintain rapport by chatting during periods of transition between tasks and at other times when it appeared there was a minimal level of discomfort. Anything more than a minimal level of discomfort was addressed directly. For example, there was a child who seemed uncomfortable prior to beginning the tasks. For this child the tasks were again described and the fact that he would not be judged for his answers was emphasized. When he appeared comfortable, the tasks were started. However, few of the children showed any concern about the tasks.

Next the PPVT-R was administered as instructed in the PPVT-R manual (Dunn & Dunn, 1981); among other instructions, the manual suggests giving the children much praise throughout. Accordingly, children were often given nonspecific praise such as "Good", "You're doing really well" regardless of their accuracy. After the PPVT-R was completed the child and researcher went into a 40" by 48" sound proof booth to perform the hearing screening. The ambient noise level in this booth was 25 dBA, quieter than would normally be found in an average country home (Considine & Considine, 1995). This level of testing room noise would allow for reliably testing at 0 dB SPL for all frequencies save 250 Hz (Wilber, 1985). As this is a somewhat forbidding room, the researcher always assessed the child's comfort level with this room, usually by simply asking. On one occasion when a child seemed uncomfortable, the mother and child were both shown the window through which the mother could see into the booth. This window was usually at least discussed. Once comfortably inside the sound proof booth, the procedures were explained to

the children. The procedures were the same as those described for adults except that each frequency was responded to only four times (twice with the loudness increasing and twice with the loudness decreasing). The results of the hearing screening are shown in Appendix H.

The children were then taken back to the original room and the emotion recognition task explained to them. The approximate instructions are shown in Appendix I. They were again told that "We want to learn how children recognize emotion". They were told the task would take approximately 21 minutes and that they were doing 6 pages of the task. This way of marking time was especially valuable with the ADD group as they tended to get more restless during the emotion recognition task. Children were told that they could take breaks in between the pages but not in the middle of the pages. They were also reminded that taking breaks would mean that the task would take longer. Children with ADD would often decide ahead of time how many breaks they wanted to take. Many of these children appeared to be excellent judges of the number of breaks they would need. They determined the number of breaks they would take and stuck to their decision; it appeared to the researcher that they were largely successful in maintaining their attention to the task.

While performing the emotion recognition task, children responded by pointing at an 8½ by 14 inch sheet of paper which held nine blocks of colour, ranging from dark grey (on the left) through successively lighter greys to white and then through successively brighter yellows to bright yellow (on the right). Each of the coloured blocks was approximately 1 inch (2.5 cm) by 1.5 inches (3.75 cm), and was separated horizontally from the next block by approximately .5 inch (1.25 cm). The blocks of colour each had a number beneath them ranging from -4 to +4. The number of the block pointed at by the child was recorded by the researcher.

This format was used successfully by children and adults

when judging inconsistent messages (Bugental, Kaswan, Love, & Fox; 1970): messages which contained conflicting information on different communication channels (e.g. "You did a great job" in an angry tone of voice). During the rating of the example utterances (each presented once prior to the experimental utterances) the response sheet included a picture of a happy woman above the square numbered +4 and a picture of an angry woman above the square numbered -4. These pictures were taken from an article assessing the ability of young children to recognize emotion (Baltaxe, 1991). After the presentation of the example utterances, the pictures were removed, and the children pointed to the colours alone.

When the researcher started to explain the emotion recognition task to children, she gestured to the response sheet and asked the child to "Point at the picture that shows a woman who's (e.g.) angry". After the child's response (always correct), the researcher pointed to the other picture and asked the child "How do you think this woman feels?" Every child answered this correctly. At the beginning of the study (the first 2 or 3 children) the researcher explained how to use the emotion recognition response sheet to indicate their judgements of the actor's emotions. When it became apparent that children were anticipating and becoming bored by the instructions, the introduction was shortened and changed to simple questions as described below.

Next, the children were asked "Which one of these colours do you think you would point to if you listened to the woman speaking and she felt really, really (e.g.) happy?" Without exception, when asked to point to the colours indicating extreme emotions, the children pointed to the intended colour. Usually, when asked to point to a "sort of" angry or happy colour the child would point to one of the colours in the middle of the correct side. The researcher would then say "Good. So if you hear a voice and you think that the woman sounds sort of (e.g.) angry you would point to one of these

colours", pointing to all of the colours in the centre of the grey side. No further explanation was felt necessary or given. This clarification appeared to be sufficient for all the children as could be seen by the fact that they all used the entire scale to rate on.

The children then listened to and judged the six example sentences. This was done to allow any difficulties to be addressed prior to the beginning of the experimental task. However, no difficulties were observed. Time-keeping (by pages) was emphasized whenever necessary to keep children working on the tasks. Breaks were taken as necessary. After the task was finished children were thanked and praised for their work. During the mothers' task, children were in the next room playing with toys and reading books. There was a one-way mirror which allowed the children to be seen by the mother and the researcher.

Emotion Portrayal Experiment

This experiment consisted of two tasks. The first (the emotion portrayal task) involved mothers providing examples of the way they portray vocal emotion. The second (the emotion judgement task) involved having university students judge the mothers' emotion portrayals.

Participants

Emotion portrayal task: Mothers

All of the mothers of the child participants performed this task. However, for various reasons emotion portrayals from only 28 of the 32 mothers were later judged as to clarity. These 28 mothers are described here. Researcher error resulted in the emotion portrayals of two mothers not being judged in the emotion judgement task. In addition, the emotion portrayals of two more mothers were not judged in the emotion judgement task to ensure their confidentiality was

maintained⁸. Because of these exclusions there were only 13 mothers in the target group and 15 mothers in the comparison group. The way in which these participants were recruited is described above.

Information about these mothers and their children is found in Table 4. The groups are similar to each other in most areas. The average age of the mothers is 37 years ($\bar{M}_T = 38$; $\bar{M}_C = 37$) while the average age of the children is 112 months ($\bar{M}_T = 112$; $\bar{M}_C = 112$). A similar number of mothers were married ($n_T = 10$; $n_C = 11$) and said that either they or they and their spouses are primary caretakers ($n_T = 12$; $n_C = 14$) of their child(ren). However, the number of mothers who work outside the home is quite different ($n_T = 12$; $n_C = 6$) for the two groups.

The target and comparison groups do not differ significantly on socioeconomic status (SES) as assessed using a Oneway ANOVA, $F(1,30) = 1.02$, $p = .32$. SES was assessed using the socioeconomic index presented by Blishen, Carroll, and Moore (1981); this index is based largely on the education and income level of a given occupation in Canada. When participants had a working spouse and were working themselves

⁸ The original plan for this study was to electronically filter the voices so as to make the words and speakers unrecognizable. However, after many attempts and much pretesting, this plan was abandoned because the words spoken were always distinguishable. Speaker identification is not especially accurate at any time, (Clifford, 1984), and is even less accurate when short speech samples (Bull & Clifford, 1984), and many voices are presented (Bull & Clifford, 1984; Deffenbacher et al., 1989; Legge, Grosmann, & Pieper, 1984) as was the case in this study. Nevertheless, it was determined to filter the voices to remove the higher frequencies, which have been found to be among the most valuable clues to speaker identification (Furui, 1986). However, the studies cited above generally employed voices unknown to the judges. Voices which could be familiar to the judges in this study were not tested. This is discussed in greater detail in Appendix J.

the SES level of both occupations were averaged and this average was tested. This method of handling two working parents is commonly used (Schneider, 1986).

The children of the mothers who performed the emotion portrayal task are slightly older ($\underline{M}_T = 112$ months; $\underline{M}_C = 113$ months) than the full group of children who participated in the emotion recognition experiment ($\underline{M}_T = 109$ months; $\underline{M}_C = 111$ months). This difference is not significant when assessed using a t test, $t(58) = -0.62$; $p > .05$. Other variables describing the mothers who performed the emotion portrayal task (i.e. primary caretaker, marital status, and average SES) are very similar to those describing the mothers in the full group.

Emotion judgement task

These participants ($n=21$) were recruited in a manner similar to that of the adult participants in the emotion recognition experiment: from names and phone numbers given to the University of Calgary Psychology Department of students willing to participate in psychological research. The recruitment procedures used were almost identical to those described in Appendix A, changing mainly in the description given to students of what they were being asked to do. However, in contrast to the emotion recognition experiment, seven of the participants were friends of the researcher or friends of friends of the researcher. The participants in this task included 6 men and 15 women. Their ages ranged from 18 to 48, with an average age of 27.1 years. Nineteen of the twenty-one participants had some post-secondary education. Of these, 5 majored in psychology and 2 in sociology. No 2 of the other 12 participants had the same major area of study.

Materials and Procedures

Emotion portrayal task

The researcher first explained to mothers that one of the aims of the study was to examine one aspect of the development of emotion recognition: that of learning. It was further

explained that, as mothers still spend more time with their children than fathers do on average, this study was concerned with the relationship between mothers' emotion portrayal and their child's emotion recognition. The approximate course of this description can be found in Appendix J.

Mothers were told they would be asked to say 12 sentences the way they would say them if they felt a specified emotion. They were shown a sheet which told them the emotion they were to portray as well as the level of intensity and the sentence itself. They were asked to say the sentence and then to pause to allow some blank space on the tape. They were asked after each portrayal if they were happy with their performance. If a mother stated that she was not happy with her performance, the sentence was recorded over until she reported being happy with it.

The mothers' voices were recorded on Sony UX Pro 60 high bias audio cassettes using the Revox Model M3500 microphone connected to a Revox MK11 microcomputer controlled audio cassette recorder. The scripts for the happy and the angry sentences were taken from a study conducted by Bugental, Kaswan, and Love (1970). Bugental et al. asked at least 25 psychology students to judge eight scripts "drawn from observations of actual parent-child interactions" (p. 649) on a 13 point friendliness/unfriendliness dimension (-6 to +6). From these prejudged scripts two negative and two positive scripts (shown in Table 5 with the ratings from the Bugental et al. study) were chosen for use in this study which approximately matched each other on length and grammatical construction. The neutral emotion sentences were adapted from two of the sentences used in the emotion recognition experiment to approximately match the positive and negative scripts on length and grammatical construction. Each mother said: a) each of the two happy sentences twice, once in an extremely happy voice and once in a moderately happy voice; b) each of the two angry sentences twice, once in an extremely

angry voice and once in a moderately angry voice; and c) each of the two neutral sentences twice in a neutral (nonemotional) tone of voice. They provided these 12 examples in one of 10 predetermined random orders corresponding to the last digit of their assigned participant number. Thus, mothers 10, 20, 30 and 40 would say the sentences in one random order while mothers 1, 11, 21 and 31 would say them in a second random order and so on.

The mothers' emotion portrayals using these sentences were recorded on a single channel. The chair the mothers sat on and the microphone stand were always in the same locations, meaning that the microphone varied in distance from the mothers' mouths from approximately three to eight inches. Echoes were dampened by carpet on the concrete floor, thick fabric screens in front of and beside the mothers (approximately 8 inches from the concrete wall), and miscellaneous furnishings. While this arrangement would allow some reflections from one wall in each direction and from the ceiling, the use of screens on the other walls and the other absorbent materials (carpet, people, upholstered chairs) should have significantly decreased reverberation in the room. The recording level was adjusted only when the mother's voice was either: a) not registering on the peak-reading meter of the cassette deck, or b) registering on the peak-reading meter as being too loud, and therefore subject to distortion.

After the 12 sentences had been recorded the mothers and the researcher rejoined the children. The participants were thanked and asked how they felt about the task. Any concerns were addressed at this time. The mothers were told, in their child's presence, that the child had worked hard. Any specific area in which the child had worked especially hard, or had done especially well, was specifically praised.

Emotion judgement task

The tape used in the emotion judgement task was developed using emotion portrayals of the 28 mothers described above.

These emotion portrayals were rerecorded on the Sony Digital Audio Tape Recorder (DAT). It was felt that this would cause little or no disintegration of the recorded signal while improving the accuracy of the timing on the final emotion judgement tape as the DAT has a very accurate tape counter. The recording level of the DAT was kept constant across mothers so as not to interfere with the loudness cues. The only exception to this rule was one mother in the target group who's voice had originally been recorded too quietly, as indicated by the fact that her voice registered much lower on the input level meter of the DAT. The recording level for this mother's voice was increased (making her voice relatively louder than the other mothers' voices) on the transfer to the DAT and again on the final transfer to the Revox audio cassette recorder.

The mothers' voices were band-pass filtered using a Wavetek Dual Hi/Lo analog filter (Model 852) to make speaker identification unlikely (See Appendix K) and then recorded using the Revox audio cassette recorder. Band-pass filtering means setting 2 cutoff values and then deteriorating all sound frequencies above and below these cutoffs. For this study frequencies below 100 Hz (mainly noise⁹) and above 1000 Hz

⁹ Low-frequency noise has several characteristics which make it troublesome. First, all extraneous noise, of which low-frequency is one type, could potentially mask the desired signal. However, this is especially true of low frequency noise, which "masks higher frequencies more than it is masked by them" (Berglund, Hassmen, & Soames Job, 1996, p. 2985). Second, major sources of low-frequency noise include heating, ventilation, and air-conditioning systems. Any or all of these sources could have been producing noise during the recording of the mothers' voices. Third, while ambient noise may contain noise energy across the entire frequency spectrum the energy of the low-frequency noise will be more and more accentuated as the distance from the noise source increases (Berglund, et al.). This is because low-frequency sounds lose less energy while travelling than do other sounds. As many of the major sources of sound

(which contain much of the information used in voice identification (Furui, 1986)) were deteriorated¹⁰. Notes on the reasoning leading to this decision can also be found in Appendix K.

Only three emotion portrayals from each mother were chosen for the emotion judgement tape due to time constraints. These emotion portrayals always included one example of each of the three emotions (happy, angry, and neutral) counterbalanced across emotion strength and sentence content. The mothers were assigned to cells in matched pairs except for the mothers who were dropped from this part of the research. Thus, one pair of mothers matched on their child's age and sex would be randomly chosen to portray a sentence in extreme happiness, a sentence in neutral emotion and a sentence in moderate anger. At the same time the sentences from another matched pair of mothers would portray moderate happiness, neutral emotion, and extreme anger. In addition, some of the pairs of mothers were judged saying one sentence in one emotion, while other pairs were judged saying the other sentence in the same emotion. Within these constraints utterances were chosen randomly. However, if there were some technical difficulty which precluded the use of the chosen utterance (e.g. sound on the tape) that utterance was rejected and the process was repeated. The distribution of maternal emotion portrayals is shown in Table 6.

were a great distance from the recording (e.g. air-conditioning), the sound made by these sources was likely to contain relatively more low-frequency noise than noises of other frequencies.

¹⁰ The functioning of the Wavetek analog filter was assessed by filtering random (white) noise and then examining the spectrum of the filtered output. This spectrum can be seen as Figure 1 and shows that the Wavetek filter deteriorated the signal below 100 Hz and above 1000 Hz to approximately 45 dB below that (quieter) of the signal between those values.

The selection process led to an unequal number of mothers in each cell because of the assignment by matched pairs. To use happiness as an example there were 14 mothers for one sentence (e.g. "That's good. That's really great.") and 16 for the other (e.g. "You really did a fine job"). Again, the groups were assigned to cells in pairs. Thus for "That's good. That's really great." 8 of the 14 mothers portrayed moderate happiness and six portrayed extreme happiness. However, when a mother was removed this left only five mothers in one cell while there were 8 mothers in the other.

Therefore, the tape for the emotion judgement task consisted of 28 mothers saying 3 sentences each, making a total of 84 utterances. Each of these utterances was played 3 times, meaning there were 252 plays of utterances. The utterances were played in blocks by emotion and sentence content. There were two different tapes: one played happy utterances first ("You really did a fine job." followed by "That's good. That's really great."), then neutral utterances ("It's a tree. It's a little tree." followed by "That really is a white dove."), and finally angry utterances ("You're hopeless. You're completely hopeless." followed by "You're a complete idiot."). The second tape played angry utterances first, followed by neutral utterances, and finally happy utterances. The neutral utterances were always between the happy and angry utterances to decrease interference between the two emotions.

Within each sentence content the utterances were played three times in random-ordered blocks of every example of that sentence. Thus, one block would (e.g.) contain 15 mothers saying "You really did a fine job". All of the 15 mothers' emotion portrayals were played once in a random order. These utterances were played a second time in a second random order, and then a third time in a third random order. The order of utterances was different on the two tapes. There were six seconds of silence between the utterances, and each tape

played for approximately 54 minutes. Two orders were used to control for order effects. However, as order was not involved in the hypotheses of the study the effect of order was not analyzed.

In addition, an example tape was made to be used during training and to allow participants to hear what filtered voices sound like. This tape included 12 examples: two of each sentence. The sentences were played in the following order: "You really did a fine job.", "That's good. That's really great.", "That really is a white dove.", "It's a tree. It's a little tree.", "You're a complete idiot.", and "You're hopeless. You're completely hopeless.". Each happy and angry sentence was recorded once in moderate emotion, and once in extreme emotion. None of the examples were also on the emotion judgement tape. The example utterances were played eight seconds apart.

Participants had been previously contacted about the study, and came at an appointed time. The researcher introduced herself and reiterated to the participants the point of the study, what they would be asked to do and the length of time their participation was expected to take. Those participants who still chose to participate (all who came) read and signed the informed consent form.

Next, the participants performed the hearing screening individually in a 40" by 48" sound-proof room (ambient noise level 25 dBA) in the same manner previously described for children except that these participants responded verbally. Again, this level of testing room noise would allow for reliably testing at 0 dB SPL for all frequencies save 250 Hz (Wilber, 1985). Only participants whose hearing was in the normal range for both ears at every frequency went on to perform the rest of their tasks. All participants did so. See Appendix L for results from the screening of participants' hearing.

All adult participants performed their tasks separately

or with one other person in the same quiet room as the emotion recognition and emotion portrayal tasks were performed in. The emotion judgement tape was played on the Revox audio cassette recorder and was listened to on headphones. When two people were together they were asked not to talk to each other about the tape; the use of headphones made discussion difficult.

The rating scale for the experimental task was explained to participants in the context of the example tape. They were told to rate the mothers' voices on a 9 point continuum from extremely negative or angry (-4) to extremely positive or happy (+4). The approximate instructions are given in Appendix M. Participants were also asked to indicate how clearly mothers had expressed the emotion they intended to express on a scale of 0 to 6. For example, on happy sentences raters were told to ask themselves: How clearly and realistically has the mother expressed happiness? They were further told that a rating of 0 meant that the intended emotion was not at all clear or realistic while a rating of +6 meant that the rater felt that the mother's portrayal of the intended emotion was perfectly clear and realistic. Only the clarity rating was examined in this experiment. This was for two reasons: 1) because the hypotheses were stated in terms of clarity making these ratings the most direct way to answer the hypotheses, and 2) to simplify the statistical analyses.

The raters were then asked to rate 12 examples. Any questions or concerns they had were addressed at this time. The emotion judgement tape was then rated. While the participants were rating the emotion judgement tape, the researcher was in the next room available to address any concerns which might arise. The rating of this tape took approximately 54 minutes. The utterances were not numbered so participants were told that if they missed an utterance they should go on to the next without attempting to listen again to the utterance they missed. They were also told that if they

got to the end of a page and were marking in the wrong spot they should simply go on to the next page without trying to figure out where they went wrong. This worked well with few utterances missed. Only one of the participants listened a second time to a segment of the tape.

Participants rating the emotion judgement tape were free to turn off the tape and take a break if they chose to do so. They were also shown the volume control so each person could adjust the volume as they chose. When finished rating, participants were thanked for their participation and asked if they had any questions or concerns. These were addressed and the session was over. The entire session took less than one and a half hours.

Results

This study produced information in several areas: the recognition of vocal emotion by children, the clarity of emotion portrayal by mothers, the interaction of these two areas and the relationship between emotion recognition and social skills.

Intra-Rater Reliability of the Emotion Recognition Tape

A preliminary question is the reliability of the emotion recognition tape. Thus, a Cronbach Alpha was used to calculate intra-rater reliability for both adults and children. It will be recalled that participants rated each utterance 3 times and that there were 4 utterances in each stimulus condition. Cronbach's Alpha is an intercorrelation of the elements being assessed for reliability (Ghiselli, Campbell, & Zedeck, 1981). The data in Table 7 shows that extreme emotion is rated more consistently than moderate emotion. The most consistency is shown in extreme happiness ($\alpha=.98$) for both adults and children with extreme anger being second ($\alpha_A=.93$; $\alpha_C=.87$). The lowest reliability for adults was on one of the Neutral utterances (Neutral #2; $\alpha_A=.79$). All others were in the .80s and .90s, showing a moderate to good level of reliability. The children's reliability was often

lower than that of adults. The lowest reliability for children was found in ratings of moderate happiness ($\alpha_c=.72$) with all the others being in the .80s or .90s, again revealing a moderate to good level of reliability.

Development of Emotion Recognition Scores

Since the hypotheses were stated in terms of accuracy and the various utterances in each cell were rated somewhat differently, a standard was employed with which to compare the children's ratings. This standard was generated by having adult participants rate the same stimuli as those judged by the children. Accuracy scores were developed by taking the absolute values of the differences between the mean ratings of adults and the child's rating on the same sentences. Thus, the accuracy score would be calculated as follows¹¹:

$$|X_{dij}| = X_{cij} - M_{Aij}$$

where X_{dij} is the child's difference score for sentence i spoken in emotion j ; X_{cij} is the child's rating of i sentence in j emotion; and M_{Aij} is the mean of the adults' ratings of i sentence in j emotion. After the difference scores were calculated they were transformed to square roots because there was considerable skewness, kurtosis and heterogeneity of variance in some of the variables. When reporting means, both the transformed difference score and the original rating will be given.

Emotion Recognition Experiment Data

The main focus of this study is the comparison of emotion recognition in children with and without ADD. The data were first examined using repeated measures ANOVAs. A 2 x 3 x 2 repeated measures ANOVA was performed using the factors: a)

¹¹ I would like to note that, although I am calling these scores accuracy scores this should not be interpreted to mean either "good" or "bad". It may be that the interpretation of children, when different from adults, is more accurate than that of adults.

the between subjects variable "group", which was defined by the presence or absence of a diagnosis of ADD for the child; b) the within subjects variable "emotion type", defined as happy, neutral, or angry; and c) the within subjects variable "emotion strength", defined as extreme or moderate strength emotion. This ANOVA provided information on the main effects of group and emotion type and the interactions among these variables. In addition, a second repeated measures ANOVA (2 (group) x 2 (emotion type: happy and angry) x 2 (emotion strength)) was calculated with neutral emotion ratings removed from the emotion type variable. As emotion strength was not manipulated for neutral emotion, it was removed to examine the effect of emotion strength. This second ANOVA provided information on the main effect of emotion strength, as well as the group by emotion strength interaction, the emotion type by emotion strength interaction, and the group by emotion type by emotion strength interaction.

After this, a priori contrasts were examined using simple effects corrected for the number of tests using the Bonferroni correction. Post hoc comparisons were examined using the Tukey Wholly Significant Difference (WSD) procedure. To correct for skewness, kurtosis, and heterogeneity of variance procedures proposed by Games and Howell (1976) were used to correct the pooled variances and the degrees of freedom on all of the Tukey tests. An alpha level of 0.05 was used throughout this experiment. Because this is an exploratory study, trends toward significance will also be discussed. The results of these statistical tests can be found in Appendix N.

The ratings of children with and without ADD (shown in Tables 8 and 9) reveal a main effect for group, $F(1,30) = 9.90$, $p=.004$. This main effect is a result of children with ADD having higher mean difference scores ($M_{d+T} = 0.84$) than their peers without ADD ($M_{d+c} = 0.65$) have. Thus, the ratings of children with ADD are less in line with adults' understanding of the same emotion portrayal. However, this

main effect is modified by two significant interactions.

There is a significant group by emotion type interaction ($F(2,60) = 4.49, p=.015$), suggesting that the difference between groups is not constant across emotions (See Figure 2). There is also a significant interaction of group by emotion strength ($F(1,30) = 5.41, p=.027$), indicating that the difference between groups varies as a function of the level of emotion strength. This can be seen in Figure 3.

To further investigate the group by emotion type differences, the means were examined using Tukey's WSD procedures. These revealed a probable trend for difference scores to be greater for children with ADD when rating happiness ($\alpha_{\text{obtain}} = 0.32$; $\alpha_{\text{WSD}}(5,20) = 0.35, p>.05$) and a significant difference in rating neutral emotion, $\alpha_{\text{WSD}}(5,23) = 0.22, p\leq.05$.¹² Children with ADD rated neutral utterances as more happy ($\underline{M}_T = +0.23$) than their normal peers did ($\underline{M}_C = -0.19$) and they rated happy utterances as less happy ($\underline{M}_T = 1.45$) than their normal peers did ($\underline{M}_C = 2.38$). See also Figure 4, which shows the original ratings of the participants as a function of emotion type. As this is an exploratory study, the ratings of happiness were examined further; it was found that children with and without ADD differed in their ratings of moderate happiness ($\alpha_{\text{WSD}}(3,19) = 0.15, p\leq.05$) and showed a probable trend toward a difference in rating extreme happiness ($\alpha_{\text{obtain}} = 0.50, \alpha_{\text{WSD}}(3,21) = 0.53, p>.05$). Children with ADD rated extreme happiness as less happy ($\underline{M}_T = 1.17$; $\underline{M}_{d*T} = 1.25$) than their normal peers did ($\underline{M}_C = 3.13$; $\underline{M}_{d*C} = 0.75$). Figure 5 shows the children's original ratings as a function of group by emotion type and emotion strength. The ratings made by

¹² I have not been able to find tables for the Tukey WSD procedure at $p=.10$. However, the values described in this paper as "probable trends" are very close to significance. As the variables examined in this research have not been studied before with this population, I believe that looking at trends will be valuable.

children with ADD of moderate happiness were also less like adults ($\underline{M}_T = 1.72$; $\underline{M}_{d*T} = 0.77$) than those of their peers without ADD ($\underline{M}_C = 1.63$; $\underline{M}_{d*C} = 0.62$). However, on average, the original ratings of moderate happiness by target and comparison children are similar. As no significant differences were found with Angry ($q_{WSD}(2,29) = 0.15$, $p > .05$) emotion it was excluded from further analyses. Neutral emotion did not vary in emotion strength, making further examination unnecessary.

There is also a main effect of emotion strength ($F(1,30) = 5.57$, $p = .025$) which, as noted above, is modified by a significant group by emotion strength interaction as well as a significant emotion type by emotion strength interaction, $F(1,30) = 15.21$, $p = .001$. The emotion type by emotion strength interaction reflects the fact that the ratings of children (both with and without ADD combined), when judging extreme happiness ($\underline{M}_d = 1.00$; $\underline{M} = 2.15$) and moderate anger ($\underline{M}_d = 0.79$; $\underline{M} = -2.43$), were less like adults than their ratings of moderate happiness ($\underline{M}_d = 0.69$; $\underline{M} = 1.74$) and extreme anger ($\underline{M}_d = 0.70$; $\underline{M} = -3.04$). As this was not central to the study no significance testing was performed.

There is a significant group by emotion strength interaction. This reflects the fact that children with and without ADD do not differ significantly in the way they rate moderate strength emotion ($F(1,30) = 1.07$, $p = .31$) but there is a trend towards a significant difference in the ratings of extreme emotion ($F(1,30) = 6.29$, $p = .07$ corrected for the number of a priori contrasts). Comparison children rated extreme emotion more like adults ($\underline{M}_{d*C} = 0.67$) than did children with ADD ($\underline{M}_{d*T} = 0.72$).

Finally, there is a significant main effect of emotion type which reflects the differences in accuracy scores for the various emotions ($\underline{M}_{d*Hp} = 0.85$; $\underline{M}_{d*An} = 0.74$; $\underline{M}_{d*Nu} = 0.65$). However, when further assessed using the Tukey WSD procedure only the difference between neutral emotion and happiness is

significant, $q_{\text{WSD}}(3,53) = 0.19$; $p \leq .05$.

Effect of age on rating happy utterances

To further examine the differences between the groups the data were separated into three groups by age. This was done because of the relatively large span of ages among the children (approximately 5 years). These data can be seen in Tables 10 and 11. This resulted in dividing the children into groups of 1) age 7 and 8 ($n=14$), 2) age 9 ($n=11$), and 3) age 10 and 11 ($n=7$). The original ratings (Figures 6 and 8) show that there is little difference between ages and groups except in the rating of extreme happiness, while the difference scores (Figure 7) again indicate that the ADD children rate emotions less like adults than do children without ADD. The effect of age was tested using a $3 \times 2 \times 3 \times 2$ repeated measures ANOVA with emotion type (happiness, neutral emotion and anger), and emotion strength (moderate and extreme) as within subjects variables. Age (3 groups as described above) and group (presence or absence of a diagnosis of ADD) were the between subjects variables. As these were post hoc tests a stricter alpha level of .01 was used. There was no main effect for age ($F(2,26) = 0.57$, $p=.574$), and the age by group ($F(2,26) = 1.31$, $p=.29$) and age by group by emotion type ($F(4,52) = 2.02$, $p=.11$) interactions were also nonsignificant.

Effect of number of repetitions on rating emotion

Another area of potential interest was whether or not children learned to recognize the taped emotions in the course of the task. Figures 9 and 10 show the difference scores and original ratings of target children while Figures 11 and 12 show the difference scores and original ratings of the comparison group. To examine this, two repeated measures ANOVAs were calculated testing happiness and neutral emotion. Separate ANOVAs were necessary because the variable emotion strength made sense only with happiness. Thus, the ANOVA for happiness was a 2 (Group) by 2 (Emotion Strength) by 6 (Repetitions) ANOVA while for neutral emotion the ANOVA was a

2 (Group) by 6 (Repetitions) ANOVA. The results from these tests will be assessed against a more stringent alpha level of .01. The main effect of repetitions was significant for both happiness ($F(5,150) = 17.41$; $p=.001$) and neutral emotion ($F(5,150) = 7.10$; $p=.001$), indicating that ratings change over time. This reflects the fact that the difference scores for rating happiness decrease from the first rating ($M_{d\text{ HP}*1} = 1.34$; $M_{\text{HP}*1} = 1.16$) to the sixth ($M_{d\text{ HP}*6} = 1.01$; $M_{\text{HP}*6} = 2.07$) while the difference scores for neutral emotion increase slightly from the first ($M_{d\text{ Nu}*1} = .95$; $M_{\text{Nu}*1} = 0.23$) to the sixth rating ($M_{d\text{ Nu}*6} = .99$; $M_{\text{Nu}*6} = -0.01$). However, the group by repetitions interactions was not significant for either happiness ($F(5,150) = 1.47$; $p=.20$) or neutral emotion ($F(5,150) = 1.10$; $p=.37$). Nor was the group by emotion strength by repetitions interaction significant for happiness ($F(5,150) = 1.16$; $p=.33$).

Emotion Portrayal Experiment Data

The data were analyzed in a manner parallel to the examination of emotion recognition data. Thus, they were first examined using a 2 x 3 x 2 repeated measures ANOVA including all of the emotions. They were then analyzed using a second ANOVA (2 x 2 x 2) utilizing only Happy and Angry emotions. The same procedures for multiple comparisons were also used; a priori contrasts were examined through use of simple effects which were corrected for the number of significance tests using the Bonferroni correction; the post hoc comparisons were examined using the Tukey WSD procedure. The results of these tests can be found in Appendix O.

The clarity ratings of mothers for all of the emotion type and emotion strength combinations can be seen in Table 12 and Figure 13. The main effect for group was not significant

($F(1,17)=2.64$, $p=.122$)¹³ although mothers of children with ADD were rated as portraying emotion slightly more clearly ($M=2.96$) than mothers of children without ADD ($M=2.87$).

Despite the fact that there is no significant main effect for group, there is a significant group by emotion type by emotion strength interaction ($F(1,17) = 33.63$, $p=.001$). This indicates that there may be differences between the groups in those emotions which vary by emotion strength. However, post hoc tests of those emotions which vary in emotion strength do not show any significant differences. The results of these tests can be seen in Table 13. The differences for anger are significant, $Q_{WSD}^{*Moderate} (3,34) = 0.38$; $p \leq .05$; $Q_{WSD}^{*Extreme} (4,34) = 0.45$; $p \leq .05$). This reflects the fact that mothers of children with ADD portray moderate anger more clearly ($M=2.71$) than their peers ($M=2.32$), but extreme anger less clearly ($M=2.58$) than their peers ($M=3.07$).

There is a significant main effect of emotion type, $F(2,34) = 8.01$, $p=.001$, indicating that the various emotions differ in clarity. These differences reflect the fact that neutral emotion is rated as being more clear ($M=3.24$) than anger ($M=2.70$) which is almost equal in clarity to happiness ($M=2.66$). These emotions are not rated as significantly different when assessed using the Tukey WSD procedure, $Q_{WSD}^{Nu*An} (3,30) = 0.78$; $p > .05$; $Q_{WSD}^{Nu*Hp} (2,30) = 0.68$; $p > .05$; $Q_{WSD}^{An*Hp} (2,30) = 0.68$; $p > .05$.

The main effect of emotion strength was also significant

¹³ As noted above one mother was recorded at a lower intensity (loudness) level than the others. To ensure that this difference in recording did not have a disproportionate effect on the results, the data was re-examined with that mother's ratings removed. This resulted in the differences between the groups being accentuated, with the finding of a significant main effect for group. However, no other differences were found and the direction of the effects does not change. Thus, only the data from the full group will be described.

($F(1,17)=11.38$, $p=.004$) reflecting the fact that extreme emotions (happy and angry) were rated as being more clear ($M=3.00$) than moderate emotions ($M=2.38$). If one makes the assumption that extreme emotion would be expected to be clearer, this provides an indication that the mothers adjusted their portrayals to the requests of the researcher.

Interaction of Child and Mother Data

One of the hypotheses was that the child's emotion recognition would be related to the mother's emotional clarity. This was tested by correlating the average accuracy score of each child (collapsed across groups) with their mother's average clarity score for the 28 mothers whose voices were rated by university students. This hypothesis was not supported, $r = -.12$, $p = .53$. Thus, for these participants there was no relationship between mothers' emotion portrayal and their child's recognition of emotion.

Relationship of Social Skills and Emotion Recognition

A final hypothesis was that emotion recognition would be related to a measure of overall social skills. This was tested by correlating the average emotion recognition accuracy score of each child with their overall standard score for social skills on the SSRS (Gresham & Elliott, 1990). The children in the target group were rated by their mothers as having social skills below the average with a mean standard score of 90.4 while their peers without ADD were rated by their mothers as having a nearly (but slightly above) average ($M_c = 105$) level of social skills. The difference between the groups is significant, as assessed using a Oneway ANOVA, $F(1,30) = 6.05$; $p = .02$. There was no significant relationship between the child's average accuracy of emotion recognition and their social skills, ($r = -.28$, $p = .12$).

Discussion

Group Differences

The preceding section makes it clear that children with ADD recognize vocal emotion differently from their peers

without ADD. However, these differences, by and large, are not the ones predicted.

Hypothesis #1

The only hypothesis which was supported was that children with ADD will show an overall deficit in emotion recognition. This was evidenced by a significant main effect for group. Children with ADD exhibited higher difference scores when rating vocal emotion (presumably reflecting less accuracy) than did children without ADD. It does not appear that this deficiency is exclusively a result of the difficulty ADD children have with vigilance tasks (Rosenthal & Allen, 1978). Children with ADD showed specific difficulties with certain emotions and did not show increasing difference scores with time, in contrast to what one would expect if the deficit were a result of vigilance problems.

The finding of an emotion recognition deficiency related to ADD is moderated by significant Group by Emotion Type and Group by Emotion Strength interactions. The difference scores of target children are higher (less like adults) for utterances of moderate emotion strength and for anger, but these differences are not significant. Target children do show deficits in recognizing happiness and neutral emotion. Children with ADD have higher difference scores for neutral emotion, although their actual average ratings are quite similar to those of children without ADD.¹⁴

Children with ADD also show a trend toward recognizing happy emotions less like adults (rating happy utterances as less happy) than do their peers without ADD. This trend is

¹⁴ Presumably, this means that the ratings of children with ADD vary more around the adults' mean, with this resulting in the larger difference score. However, these variations from the mean must also balance each other out (i.e. be approximately equally happier and angrier than the adults's mean ratings) if their mean original ratings are to be similar to the mean original ratings of the comparison group.

consistent with the findings of a study conducted by Becker and colleagues (Becker, Doane, & Wexler, 1993) which found that children with ADD show an abnormal reaction to positive emotional stimuli. According to these researchers there is evidence which suggests that the left (especially frontal) hemisphere has a specialized role in processing positive emotional information. Because data from sensory organs is transported primarily through contralateral pathways, one would therefore expect that there would be a right ear advantage in processing positive emotional stimuli. However, children with ADD show a smaller right ear advantage when emotionally positive information is presented dichotically with information which is either emotionally neutral or negative. Thus, Becker et al. report that

"The outcome of this study suggests that patients with ADHD do not process positive emotional stimuli normally, that is, the addition of positive emotional tone to the task results in a relative decrease in left hemisphere efficiency, rather than the usual enhanced left hemisphere efficiency" (p. 320).

A deficiency in processing positive emotional stimuli could result in the deficits shown in the present study.

When one further examines happiness as a function of emotion strength one sees that children with ADD recognize both extreme and moderate happiness significantly differently from their peers. Children with ADD recognize moderate happiness less like adults than do children without ADD, although their average ratings are similar to those of their peers without ADD. Again, it seems that the ratings of target children vary more around the mean, resulting in higher mean difference scores, while presumably balancing out. In contrast, the ratings of extreme happiness by target children were very different from both adults and their peers without ADD. They rate extreme happiness as being much less happy than their peers do. Thus, the recognition of extreme happiness seems to bear special difficulties for these

children, although age does not seem to relate to these difficulties.

There are several possible reasons for the findings discussed above. It may be that there are problems with the quality of the happy and neutral stimuli. If the emotion portrayals of (e.g.) extreme happiness were poorer relative to the other emotion portrayals on the tape, and if the emotion recognition skill of the children with ADD is less robust or less developed, they could have had more difficulty interpreting these emotion portrayals. There is some suggestion of this for extremely happy utterances in that they were often rated more negatively when first heard (See Figures 10 and 12). However, this change in rating over replications is more noticeable in children with ADD. Finally, there is nothing to indicate that the neutral utterances were ineffective examples of neutral emotion. In addition, the reliability estimates (Cronbach Alphas) do not support this interpretation.

It is also possible that children with ADD simply rate each stimulus as a separate stimulus while other children rate the stimuli in reference to each other. While children were performing this task it appeared to the researcher that many of them, with and without ADD, originally (during the example utterances) rated extreme happiness less positively than they did later. After the examples, children without ADD rated the extremely happy utterances similarly to adults and did not change greatly throughout the task, as can be seen in Figures 9 and 11. In contrast, the extreme happiness ratings of children with ADD changed throughout the research to become more like (but still quite different from) the ratings of adults. Nevertheless, the ratings of neither group changed significantly during the task. It may be that after listening to the examples the comparison children realized either: a) that the extremely happy utterances were *intended* to be rated as extremely happy; or b) that relative to the other

utterances these emotion portrayals were extremely happy. This could have led the children in the comparison group to rate these utterances as extremely happy. It is possible that children with ADD simply did not make these realizations, or conversely, made the realizations but did not act upon them.

Finally, it is possible that the frequency of maternal emotion portrayals is related to their child's accuracy of emotion recognition (Camras et al., 1990; Denham & Grout, 1992). It may be that children with ADD are exposed to fewer examples of emotion portrayals by their mothers. However, while this has been examined by many researchers (Barkley, 1989; Barkley et al., 1985; Cunningham & Barkley, 1979; Mash & Johnston, 1982; Tallmadge & Barkley, 1983) only two studies found that during mother-child interactions mothers of children with ADD express less positive feelings (i.e. praise and positive emotions) than do mothers of children without ADD (Cunningham & Barkley; Mash & Johnston). In addition, one of the studies (Mash & Johnston) found this difference only in a structured, task-oriented situation.

However, these studies coded instances of "verbal statements or nonverbal behavior (which) indicate(s) encouragement, acceptance and/or approval of the child or the child's behavior" (Mash & Johnston, 1982; p. 1375). This is a broader definition than simple happiness. Thus, those studies which indicate that mothers of children with ADD express less positivity to their children (Cunningham & Barkley, 1979; Mash & Johnston) are only peripherally of interest here. However, by the same token, studies which did not find any differences between mothers of children with and without ADD (Barkley, 1989; Barkley et al., 1985; Tallmadge & Barkley, 1983; Tarver-Behring et al., 1985) are also only peripherally of interest. It may be that these mothers show as much praise but less happiness.

This possibility is consistent with reports that mothers of children with ADD express heightened feelings of stress

related to parenting when compared to mothers of children without ADD (Mash & Johnston, 1983a), especially mothers of pervasive (versus situational) ADD children (Beck, Young, & Tarnowski, 1990). In addition, studies (Cunningham, Benness, & Siegel, 1988; Johnston, 1996) indicate that mothers of children with ADD report feeling more depressed than do their peers without ADD children. This is of particular interest as depression is related to a flattening of speech characteristics. Depressed patients show less variability in their fundamental frequency (F_0 : analogous to the subjective experience of pitch; Nilsonne, 1988). Across emotions depressed women have a lower average F_0 , as well as a smaller range of F_0 than do well women (Breznitz, 1992). The differences between groups are accentuated for happiness; when speaking "happily" depressed women have a lower average, maximum, minimum F_0 , and a smaller F_0 range than well women (Breznitz). In addition, the speech of depressed women displays fewer differences between the various emotions when compared to the speech of well women. This would tend to make the emotion portrayals of depressed speakers less clear, particularly when portraying happiness.

Thus, feelings of stress and especially depression have the potential to affect both the amount of happiness displayed and the way it is displayed. If the mothers of children with ADD feel more stress and depression than do comparison mothers it may be that they would express happiness less frequently and/or less clearly. Alternatively, they may simply express less extreme happiness, leading to their child displaying a specific deficit in recognizing happy emotion. This could, in turn, decrease the opportunities these children have of learning to interpret vocal expressions of happiness. Or it could mean that children with ADD have a different concept of vocal expressions of happiness than do their peers, with this difference affecting their accuracy scores when decoding this emotion. Finally, as shown in Table 4, more of the target

mothers than the comparison mothers worked outside the home. While this is unlikely to be a factor in all cases, and I have seen no evidence which indicates it, working outside the home may result in some mothers spending less time with their children. This could, in turn, have resulted in their children receiving fewer examples of happy emotion from them.

Another possible explanation, specific to happiness, is suggested by studies examining children's recognition of inconsistent messages. Bugental and colleagues (Bugental, Kaswan, Love, & Fox, 1970) found that children rated a woman's smiles more positively with age (from 5 to 18); thus, younger children rated smiles more negatively than adults. In another study, (Bugental, Kaswan, & Love, 1970) children rated "joking" messages (critical messages spoken with a smile) more negatively than did adults. Thus, children with ADD may simply be less developed in their coding of happiness. Difficulty recognizing vocal happiness is also found in Dimitrovsky's (1964) study. Happiness was recognized less accurately than sadness and anger for every age group from age 5 to 12. The emotion "Loving" was the only one which was usually recognized less well than happiness. Thus, it may be that recognizing happiness is more complex for children than is recognizing other emotions, at least when the vocal channel is involved. Difficulty recognizing happiness is not found in facial emotion recognition. It seems likely that facial expressions of happiness (a smile) are easily recognized. In fact, one review of children's recognition of facial expression found that children as young as 2 years of age could accurately sort pictures of emotions including happiness (Gross & Ballif, 1991). In addition, by the age of 4 or 5 facial expressions of happiness were recognized most accurately, while children of that age had great difficulty with neutral emotion.

Finally, a review of the emotion recognition literature by Murray and Arnott (1993) suggests that misjudgments of

vocal emotion are more likely to be along a dimension of central nervous system activity or arousal (as indicated by pitch and loudness) than along the dimension of valence. Anger and happiness are both usually high in central nervous system activation. This would, presumably, be especially true for extreme "hot" anger (some anger becomes cold and lower in activity (Frick, 1986)) as well as for extreme happiness. These two emotions are therefore more likely to be confused than would be happiness and sadness as sadness is low in central nervous system activation. Errors along a dimension of activation become less surprising when one considers that joy/elation is found to share many acoustic traits with rage/hot anger (Scherer, 1986). Both emotions have increased mean F_0 , F_0 range, F_0 variability, as well as increased mean intensity (analogous to the subjective experience of loudness) and speech rate (Scherer, 1986). This means that the errors made, especially by children with ADD, may have been to confuse two emotions of similar activity. However, it is difficult to compare the errors made in this study with those described above because: 1) the raters were asked to judge the emotions along a valence dimension from positive/happy to negative/angry; and 2) the use of an emotion strength continuum may correspond to an activity continuum. It is impossible to know how these differences affected the propensity to make errors along an activity continuum.

Hypothesis #2

The expected finding that children with ADD would have poorer social skills than their normal peers was found. However, the hypothesized relationship between social skills and emotion recognition was not found, although the children with ADD also had poorer emotion recognition. It is possible the relationship would have been found with a larger number of children.

It is also possible that a significant relationship would have been found with younger (kindergarten) children. The

studies which have looked at this relationship found that social skills was related to emotion recognition in younger children (Spence, 1987) or found that emotion recognition bore a different relationship to social skills with age (Monfries & Kafer, 1987). One study which looked at school-aged girls and boys (aged 9 to 12 years) found that girls (but not boys) with above-average social competence were better than their less socially competent peers at recognizing and portraying emotion (Custrini & Feldman, 1989). Therefore, it may be that with age the relationship between emotion recognition and social skills disappears, at least for boys. The present study involved the participation of school-age children who were mostly boys.

It is also possible that these children present a truncated range of social skills. The children used in the studies which have looked at the relationship between social skills and emotion recognition previously (Custrini & Feldman, 1989; Edwards et al., 1984; Kafer, 1981; Monfries & Kafer, 1987) were selected to be either normal (popular) children or at the end of the popularity continuum (rejected or neglected children). Thus, it is likely that the children in these studies represented a less homogeneous population than the children who participated in the present study. Correlations are affected (decreased) by having a restricted range (Howell, 1992); thus, a restricted range may have led to the absence of finding a significant relationship between social skills and emotion recognition in the present study.

Hypothesis #3

In addition, although children with ADD show a deficit in emotion recognition, they do not show the specific deficit in recognizing moderate emotion which was hypothesized. As noted above, Klorman (1991) suggests that ERP deficiencies in children with ADD may be more pronounced in tasks of moderate or greater difficulty. As it could be argued that moderate emotion would have more subtle cues, thereby making it more

difficult to recognize, it was hypothesized that children with ADD would show specific difficulties in recognition of moderate emotion.

However, the hypothesized deficit in recognizing moderate emotion was not found. An unexpected finding was that children with ADD showed a trend toward recognizing extreme emotion less well than their peers. This is the opposite of what was expected. It is likely that the ratings of extreme happiness by children with ADD contributed much toward the finding of a deficiency in rating extreme emotion. Children with ADD rated extreme happiness more negatively than did adults and peers without ADD, resulting in much larger difference scores for this cell. The difference scores of extreme anger are also larger in children with ADD than in their peers, but only slightly. Thus, the ratings of extreme anger would have less effect on the group by emotion strength interaction. Nevertheless, the differences in ERPs shown by children with ADD did not lead to them having more difficulty in rating moderate emotion.

It is possible that, contrary to expectation, moderate emotion is not harder to recognize. Thus, if recognizing moderate emotion is not harder, it should not be expected to differentially evoke the ERP differences of children with ADD. Another possibility is that moderate difficulty is not a requirement for the ERP differences shown by children with ADD. Finally, the conditions of this study may not have evoked ERPs, particularly P300. None of the stimuli were designated as target stimuli, and an active response was required to all (not only to some) stimuli. Thus, there was no requirement to differentially allocate attention.

Hypothesis #4

Nor was there evidence of the hypothesized relationship between the clarity of mothers' emotion portrayal and their child's emotion recognition. It may be that these children are simply too old to show such a relationship. The children

participating in all of the studies which have found a relationship between mothers' emotion portrayal and their child's emotion recognition were preschoolers: the children in Camras et al.'s studies (Camras et al., 1988; Camras et al., 1990) had an average age of 4:11; while the children in Daly et al.'s study (1980) had a mean age of 5:7; finally, Denham & Grout's (1992) study involved preschoolers with a mean age of less than 4 years. These children were much younger than the children involved in this study, who had a mean age of 9:10. It is possible that this relationship exists only while children are still developing their ability to recognize emotion. While it is unlikely that the development of emotional knowledge is complete by the age of 12, the major development may be complete. For example, with increasing age from kindergarten to adulthood "the relative importance of intonation to perception of affective meaning increases" (Solomon & Ali, 1972, p. 242), suggesting that development of emotional knowledge continues, but may be more on the level of integrating information from many channels.

In addition, the relationship between mothers' encoding of emotion and their child's decoding of it has not been tested with vocal emotion. It may be that this relationship simply does not exist in this modality.

Finally, the emotion portrayals of mothers of ADD children were not found to be deficient except in extreme anger. It may be that, while deficient emotion portrayals by mothers impact on their child's emotion, there are other factors which can lead to deficient emotion recognition as well. Children with ADD may have a difficulty with emotion recognition which is unrelated to learning. Other possibilities will be discussed in the next section.

Hypothesis #5

It was hypothesized that mothers of children with ADD would portray emotion less clearly than did mothers of children without ADD. This hypothesis was not supported.

Mothers of children with ADD certainly did not show the hypothesized deficit in clarity of emotion portrayal. In fact, the emotion portrayals of mothers of children with ADD were judged to be as clear as those of comparison group mothers.

It may be that mothers of children with ADD need to be better at portraying emotion. If their children have difficulty recognizing emotion these mothers may have learned to compensate for them. They may have learned that to be understood they needed to project emotion clearly. Another possibility is that portrayal of emotion attracts attention. This would be more relevant to mothers of children with ADD because of the difficulty ADD children have in maintaining attention (Barkley, 1990). This could again lead the target mothers to use more emotion portrayal and/or more effective emotion portrayal.

Although mothers do not show an overall difference in clarity of emotion portrayal there was a significant interaction between group, emotion type, and emotion strength. This indicates that mothers in the different groups have different strengths when it comes to portraying emotion. When examined further it was found that mothers of children with ADD portray moderate anger more clearly than their peers, but extreme anger less clearly than their peers.

This could be a result of target mothers feeling more strongly the need to hide their extreme anger: they may respond more strongly to societal mores which argue against the expression of extreme anger. Expressing anger unclearly could also have implications for mothers' maintenance of discipline. It could affect their child's ability to recognize when they have annoyed their mother. In fact, one could conjecture that with some mothers this may be the intention. Children with ADD are more often noncompliant than their peers. Thus, their mothers may be more often angry than their peers. However, mothers may try not to show their anger

in an attempt to create a loving atmosphere for their children. However, it is extremely unlikely that any one factor could create the extremely complex family system in which children and their families live.

It is also possible that higher depression scores (Cunningham et al., 1990; Johnston, 1996) could account for this difference. According to Breznitz (1992), anger (which one would expect to show high, extremely variable, and quickly changing F_0) is differentially (more extremely) affected by depression, at least in women. Finally, this finding is at least partially in accordance with the Bugental and Love (1975) finding that mothers of "disturbed" children express approving and disapproving emotions less assertively than their peers.

Mothers' Emotion Portrayals

The major findings of this experiment, those relating to group differences, have been described above. There was also a significant main effect of emotion type. However, when further assessed by the Tukey WSD procedure, the differences were no longer significant. There was also a significant main effect of emotion strength, reflecting the fact that extreme anger and happiness were rated as being more clear than moderate happiness and anger. If one assumes that extreme emotion would be more clear than moderate emotion, this suggests that mothers did adjust their emotion portrayals in response to the requests of the researcher.

Finally, there was a significant group by emotion type by emotion strength interaction, indicating that the groups differ in the way emotion type and emotion strength interact. However, when analyzed further using the Tukey WSD procedure, no additional significant differences were found.

Effects of Emotion Strength

In both the emotion recognition experiment and the emotion portrayal experiment, emotion strength had a significant effect on ratings of vocal emotion. Children's

ratings of extreme emotion were less like adults' ratings than were their ratings of moderate emotion, probably due mainly to the differences of rating extreme happiness. This is suggested by the fact that children's difference scores for rating extreme happiness were substantially higher than their overall difference scores, while their difference scores for rating extreme anger were slightly lower than their overall difference scores. Thus, their difficulty seems to be with rating extreme happiness, not with rating extreme emotion in general.

Mothers' portrayals of extreme emotion were rated as being more clear than were their portrayals of moderate emotion. If one accepts the assumption that extreme emotion would be more obvious than milder emotion this provides some support for the success of the emotion strength manipulation. In addition, while there is a significant main effect of emotion strength this seems to differ between groups, as there are significant interactions: group by emotion strength for children and group by emotion type by emotion strength for mothers. These interactions were discussed previously.

These findings speak to the importance of this dimension. It may be that our understanding of emotion will change with more research into this variable. It is certainly likely that moderate versus extreme emotions (both recognized and experienced) have very different implications and impacts on various interactional variables.

Study Limitations

Some of the limitations of this study have been mentioned already. However, there are others that should be highlighted here. The most obvious limitations are common to most studies. Until this study has been replicated the results should be treated as preliminary. In addition, many of the effects discussed were assessed using the Pearson Product Moment (PPM) correlation; one of the limitations of using correlations is that they do not provide any information about

causality. It is tempting to assume that most influence comes from the mothers when looking at effects involving mothers and children. However, correlations can be effected by variables other than the ones measured. Thus, correlations do not give us any information as to causality, so any discussion of influence was purely speculative. Third, although an attempt was made to control for family-wise error rate, there were a large number of significance tests, particularly involving the children. Because of this, the results should be interpreted with caution.

Another issue common to many studies is that this finding does not speak directly to the extent to which this deficiency would be found in a natural situation. It is likely that in a natural environment a child would have many more clues to another person's emotions. For example, the child would normally have situational, facial, and postural (body language) information to draw on. These clues may act together to provide enough information to surmount the deficiency shown by children with ADD. Therefore, it is possible that in situations with more information, children with ADD would show no deficit in emotion recognition.

Another limitation is associated with the stimuli used to test the children's emotion recognition. The use of only one speaker for the children to judge means that characteristics peculiar to this speaker could have influenced the way children rated this tape. Thus, for example, the finding that ADD children have difficulty recognizing happiness may be due to the portrayals of happiness by this particular speaker. With only one speaker there is also the concern that the emotion portrayals were simply not very good (See Scherer, Banse, Wallbott, & Goldbeck, 1991). However, the judgements by adults of the emotion recognition stimuli indicated that the stimuli were judged as the researcher intended. Moderate happiness was judged as less happy than extreme happiness and both were rated as positive/happy. Moderate anger was judged

as less angry than extreme anger and both were rated as negative/angry. Neutral emotion was judged as nonemotional. In addition, the children's accuracy was assessed using the ratings of adults as the standard for the rating. Regardless of the quality of the emotion portrayals, the final scores used represent a distance from the ratings of adults: they provide an indication of how similar these children are to adults. Nevertheless, another study would be improved by using several voices.

Another limitation is that, despite attempts to diminish the difficulty by providing breaks as necessary, children with ADD did appear to be more active, with this potentially affecting their attention. This was despite the excellent job these children did of attempting to maintain their attention. Decreased attention could have had an effect on the children's ratings and some of the results (e.g. the overall deficit in emotion recognition) could result from this. However, there were specific deficits which are unlikely to be a consequence of poor attention alone.

Another issue which requires discussion is the use of a continuum of emotion strength. Testing a dimension such as strength of emotion is difficult as each person could be expected to have their own personal concept of (e.g.) extreme anger. For one person, it could mean someone ranting and raving; for another it could evoke a person who is angry but not out of control, a person who becomes quieter with anger. Each of these ideas would affect the way the person attempts to portray the emotion in question. In this study little attempt was made to measure or modify each person's concepts of each emotion. The work on this variable was considered to be very preliminary. Thus, any attempt to provide a shared understanding of each emotion was considered premature. Each mother was asked to decide whether she thought she had done what she wanted to do. The fact that so many of the emotion strength effects were significant suggests that more attention

should be paid to this variable in future studies.

Finally, the characteristics of the children themselves have important influence on the research; there are two which deserve mention in this section. First, the children participating in this study were diagnosed as having ADD, and were rated as having more than eight symptoms of ADD by their mothers. However, the identity of the diagnostician was not controlled, and the interpretation of these results as pertaining to ADD children is appropriate only to the extent that these children were diagnosed accurately. This should be considered in interpreting these results.

Second, there was a trend for children with ADD to have a lower standard score on the PPVT-R (Dunn & Dunn, 1981). One must question whether a deficiency in receptive vocabulary may be related to poor emotion recognition. However, Camras et al. (1990) found no correlation between scores on the PPVT-R with abused and nonabused children as participants. In addition, Dimitrovsky (1964) examined the correlations between verbal intelligence (using a test similar to the PPVT-R) and emotion recognition for children between the ages of 5 and 12. She found a significant correlation only for the 5-year-olds and the correlation explained only 14% of the variance in emotion recognition. Thus, while poor receptive vocabulary could have had an effect on the results previous research indicates that it is not likely.

Therefore, there are a number of issues which could be clarified in future studies by: 1) employing more speakers on the tape used to assess emotion recognition; 2) increasing the value of the pretest by basing it on the judgements of more participants; 3) testing more emotions and using two response modes: categorical (i.e. happy vs. sad) and dimensional (i.e. the degree of happiness); and 4) assessing emotion recognition in a natural situation.

There were also several limitations associated with the testing of mothers' emotion portrayal. For instance, mothers

of children with ADD appeared to be less relaxed throughout the session. This was in spite of the fact that the researcher tried to make it clear both during phone conversations and the research session that differences in emotion portrayal were normal. However, while this nervousness would have been expected to have a negative impact on the emotion portrayals of mothers of ADD children, these mothers did not show any deficit in emotion portrayal. This suggests that nervousness had little effect. Nevertheless, the study could perhaps have been improved by spending more time putting mothers at ease. In addition, mothers' concern about their child's behaviour could be addressed in future by having a second person present to stay with the child while the mother provides emotion portrayals, or by having the mother come back for a second session without the child present.

Another limitation was that mothers generally did not practice their emotion portrayals prior to recording although they were invited to do so. Thus, the emotion portrayals may not have been characteristic of the mothers' normal way of expressing emotion. However, mothers were asked if their emotion portrayal was acceptable. Perhaps changing the instructions to stress practice would lead mothers to practice more. It could also be helpful to allow mothers to practice while alone.

In addition, the small number of emotion portrayals from each mother is a problem. The decision to use only 3 utterances from each mother was made for practical reasons and may have had negative effects on the reliability of the judgements. However, random assignment of utterances to the emotion judgement tape should have eased this concern to some degree. Nevertheless, the study would have been improved by testing more of the mothers' utterances. Finally, fewer of the mothers from each group, but especially the mothers of children with ADD, were on the emotion judgement tape. This

means that there must be more concern about the results; it also means that there was less power for this part of the study.

Study Implications

This study provides valuable information to professionals who work with ADD children. It indicates that training in emotion recognition would be a valuable addition to training in social skills for these children. This may be especially true for younger children as it appears that emotion recognition is primarily developed at a younger age.

It is also possible that there would be some value in training mothers of children with ADD to display more happiness. Again, this training would probably have more impact with mothers of younger children than with mothers of older children. In addition, a preliminary assessment of the mother's emotional state may be valuable, as treating maternal depression could have significant benefits for the child of a depressed mother.

However, it should be noted that the support for this suggestion is substantially limited by the fact that no significant correlation was found between the clarity of mothers' emotion portrayals and their child's recognition of emotion. Nevertheless, this study does add support to the belief that people, children especially, are best studied with attention to the context in which they live.

Finally, I would like to highlight the positive aspects of this research. Mothers of children with ADD were generally found to portray emotion as clearly as other mothers. In fact, they were sometimes clearer. This could be a result of mothers attempting to compensate for any difficulties their children may have.

Conclusions

In conclusion, this study indicates that children with ADD recognize vocal emotion differently from other children, particularly happiness and neutral emotion. Their mothers,

however, showed little deficit in portraying emotion. Only extreme anger was portrayed less well by target mothers than control mothers. Nor was there a significant relationship between the mothers' emotion portrayal clarity and their child's emotion recognition accuracy, or between children's emotion recognition accuracy and their overall social skills.

If these conclusions are born out by further research they have serious implications for children with ADD: recognition of emotion presumably plays a role in interactions with family members, and in developing and maintaining friendships. Any deficiency in these areas could lead to further difficulties. For example, it is likely that children learn many things from their peers. This type of learning could be affected if a child has fewer friends. To the extent that positive and negative emotions act as consequences to behaviour emotion recognition could even play a role in general learning. One example would be a child who performs an activity a second time because it made someone else happy. If the child does not recognize the other person's emotion this type of learning would again be an impossibility.

Thus, while this research does provide us with some information about children with and without ADD, it raises several questions. Further research could include: a cross-sectional study involving participants of different (especially younger) ages which reassesses the hypotheses examined in this research; assessing the affects of emotion recognition training; examining whether there is a relationship between mothers' reports of depression and stress and their child's emotion recognition; acoustically analyzing the emotion portrayals of mothers of children with and without ADD; comparing the emotional cues used by children with and without ADD.

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Table 1

Contact Sources for Mother/Child Dyads Participating in the
Emotion Recognition Experiment and Emotion Portrayal Task

	<u>Target (n/percent)</u>	<u>Comparison (n/percent)</u>
Radio	6/18.75%	2/06.25%
Newspaper	1/03%	4/12.5%
Organizations	7/21.88%	4/12.5%
Friends	2/06.25%	3/9.75%
Unknown	0/00%	3/9.75%

Table 2

Demographic Information on the Children in the Emotion Recognition Experiment

	Target	Comparison
Age		
(in months)	109	111
Sex		
Males	14	14
Females	2	2
ADHD Rating Scale ¹		
# Symptoms	12.4	.75
PPVT-R ² (Std Score ³)	108	116

¹ Barkley & DuPaul (1990)

² Dunn & Dunn (1981)

³ Standard Score

Table 3

Emotion Recognition Task Sentence Content and Ratings of Nouns
on Imagery (I), Concreteness (C), and Meaningfulness (M)
According to Paivio, Yuille, and Madigan, (1968)

Sentence	I	C	M
1) This is a green peach.	6.6	6.8	6.84
2) These are several cats.	6.8	7.00	6.76
3) There are six shoes.	6.63	7.00	7.52
4) It is a little tree.	6.77	7.00	6.79
Example Sentence			
A) That is a blue ball.			

Table 4

Demographic Information on the Mother/Child Dyads Who Participated in the Emotion Portrayal Task and the Emotion Recognition Task.

	Emotion Portrayal		Emotion Recognition	
	Target	Comparison	Target	Comparison
n	13	15	16	16
M Age of Mothers (in years)	38	37	37	36
Primary Caretaker				
Mother	4	7	6	8
Father	0	0	0	0
Both	8	7	8	7
Other	1	1	2	1
Marital Status				
Single	2	1	2	1
Married	10	11	11	11
Separated	0	1	1	1
Divorced	1	1	2	2
Widow	0	1	0	1
SES				
Mothers	48.63	54.83	47.87	52.46
Fathers	42.46	57.31	41.28	52.54
Average	45.58	56.07	44.58	52.5
Number of Mothers Working Outside of Home	11	6	14	7

Demographic Information: Children

	Emotion Portrayal		Emotion Recognition	
	Target	Comparison	Target	Comparison
Age				
(in months)	112	112	109	111
Sex				
Males	12	13	14	14
Females	1	2	2	2
ADHD Rating Scale ¹	12.46	.8	12.4	.75
(Number of Symptoms)				
PPVT-R ² (Std Score)	106	115	108	116

¹ Barkley & DuPaul (1990)² Dunn & Dunn (1981)

Table 5

Scripts for Emotion Portrayal and Ratings on a Friendly (+6)/
Unfriendly (-6) Continuum from Bugental, Kaswan, Love, & Fox,
1970, p. 649.

Positive Scripts (Ratings)

That's good. That's really great (+5.78).

You really did a fine job (+5.74).

Negative Scripts (Ratings)

You're hopeless. You're completely hopeless (-5.89).

You're a complete idiot (-5.96).

Neutral Scripts

It's a tree. It's a little tree.

That really is a white dove.

Table 6

Distribution of Sentences on Emotion Judgement Tape

Emotion Sentence	Happy		Neutral		Angry	
	FJ	RG	WD	LT	CI	CH
Emotion Strength						
High	8	5	6	8	7	8
Moderate	7	8	8	6	8	5

Note. FJ is "You really did a fine job". RG is "That's good. That's really great". WD is "That really is a white dove. LT is "It's a tree. It's a little tree". CI is "You're a complete idiot" while CH is "You're hopeless. You're completely hopeless".

Table 7

Cronbach Alpha Values for Ratings by Adults and Children of the Emotion Recognition Tape.

	Adults Mean/S.D.	Children Mean/S.D.
Happiness		
Extreme	.98	.98
Moderate	.80	.72
Neutral		
#1	.88	.88
#2	.79	.85
Anger		
Moderate	.87	.83
Extreme	.93	.87

Table 8

Means and Standard Deviations of Children's Difference Scores
(Square Root of Children's Ratings Minus Adults' Ratings)
Organized by Group, Emotion Type and Emotion Strength.

	All	Target	Comparison
	Mean/S.D.	Mean/S.D.	Mean/S.D.
Overall	0.75/0.19	0.84/0.23	0.65/0.08
Happiness	0.85/0.37	1.01/0.44	0.69/0.17
Extreme	1.00/0.62	1.25/0.74	0.75/0.33
Moderate	0.69/0.18	0.77/0.22	0.62/0.08
Neutral	0.65/0.24	0.77/0.27	0.54/0.14
Anger	0.74/0.15	0.75/0.17	0.74/0.14
Moderate	0.79/0.21	0.77/0.24	0.80/0.17
Extreme	0.70/0.14	0.72/0.14	0.67/0.14

Table 9

Means and Standard Deviations of Emotion Ratings by Adults and Children, Organized by Group, Emotion Type and Emotion Strength.

	Adults		Children	
		All	Target	Comparison
	Mean/S.D.	Mean/S.D.	Mean/S.D.	Mean/S.D.
Happiness	2.41/0.84	1.91/1.05	1.45/1.24	2.38/0.55
Extreme	3.07/1.52	2.15/2.12	1.17/2.48	3.13/1.04
Moderate	1.74/0.45	1.67/0.48	1.72/0.61	1.63/0.31
Neutral	-0.11/0.32	0.02/0.56	0.23/0.69	-0.19/0.29
Anger	-2.52/0.60	-2.88/0.47	-2.89/0.49	-2.86/0.47
Moderate	-1.99/0.76	-2.43/0.58	-2.48/0.59	-2.38/0.58
Extreme	-3.04/0.48	-3.33/0.41	-3.30/0.43	-3.35/0.40

Table 10

Mean Difference Scores (Square Roots of Children's Minus Adults' Ratings) of Children by Group, Emotion Type, Emotion Strength, and Age of the Child.

	Comparison Children			Target Children		
	7/8 (n=7)	9 (n=5)	10/11 (n=4)	7/8 (n=7)	9 (n=6)	10/11 (n=3)
Overall	0.63	0.67	0.66	0.93	0.78	0.75
Happiness	0.62	0.78	0.68	1.13	1.04	0.66
Extreme	0.60	0.96	0.76	1.39	1.34	0.77
Moderate	0.64	0.60	0.60	0.88	0.74	0.56
Neutral	0.58	0.50	0.50	0.80	0.66	0.93
Anger	0.70	0.73	0.81	0.87	0.65	0.65
Moderate	0.72	0.81	0.94	0.93	0.61	0.71
Extreme	0.68	0.65	0.68	0.80	0.70	0.60

Table 11

Mean Ratings of Children by Group, Emotion Type, Emotion Strength, and Age of the Child.

	Comparison Children			Target Children		
	7/8	9	10/11	7/8	9	10/11
	(n=7)	(n=5)	(n=4)	(n=7)	(n=6)	(n=3)
Happiness	2.43	2.04	2.72	1.29	1.14	2.43
Extreme	3.36	2.47	3.54	0.69	0.72	3.21
Moderate	1.49	1.61	1.90	1.88	1.55	1.65
Neutral	-0.18	-0.13	-0.27	0.39	0.31	-0.28
Anger	-2.86	-2.76	-3.00	-3.29	-2.50	-2.75
Moderate	-2.40	-2.28	-2.47	-2.88	-2.03	-2.46
Extreme	-3.32	-3.25	-3.53	-3.70	-2.97	-3.04

Table 12

Mean Clarity Scores and Standard Deviations of Mothers,
Organized by Group, Emotion Type, and Emotion Strength.

	All Mean/S.D.	Target Mean/S.D.	Comparison Mean/S.D.
Happiness	2.71/0.95	2.76/0.98	2.66/0.94
Extreme	3.17/0.90	3.32/0.89	3.03/0.91
Moderate	2.25/0.77	2.21/0.73	2.29/0.82
Neutral	3.36/0.79	3.48/0.77	3.24/0.81
Anger	2.67/0.81	2.64/0.74	2.70/0.89
Extreme	2.83/0.90	2.58/0.79	3.07/0.97
Moderate	2.51/0.69	2.71/0.70	2.32/0.64
All Emotions	2.91/n.a.	2.96/0.91	2.87/0.91

Table 13

Tukey WSD Tests of Mothers Clarity Scores by Group, Emotion Type, and Emotion Strength.

Effect	q Obtain	# of Steps	Calculated df	q wsd
Happiness				
Extreme	0.284	3	34	0.44
Moderate	0.086	2	34	0.38
Anger				
Extreme	0.493	4	34	0.45
Moderate	0.413	3	34	0.38

Figure Captions

Figure 1: Spectrum of output from Wavetek analog filter: Random (white) noise input band-pass filtered at 100 Hz and 1000 Hz.

Figure 2: Emotion recognition difference scores (square roots of children's minus adults' ratings) of children as a function of group and emotion type.

Figure 3: Emotion recognition difference scores (square roots of children's minus adults' ratings) of children as a function of group, emotion type, and emotion strength.

Figure 4: Emotion recognition ratings of children as a function of group and emotion type.

Figure 5: Emotion recognition ratings of children as a function of group, emotion type, and emotion strength.

Figure 6: Emotion recognition ratings of children as a function of group, emotion type, emotion strength, and age of the children.

Figure 7: Emotion recognition difference scores (square roots of children's minus adults' ratings) of children as a function of group, emotion type, and age of the children.

Figure 8: Emotion recognition ratings of children as a function of group, emotion type, and age of the children.

Figure 9: Target children's emotion recognition difference scores (square roots of children's minus adults' ratings) as a function of emotion type, emotion strength, and the number of times they had heard the utterances.

Figure 10: Target children's emotion recognition ratings as a function of emotion type, emotion strength, and the number of times they had heard the utterances.

Figure 11: Comparison children's emotion recognition difference scores (square roots of children's minus adults' ratings) as a function of emotion type, emotion strength, and the number of times they had heard the utterances.

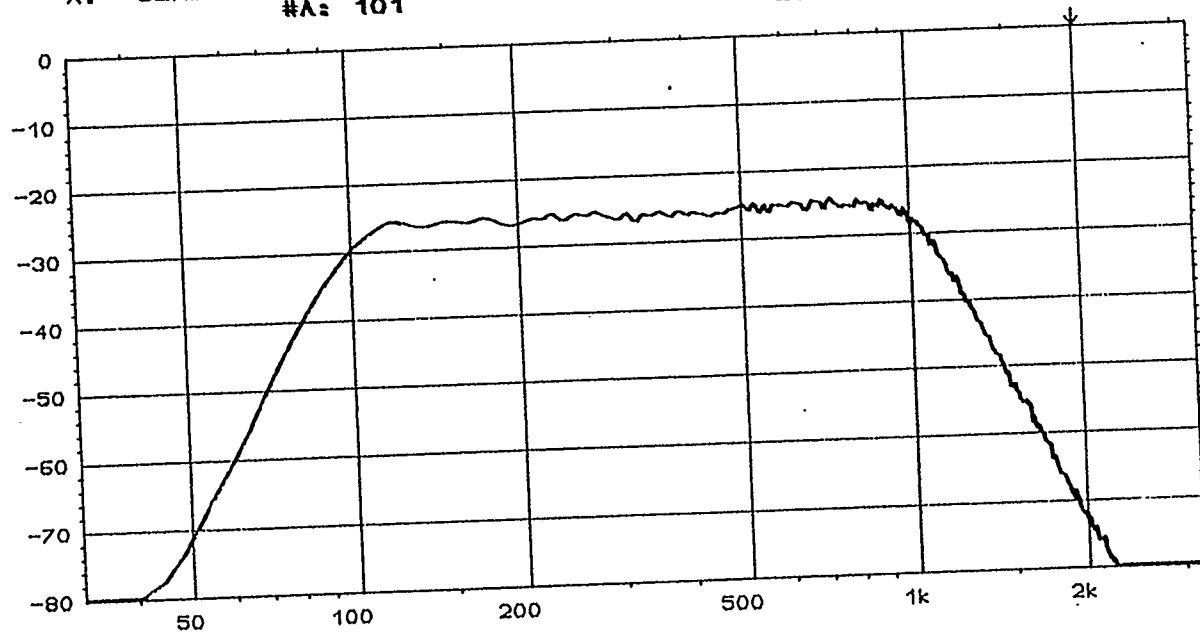
Figure 12: Comparison children's emotion recognition ratings as a function of emotion type, emotion strength, and the

number of times they had heard the utterances.

Figure 13: Mean clarity scores of mothers' emotion portrayals as a function of group, emotion type, and emotion strength.

White Noise input.
Spectrum of output
w/ 100Hz $\rightarrow$ 1KHz
Bandpass filtering

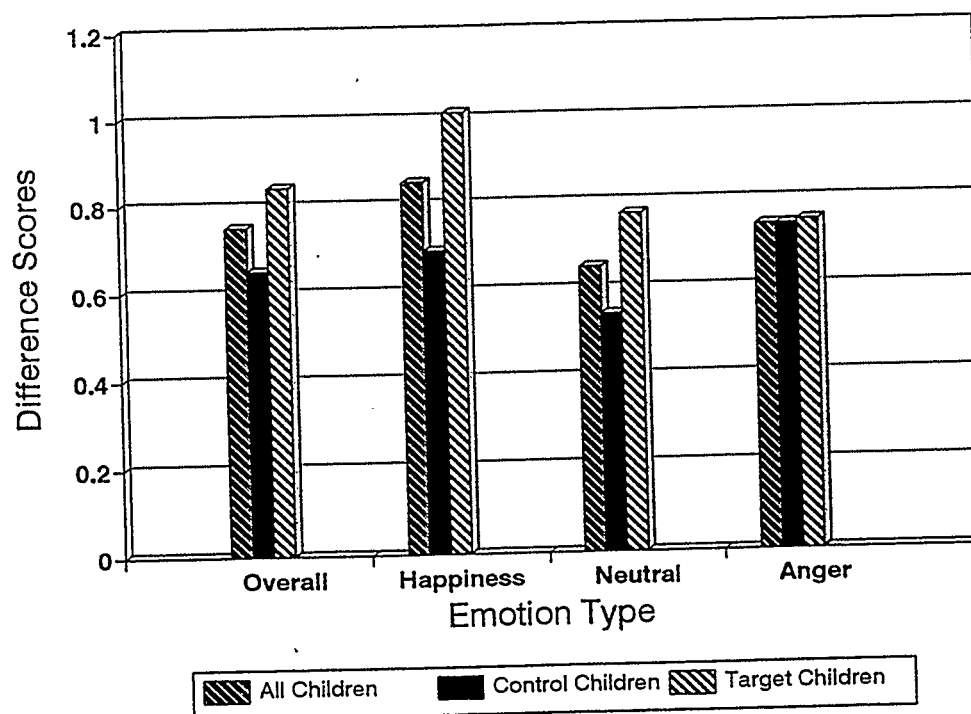
AUTO SPEC CH.B **INPUT**
Y: 0.0dB / 1.00V² PWR 80dB
X: 32Hz TO 3.2kHz LOG
#A: 101
REF Y: -73.0dB
X: 2000Hz
 Δ X: 1000Hz
 Δ Y: -45.0dB



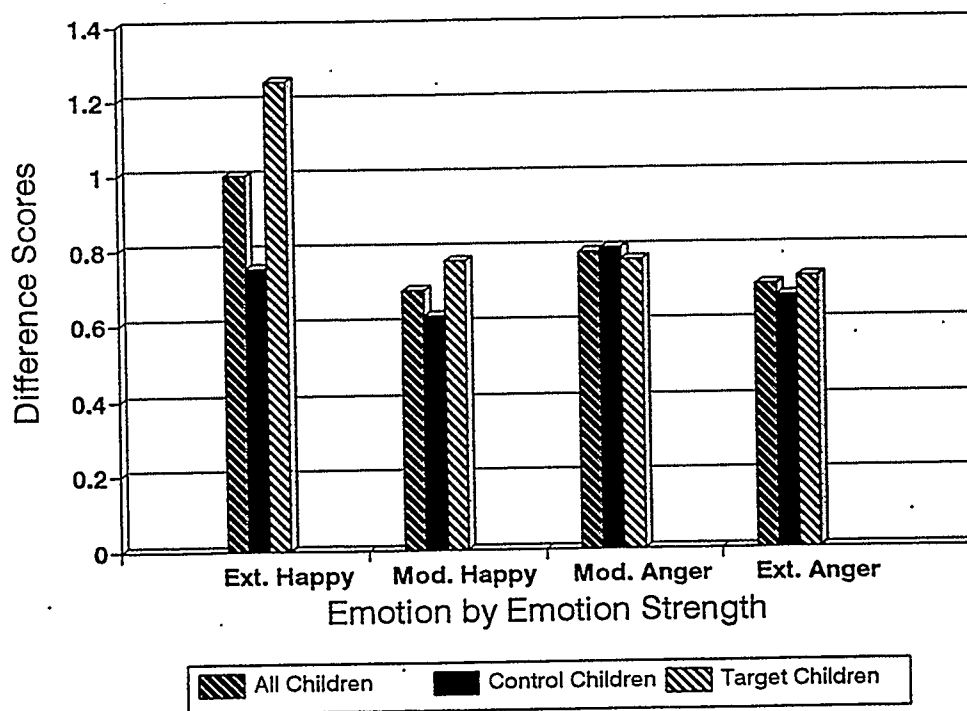
SETUP W7

MEASUREMENT: DUAL SPECTRUM AVERAGING, ZERO PAD
TRIGGER: FREE RUN
DELAY: CH.A+B: 0.00ms
AVERAGING: LIN 32767 OVERLAP: MAX
FREQ SPAN: 3.2kHz Δ F: 4Hz T: 125ms Δ T: 122 μ s
CENTER FREQ: BASEBAND
WEIGHTING: HANNING
CH.A: 4V + 3Hz DIR
CH.B: 4V + 3Hz DIR
GENERATOR: RANDOM NOISE
FILT: 25.6kHz 1V/V
FILT: 25.6kHz 1V/V

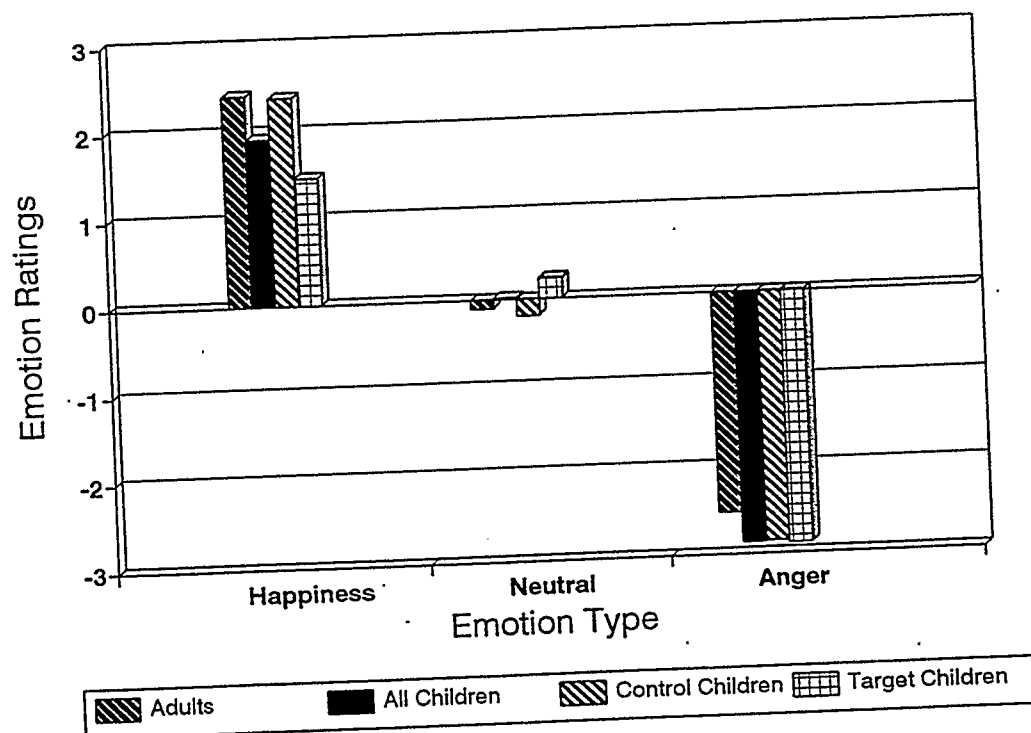
Emotion Recognition Difference Scores by Group & Emotion



Emotion Recognition Difference Scores by Group, Emotion, and Emotion Strength

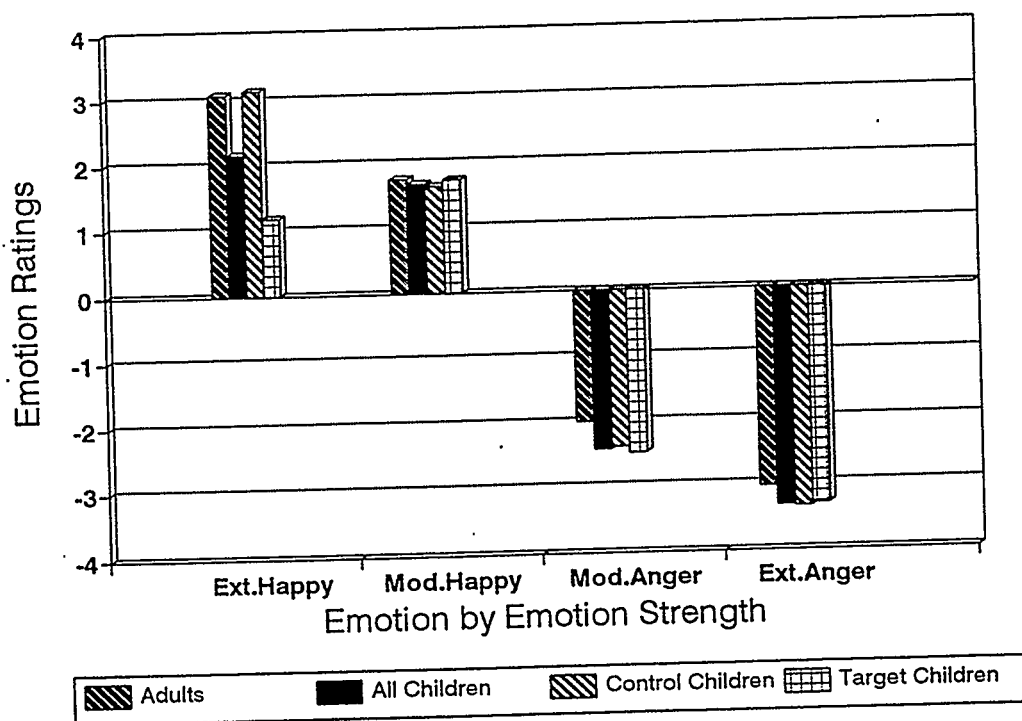


Emotion Recognition Ratings by Group & Emotion

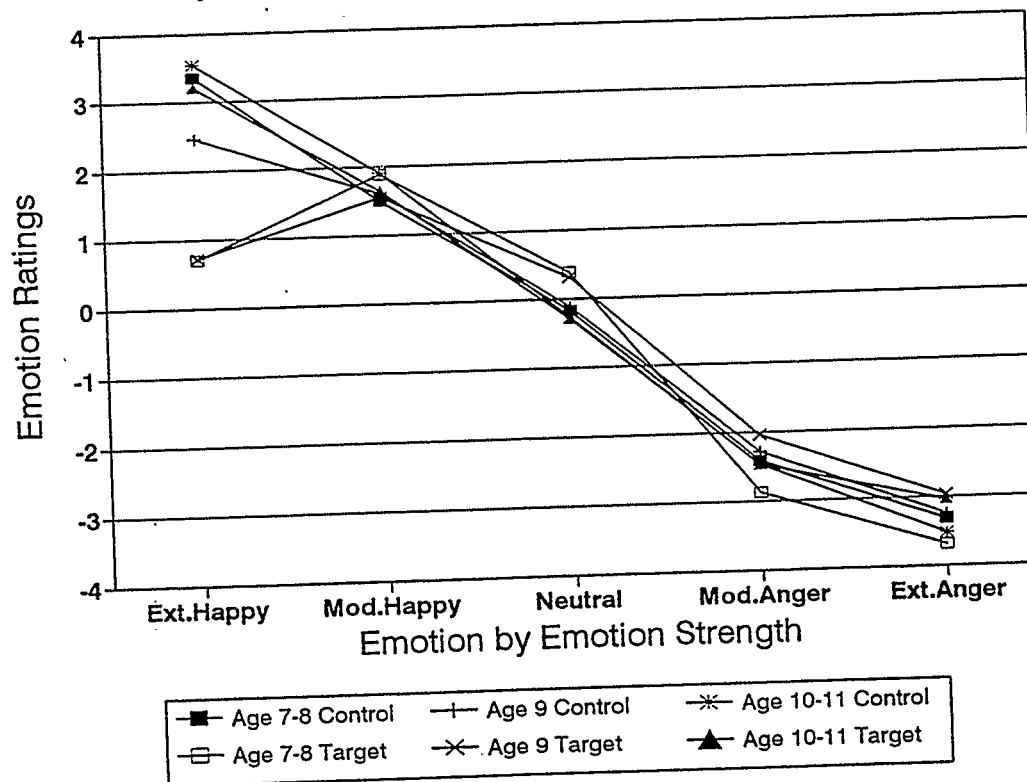


Emotion Recognition Ratings

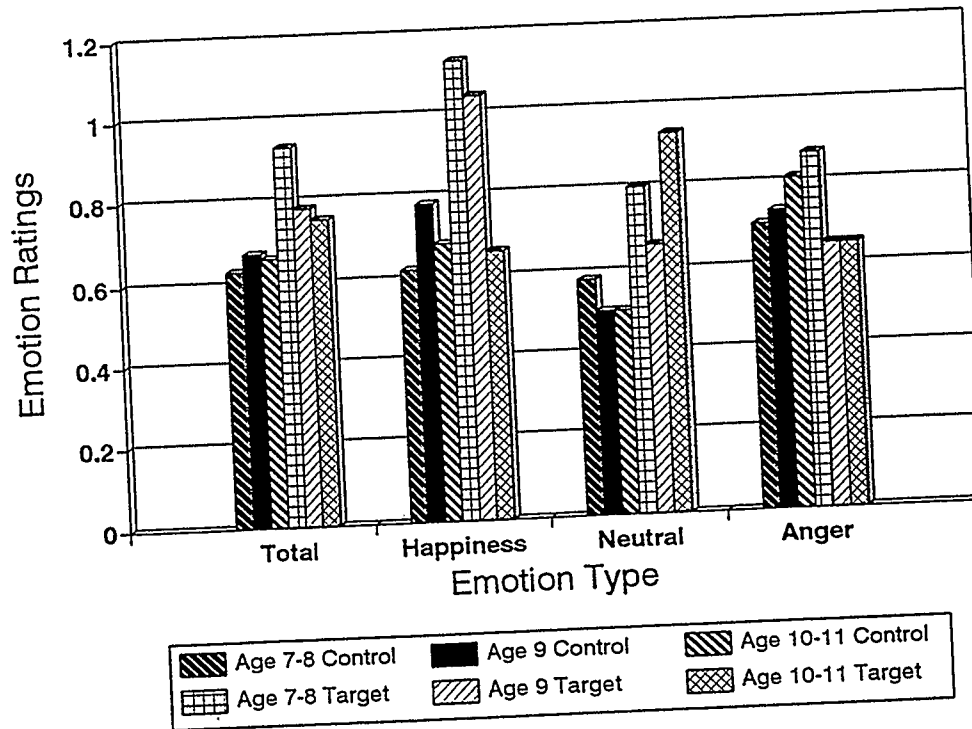
by Group, Emotion, and Emotion Strength



Emotion Recognition Ratings by Group, Emotion Strength, and Age

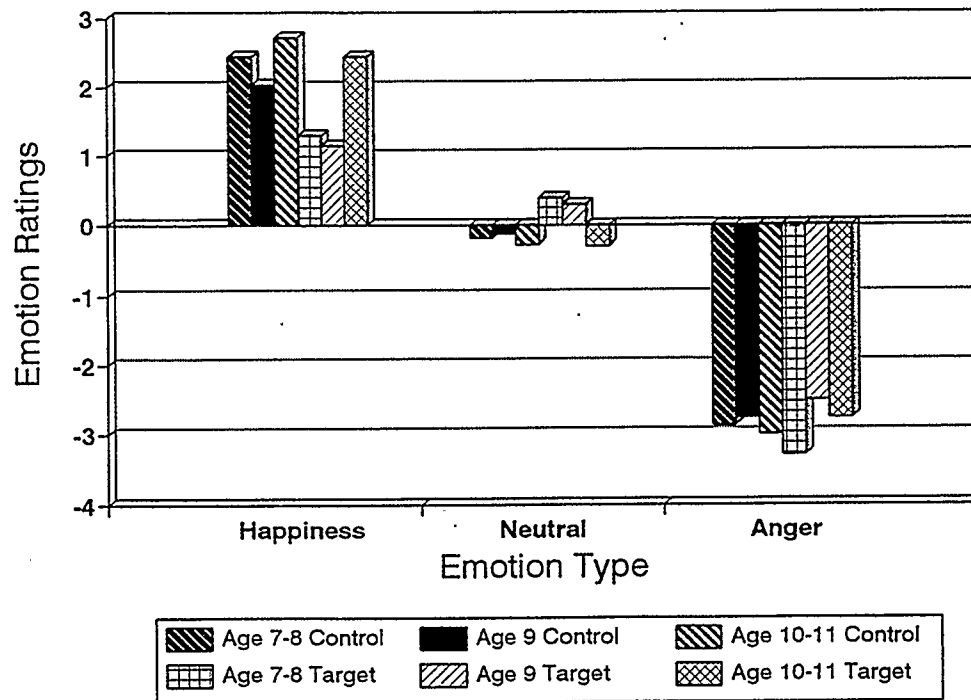


Emotion Recognition Difference Scores by Group, Emotion, and Age

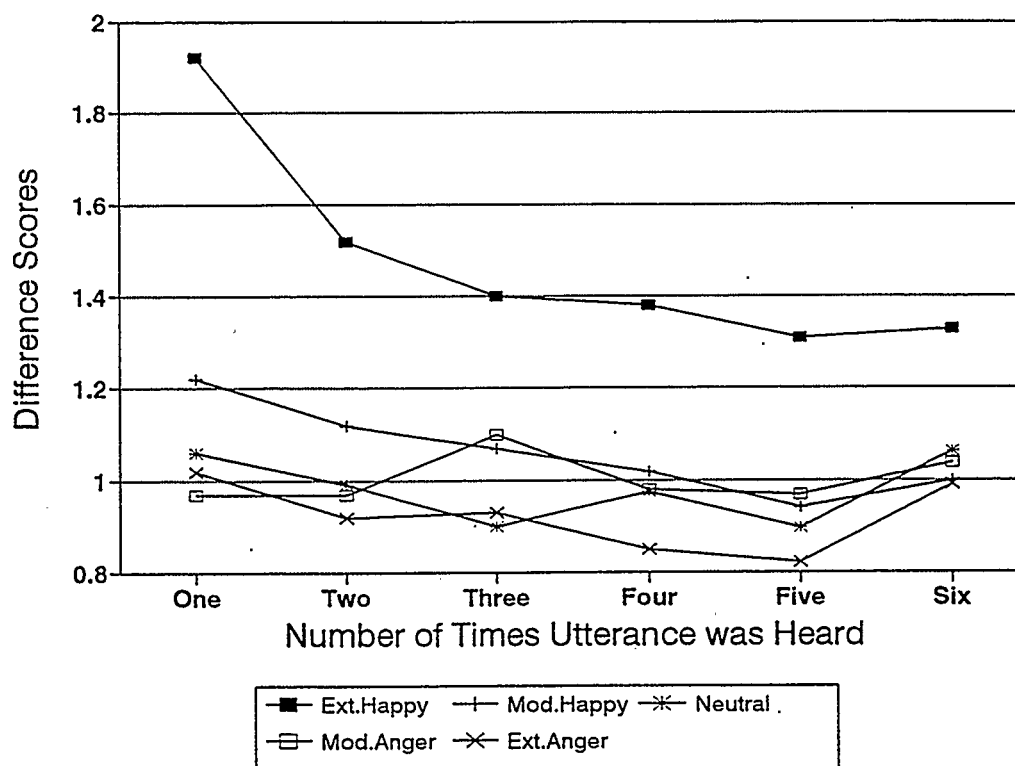


Emotion Recognition Ratings

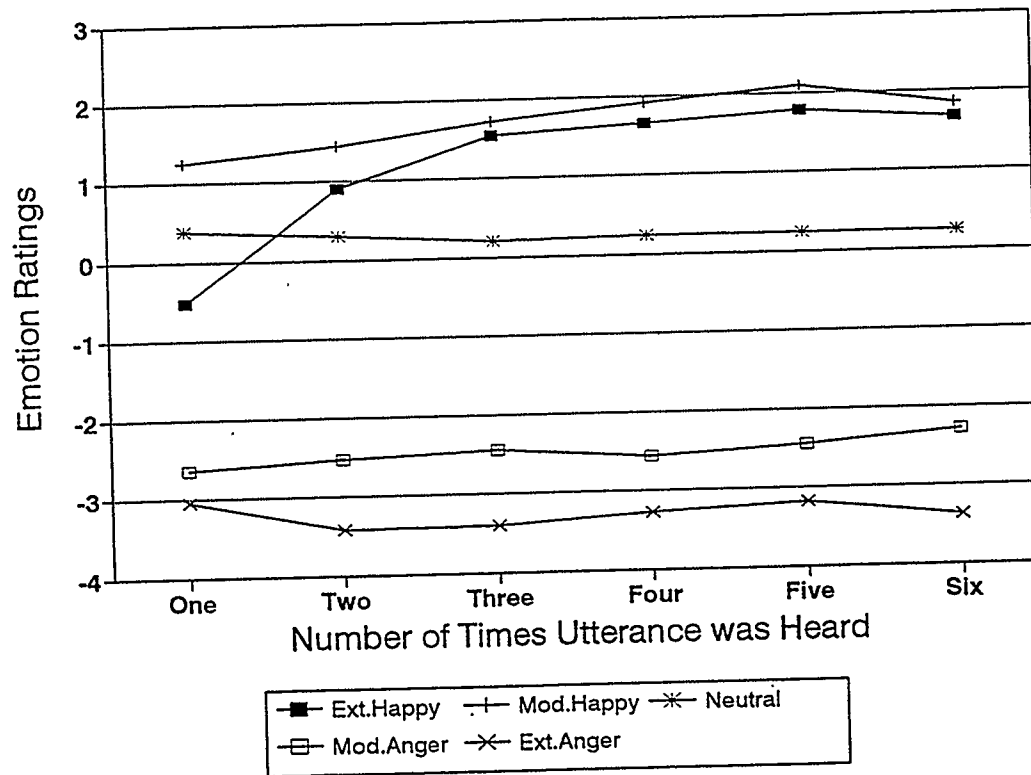
by Group, Emotion, and Age



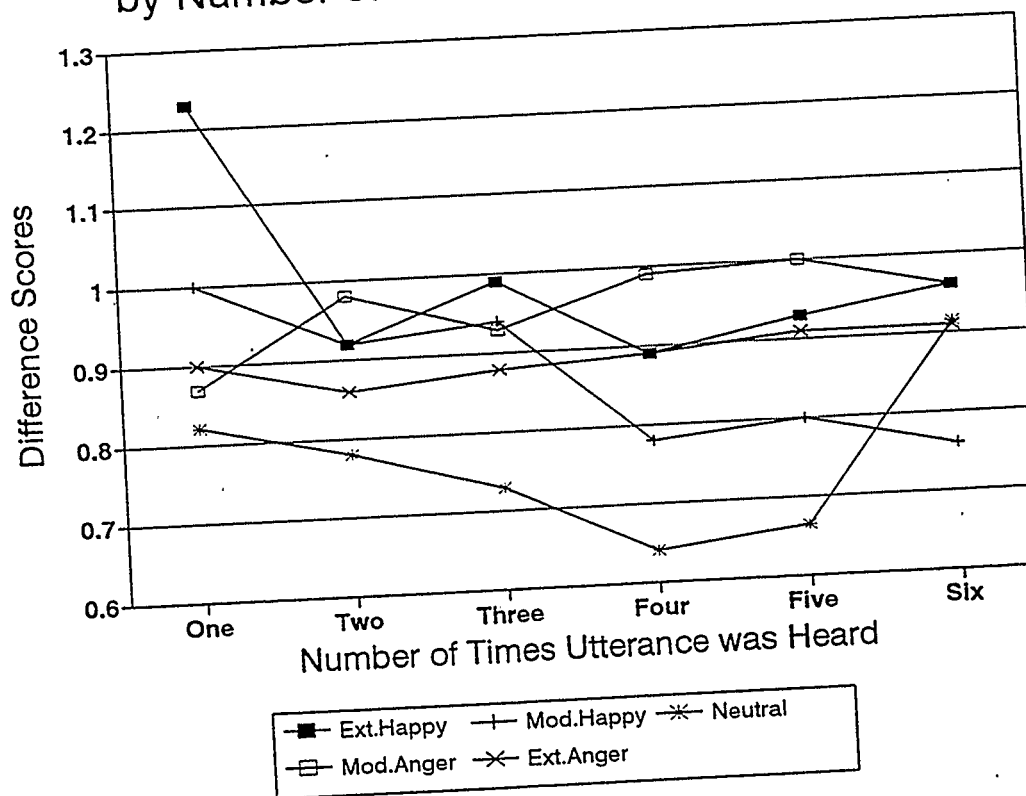
Emotion Recognition Difference Scores by Number of Times Heard: Target Group



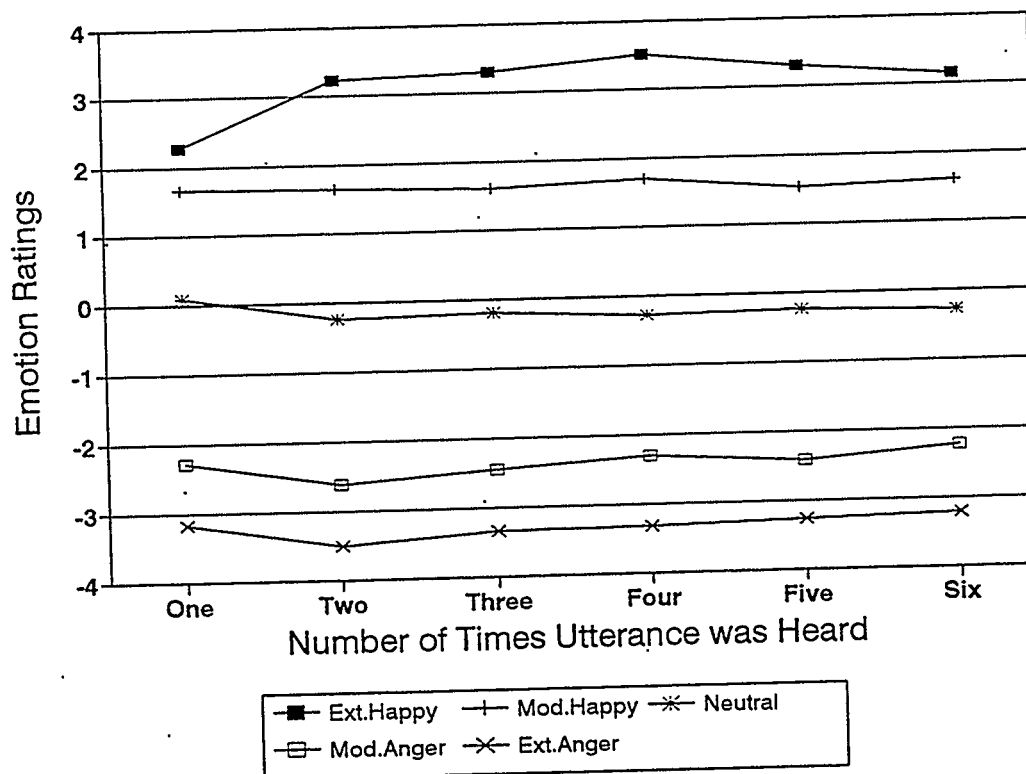
Emotion Recognition Ratings by Number of Times Heard: Target Group



Emotion Recognition Difference Scores by Number of Times Heard: Control Group

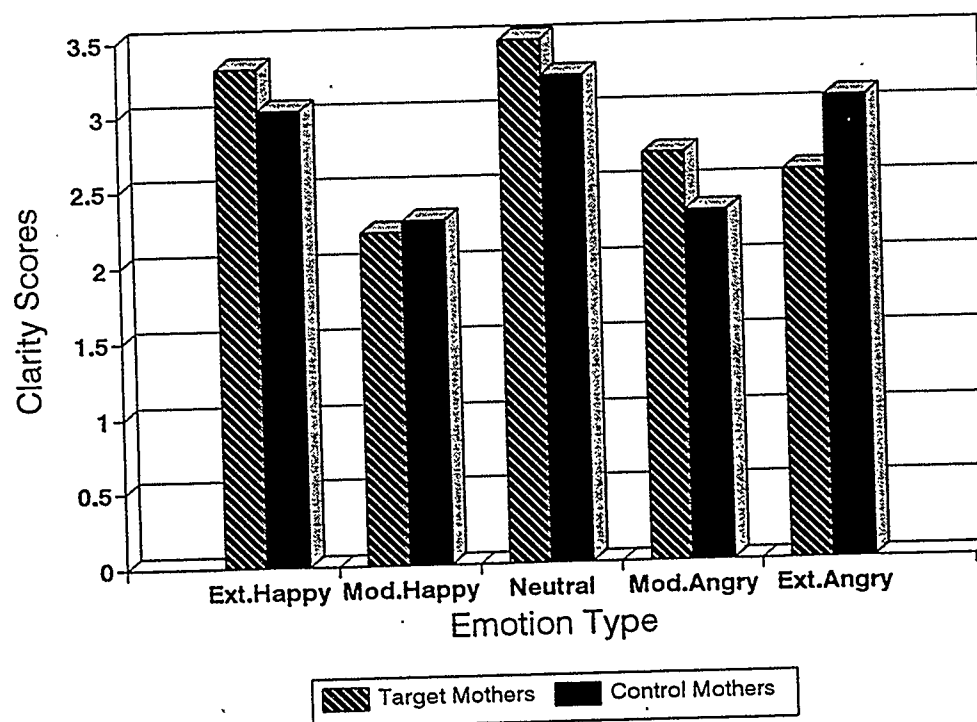


Emotion Recognition Ratings by Number of Times Heard: Control Group



Emotion Judgement Data

Clarity Scores by Emotion Type



Appendix A.

Phone call to University Students Asking for Participation

Note: The following procedures should be considered a guide only.

Procedures

1) Preliminary Procedures

Ask for potential subject by name. If not available, leave message. Once connected confirm that the person speaking is the potential subject. For example, one might say:

Hello. I wonder if I could speak to name of potential subject. Once connected to that person one could say: Is this potential subject?

2) Introduction of Administrator

Once connected to the potential subject the introduction will be informal, brief, and include the following information: (a) the name, status (e.g., graduate student, research assistant), and affiliation (Programme in Clinical Psychology) of the administrator.

For example, one might say: **"Hi. My name is Sandy Large. I'm a graduate student in the Programme in Clinical Psychology here at the University of Calgary."**

State the reason for calling.

For example, one might say: **"I'm performing a study on vocal emotion recognition for my Masters Thesis. You filled out a card indicating your willingness to become involved in psychological research in your say name of class. So I thought you might be interested in helping me with this study. So today I wanted to tell you about what I'm doing and ask you if you would be willing to take part. Do you have time to listen now?"**

If the potential subject says no, check on rescheduling to speak to them. For

example, one might say: **Is there any time I could talk to you which might be better?**

If they say no again, say:
Well, thank you for your time anyway. I appreciate your interest in psychological research.

If the potential subject says yes, that they have time to discuss the study now, continue with the study description.

3) Introduction of Study

The administrator will tell the subjects: (a) what the project is about; and (b) a general description of what the subjects will be doing. For example, the administrator might say:

"The general aim of this study is to examine the way children recognize emotion. Specifically, I am interested in the accuracy of children's recognition of emotion and how this relates to the portrayal of emotion by their mothers. I am also interested in how the accuracy of the child's recognition of emotion relates to their social skills."

4) Description of Participation Requested

The listener will then be told what they are being asked to do.

"The reason I've phoned you is that I'm looking for people to judge the tape I'm using to assess emotion recognition. I need to ensure it portrays the emotion it is intended to portray. (manipulation check) Specifically, I'm looking for people to listen to the tape for me and let me know how they think the speaker feels. Thus, participants will be rating the voices as to

whether they feel the speaker sounds happy, angry, or neither. They'll also be indicating how confident they feel in their judgements. This task will take between one half and one hour."

5) Ask for Participation

After this, the subjects will be given an opportunity to ask any questions they would like to. If they have not spontaneously asked questions the administrator might ask them:

"Do you think you would be interested in doing something like this?"

If the potential subject says no, they should be thanked for their time and interest. For example, one might say: **"I realize that one doesn't always have the time to do everything one is interested in, so I certainly understand. Well, thank you for listening. I appreciate the time you've given me and the interest you've shown in psychological research."**

6) Schedule (if applicable)

If the students say yes an appointment will be made with them. For example, one might say:

"That's great. When do you think you would be available to come in to the laboratory?"

7) Thanks

Finally, the student will be thanked. For example, one might say:

"Thanks a lot for your willingness to help. It's people like you who make psychological research possible."

Appendix B

Notice Placed in Community Newspaper

Emotion Recognition Study requires participants. Positive social interactions are essential for children, and are affected by the quality of each child's social skills. A study at the University of Calgary examining an important component of social skills requires the participation of 7 to 11 year-old boys and their mothers. If you are willing to hear about this study, please call the number below and leave a message with your name, phone number, and a convenient time when you can be reached. Thank you for your consideration.

Sandra F. Large / Emotion Recognition Study

244-7715

Appendix C

DSM-III-R Diagnostic Criteria for Attention-deficit
Hyperactivity Disorder (APA, 1987)

"Note: Consider a criterion met only if the behavior is considerably more frequent than that of most people of the same mental age.

A. A disturbance of at least six months during which at least eight of the following are present:

- (1) often fidgets with hands or feet or squirms in seat (in adolescents, may be limited to subjective feelings of restlessness)
- (2) has difficulty remaining seated when required to do so
- (3) is easily distracted by extraneous stimuli
- (4) has difficulty awaiting turn in games or group situations
- (5) often blurts out answers to questions before they have been completed
- (6) has difficulty following through on instructions from others (not due to oppositional behavior or failure of comprehension), e.g., fails to finish chores
- (7) has difficulty sustaining attention in tasks or play activities
- (8) often shifts from one uncompleted activity to another
- (9) has difficulty playing quietly
- (10) often talks excessively
- (11) often interrupts or intrudes on others, e.g., butts into other children's games
- (12) often does not seem to listen to what is being said to him or her
- (13) often loses things necessary for tasks or activities at school or at home (e.g., toys, pencils, books, assignments)

(14) often engages in physically dangerous activities without considering possible consequences (not for the purpose of thrill-seeking), e.g., runs into street without looking

Note: The above items are listed in descending order of discriminating power based on data from a national field trial of the DSM-III-R criteria for Disruptive Behavior Disorders.

B. Onset before the age of seven.

C. Does not meet the criteria for a Pervasive Developmental Disorder.

Criteria for severity of Attention-deficit Hyperactivity Disorder:

Mild: Few, if any, symptoms in excess of those required to make the diagnosis, **and** only minimal or no impairment in school and social functioning.

Moderate: Symptoms or functional impairment intermediate between "mild" and "severe."

Severe: Many symptoms in excess of those required to make the diagnosis **and** significant and pervasive impairment in functioning at home and school and with peers." (p.52-53)

Appendix D

Stories Given to Actor to Evoke Emotions

Intense Negative/Angry

Your friends have come to your place for a drink. You want to ask them to look after your child while you go out on the weekend to look for a job. If you don't find one this weekend you won't be able to buy food for next week. Your friends don't like to watch your child. While you're working up the courage to ask them your child comes into the room swinging a toy around in a dangerous way. You tell your child to stop several times and are ignored. Finally, your child gets angry and hits you with the toy. You're furious because it hurts and you're afraid this scene will mean you won't be able to get your friends to babysit. You say:

"You're a complete idiot."

Moderate Negative/Angry

You have friends and family coming over. You expect them in 25 minutes. An hour ago you told your child to clean up the mess in the living room. You go in to check and you see your child laying on the couch watching their favourite show on television and the room still a mess. You don't have time to clean up yourself so you're angry. You walk over to the television, turn it off and say:

"Clean this up now."

Intense Positive/Happy

You're at your child's sports day. You've recently moved into a small town and don't know anyone very well, so you want yourself and your child to look good. All has gone well. You've talked to your child's teacher. She's said what an intelligent, pleasant child you have and that she'd like you to come out to the town PTA meeting. Your child comes up and wants you to take part in the 3-legged race. You laugh all the way to the end where you win the race. You say:

"That's good. That's really great."

Moderate Positive/Happy

Your best friend is making a weekly visit to play cards. You were late home from work today so you haven't had a chance to clean up. After you're finished making coffee you go into the dining room to set up for the cards. You find that your child has already cleaned off the table and set up the cards. You're happy about this. You say:

"That was a really nice thing for you to do."

Neutral #1

Your child is doing homework at the table while you're reading the newspaper. You say:

"They're closing the hardware store."

Neutral #2

You're driving to the store with your child in the front seat beside you. You see the look your child gives to the new building. You say:

"That's going to be a gas station."

Appendix E

Approximate Instructions Given to Adults During the Emotion Recognition Task

Note: The following procedures should be considered a guide only.

1) Introduction of Administrator

The session introduction will generally be informal, brief, and include the following information: (a) the name of the administrator, and (b) appreciation for coming.

For example, one might say **"Hi. Thanks for coming. I'm Sandy Large. I talked to you on the phone. It was really nice of you to come."**

2) Introduction of Study

The administrator will then tell the subjects: (a) the status (e.g., graduate student, research assistant), and affiliation (Programme in Clinical Psychology) of the administrator, (b) what the project is about; and (c) a general description of what the subjects will be doing. For example, the administrator might say:

"As you know, I'm a graduate student in the Programme in Clinical Psychology and I'm looking at how well different children recognize emotion. I'm also examining whether emotion recognition of children is related to the way their mothers express emotion.

What I hope this study will give me is a picture of the emotional expression children hear.

3) Description of Task

The administrator will then give the subjects a general description of what they will be doing. For example, the administrator might say:

To assess this I have asked an actor to say several sentences in different emotional tones of voice. While a preliminary assessment of this material has been done it is necessary that I ensure that she

has portrayed the emotions well. All of the sentences the actor says are similar (e.g. There are several cats. and That is a white house.) in structure. The primary difference is only the emotion portrayed.

What I want you to do is to listen to some tape-recordings of voices for me and let me know how you think the speaker feels.

In addition, I want you to let me know how confident you feel about your ratings."

"Do you have any questions?" (Answer any questions asked.)

4) Explain Consent Forms

"This would be a good time for you to read the consent form."

After the participant has finished reading say: Do you have any questions about this form? (Answer questions).

If you're still willing to participate please sign the form in the space marked "Participant's Signature" and enter today's date."

If potential subject has decided not to sign the form say: Thanks for listening.

I appreciate the time you've given me and the interest you've shown in psychological research.

5) Demographic Information

Point to relevant section. "The first thing I would ask you to do is to answer the questions found on the first page."

6) Hearing Screening

The audiometer should be set up for use. The participant should be told that the next task to be done will be the hearing screening, that there's no right or wrong answer, but that I just want to know what he hears.

For example, one might say: **The next thing I want you to do is a simple hearing test. You will listen on headphones for beeps which come and go. I would like you to let me know when you hear them. There's no right or wrong answer on this. I just want to know what you hear.**

Explain the task to the participant **BEFORE GIVING THEM THE HEADPHONES.**

The way this task works is as follows: You will put on the headphones and sit in this chair which will be turned away from me. When you hear the beep, raise the hand which corresponds to the ear you hear the sound in so that I can see it. Thus, if you hear the sound in your right ear you would raise your right hand and so on. Keep holding your hand up for as long as you hear the beep. So you raise your hand when you hear the beep and keep it up until you don't hear it any more. Okay? Let's try it.

After the participant understands his/her task, the headphones should be placed on their head and adjusted until they are comfortable. If the participant does not like the headphones they should be told that **I know what you mean. But this is a very quick task. It will only take a couple of minutes.**

Let's start then. Remember, once you hear the beep, you raise your hand.

Turn on the power and the tone button on the audiometer. Ensure the frequency is set to 250 and the H.T.L. (Hearing Threshold Level) knob is set to 0. While the participant is sitting quietly, slowly turn the H.T.L. knob up one step at a time. Increase the tone loudness at a rate of approximately 3 seconds per step. When the participant raises his/her hand mark the H.T.L. at which s/he did so on the hearing screening sheet. Then lower the H.T.L. at the same rate (1 step/3

seconds) and wait for the participant to lower their hand.

Continue raising the H.T.L. until the participant indicates hearing the tone. Then lower the H.T.L. at the same rate (1 step/3 seconds) and wait for the participant to lower their hand.

The above procedure will be carried out three times to ensure reliability.

7) Training Procedures - Emotion Recognition Task

Take the participant back into the Emotion Recognition Task room. Ask them to sit, and start explaining the procedures.

"Now I will describe the procedures. While I do this, please look at your rating form. You will be listening to tape recordings of speech samples.

After you hear each speech sample you will be asked to rate it on the emotion portrayed by the speaker. You will be rating the extent to which you think the voice sounds Happy and Positive as opposed to Angry and Negative.

The administrator will describe how to use the rating scale. Each time a specific section of the rating scale is described that section should be pointed to.

You will do this on a 9 point scale with a rating of -4 meaning that you think the voice sounds extremely negative\angry and a rating of +4 meaning that you think the voice sounds extremely positive\happy.

The midpoint is 0 so if you listen to the voice and think that it does not express either positive or negative emotion you will mark 0.

Thus, I am looking for your opinion about the emotion expressed by the speaker. There are no right or wrong answers. I would like you to indicate how the mother's tone of voice sounds to you.

Not all voice samples will be equally easy to judge so after you have rated the speech sample on Positive/Happy versus Negative/Angry you will indicate the extent to which you feel confident about your rating.

You will do this on a scale of 0 to 6, with a rating of 0 meaning that you have no confidence in your rating while a rating of +6 means that you feel certain your rating is correct.

You will be given 6 seconds in which to perform these two ratings."

Give subject a pencil to mark their rating with.

"The first 6 speech samples you hear will be practice examples.

Please listen carefully to every voice sample.

Review if necessary:

To review, if you listen to the voice and you think it sounds positive and happy, then depending on the extent to which you think this is the case, you would mark one of the points from +1 to +4.

On the other hand if you listen to the voice and you think it sounds negative and angry, then again depending on the extent you think this is the case, you would mark one of the points from -4 to -1.

Finally, you will rate the extent to which you feel confident about the rating you made.

Okay, I'll turn on the tape recorder now. After we've heard the 6 examples I will stop the recorder.

Turn on the tape recorder. Say nothing during the examples. After the last example stop the tape recorder.

Do you have any questions or comments?

8) Experimental Task

"Okay. Now that you have had some practice we will begin. The rest of your ratings will be done on the following pages.

If, when you're turning the page you realize that you've lost your place, don't try to go back and fix it. Just make a note of this on the sheet and start anew on the next page.

Also, if you realize at some point that you've missed an utterance, don't go back to try to find it. Just make a note of this on the sheet and start anew on the next sentence.

Do you have any questions before we begin?"

Answer any questions.

"Okay. I will now start the tape."

Turn on the tape recorder. Say nothing during the play of the tape.

After the final utterance is played stop the tape recorder.

9) Thanks

"We are finished with the ratings. I would like to thank you again for your participation. Do you have any questions?"

Answer any questions.

"Also, if you have any comments about the study or your part in it I would love to hear what you have to say."

Note any comments made.

"Thank you very much. Your help has been invaluable. It's people like you who make much of psychological research possible."

Appendix F

Results of the Hearing Screening of Adults Participating in
the Emotion Recognition Task: Average Value of 6 Judgements*

Tone Frequency (in Hertz)	Left Ear (Mean/S.D.)	Right Ear (Mean/S.D.)
250	10.00/6.6	7.42/3.68
1000	3.57/4.71	1.78/1.47
2000	1.91/3.29	1.52/2.38
4000	4.72/4.12	1.67/2.36
6000	6.18/3.36	7.15/3.95

* Anything below approximately +20 to +30 is in the normal hearing range.

Appendix G

Questionnaire Package Delivered to Mothers

Sandy Large - Emotion Recognition Study
Ed.B. 292, University of Calgary
Calgary, Alberta
T2N 1N4

February 4, 1995

Mother's Name
Family Address
Calgary, Alberta
T** **

Dear Ms. _____,

Thank you for your interest in this project. Enclosed you will find several questionnaires which will provide us with information about your child. You will also find a form which describes what you will be asked to do and a consent form. Please follow the directions described on the "Instructions for Completing Questionnaires" sheet.

Your help will assist in increasing understanding of the social interactions of children with attention deficit hyperactivity disorder. You and your child are completely free to decide whether or not to take part at any time during the study. You can also request a summary of the findings of the study. All individual answers will be kept completely confidential.

If you have any comments or questions please feel free to call me at the number below at any time and leave a message with your name, phone number, and a convenient time when I can call you back. Thank you again for your time and consideration.

"Emotion Recognition" Study
Programme in Clinical Psychology, University of Calgary
Sandra Large
244-7715

Instructions for Completing Questionnaires

1. Please read the detailed description of the study provided.
2. If you choose to participate in this study, please complete the consent form. THIS STEP IS ESSENTIAL. IF THE CONSENT FORM IS NOT FILLED IN WE CAN NOT USE THE INFORMATION ON YOUR QUESTIONNAIRES.
3. After completing the consent form, complete the questionnaires. Please complete them in the order in which they are placed in the envelope. However, please do not fill in your name or the name of your child in any of the spaces for this purpose.
4. When you have completed the consent form and the questionnaires please place these documents in the enclosed stamped and addressed envelope and mail them to the researcher. After the envelope has been received you will be contacted to decide when you can perform the second part of the study.

"Emotion Recognition" Study
Programme in Clinical Psychology, University of Calgary
Sandra F. Large
244-7715

Understanding Children's Emotion Recognition

Thank you for expressing interest in this research. The following description is intended to inform you about the reason for this study and how it is to be carried out.

Research has found that children who are rejected by their peers are at higher risk for later difficulties. Some children, including children with Attention Deficit Hyperactivity Disorder (ADD children), are at higher risk for peer rejection. This type of finding has led researchers to study social skills, one important factor in peer acceptance.

This study will examine one specific social skill: emotion recognition. Competent recognition of other people's feelings allows a person to better adapt their behaviour to their companions. There is evidence that the way a child recognizes emotion is related to their mother's portrayal of it. To test this the portrayal of emotion by mothers will also be examined.

Evidence from studies suggests there may be a difference between ADD children and their peers in their ability to recognize emotion of different intensity. It is possible that ADD children recognize strong emotion as well as other children but have more difficulty recognizing subtle emotion. To test this, children will be asked to judge emotion of different intensity.

Participants in this study will complete 4 questionnaires and perform brief tasks at the University of Calgary. These questionnaires will provide two types of information: demographic (e.g. age), and behavioural information on the child. Participants are free to not answer any specific questions.

The information from these questionnaires will be used in two ways. First, it will be used to ensure that the group of children participating in this study are similar to one another on certain facets which may affect their behaviour on the study tasks. For example, the questionnaires will request information such as the degree to which your child gets distracted. In addition, the data from the questionnaires will also provide important information which will be used in conjunction with other data to answer the study questions.

In addition to filling out questionnaires participants will be asked to perform tasks at the University of Calgary. Children will be asked to complete a hearing test and a simple vocabulary test (by pointing at pictures) and to give her/his opinions on the emotion portrayed on a prepared audio tape.

Mothers will be asked not to give their child any stimulant medication (e.g. Ritalin) in the 12 hours prior to the tasks being performed.

The questionnaires will take 30 minutes to 1 hour to complete while the research session should take approximately 1 hour.

Thank you for taking the time to read this description of the project. Participation in this study will help to gain a better understanding of children and their ability to recognize emotion.

If you would like further information or have any questions regarding the study please call Sandy Large at 244-7715.

"Emotion Recognition" Study
Programme in Clinical Psychology, University of Calgary
Sandra F. Large
244-7715

Consent Form for Participation

Title of Investigation: Hyperactive Children and Emotion: Relationship between Mothers' Encoding and their Child's Decoding of Emotional Cues

Principal Investigator: Sandra F. Large, Master's Student, Programme in Clinical Psychology, University of Calgary.

This consent form, a copy of which has been given to you, is one part of the process of informed consent. If you would like more detail about something mentioned here, or information not included here you should feel free to ask the experimenter. This process should give you a basic idea of what the research project is about and what your participation will involve. Please take the time to read this carefully.

Purpose of the Research

The general aim of this study is to examine the way children diagnosed as having Attention Deficit Hyperactivity Disorder recognize emotion. Specifically, I am interested in the accuracy of the child's recognition of emotion and how this is related to their mother's portrayal of emotion. I am also interested in how the accuracy of the child's emotion recognition is related to their social competence.

Description of the study

You will be asked to complete several paper and pencil tasks which will provide the experimenter with information about your child. Your child and yourself will be asked to perform several tasks which will provide the experimenter with information about your child's recognition of emotion and your own portrayal of emotion. Specifically, you will be asked to:

1. Supply demographic information such as the age of your child and yourself, the gender of your child, background information on your child, and information on your marital status and occupation.
2. Supply information about your child's behaviour.
3. Supply 12 examples of how you portray emotion.

Specifically, your child will be asked to:

1. Perform a hearing test.
2. Complete the Peabody Picture Vocabulary Test - Revised. This is a test which measures vocabulary knowledge and takes between 5 and 15 minutes. Your child will be asked to point to pictures which match a given word.
3. Give his/her opinion on the emotion expressed in several audio recordings.

The tasks can take up to 2 hours to complete. The experimenter is willing to provide a summary of the study to

you once all data have been analyzed.

Risks and Benefits

Your participation is completely voluntary, and you and your child are free to withdraw from the study at any time you choose. The general plan has been outlined to you including any possible known risks. This project is not supposed to involve risks of harm any greater than those ordinarily encountered in daily life. It is not possible to identify all potential risks in any procedures, but all reasonable safeguards have been taken to minimize the potential risks.

Confidentiality

The results of this project will be coded in such a way that your identity will not be kept physically attached to the experimental data. The key which lists your identity will be kept separate from the experimental data in a locked file accessible only to the project director. This key will be physically destroyed at the conclusion of the project.

The results of this research may be published or reported to government agencies, funding agencies, or scientific groups, but your name will not be associated in any way with any published results.

Your signature on this form indicates that you understand to your satisfaction the information regarding your participation in the research project and agree to participate as a subject. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw at any time. Your continued participation should be as informed as your initial consent, so you should feel free to ask for clarification or new information throughout your participation. If you have further questions concerning matters related to this research, you are welcome to contact Sandy Large, Principal Investigator at 244-7715.

If you have any questions concerning your rights as a possible participant in this research, you are welcome to contact the Programme in Clinical Psychology, University of Calgary at 220-5659. You can also contact Dr. Richard Conte at 245-0568 or Dr. Michael Boyes at 220-7724.

Name of Subject

Name of Witness

Signature of Subject

Signature of Witness

Date

I wish to have a summary of the results mailed to me.

Yes ____ No ____

Mailing address of Subject:

Notes to Subjects: Please keep this information sheet for your records and future reference.

Subject Information Form

Subject# _____

Mother's Marital Status (Please circle one):

Single Married Separated Divorced Widow/Widower

The primary caretaker for the child(ren) is:

Father Mother Both

Information on:

Mother

Father

Birthdate: _____

Occupation _____

Age and Gender of All Children: _____

(Do Not Include _____

the Participating Child) _____

Participating Child's Birthdate _____

Participating Child's First Name _____

Participating Child's Gender:

Male

Female

Has your participating child been diagnosed as having
 Attention Deficit Hyperactivity Disorder or Attention Deficit
 Disorder?

Yes

No

If yes, who made the diagnosis? _____

Circle all areas in which your participating child has ever
 shown significant difficulties:

Significant language delays

Yes

Sensory handicaps

Yes

Severe psychopathology

Yes

Seizures

Yes

Psychosis

Yes

Significant motor impairment

Yes

Has your child ever been referred for psychological treatment?

Yes

No

If yes, what was the difficulty? _____

Note: If you have more than one child who is between 7 and 11 years old **and** if one has not already been chosen for this study, please choose one at random (e.g. by flipping a coin) and base your answers on that child. That child can then participate in the laboratory session.

ADHD Rating Scale
Barkley & DuPaul, 1990

Subject Number: _____

Completed by: _____ Date Completed: _____

Circle the number in the one column which best describes the child.

		Not at all	Just a little	Pretty much	Very much
1.	Often fidgets or squirms in seat.	0	1	2	3
2.	Has difficulty remaining seated.	0	1	2	3
3.	Is easily distracted.	0	1	2	3
4.	Has difficulty waiting turn in groups.	0	1	2	3
5.	Often blurts out answers to questions.	0	1	2	3
6.	Has difficulty following instructions.	0	1	2	3
7.	Has difficulty sustaining attention to tasks.	0	1	2	3
8.	Often shifts from one uncompleted activity to another.	0	1	2	3
9.	Has difficulty playing quietly.	0	1	2	3
10.	Often talks excessively.	0	1	2	3
11.	Often interrupts or intrudes on others.	0	1	2	3
12.	Often does not seem to listen.	0	1	2	3
13.	Often loses things necessary for tasks.	0	1	2	3
14.	Often engages in physically dangerous activity without	0	1	2	3

considering consequences.

Appendix H

Results of the Hearing Screening of Children Participating in
the Emotion Recognition Task: Average Value of 4 Judgements as
a Function of Group Membership*

Tone Frequency (in Hertz)	Target Group		Comparison Group	
	Left Ear Mean/S.D.	Right Ear Mean/S.D.	Left Ear Mean/S.D.	Right Ear Mean/S.D.

250	7.72/6.30	6.85/6.46	8.99/6.45	4.77/3.74
1000	3.57/3.70	5.41/6.43	3.59/5.28	3.98/5.29
2000	3.28/5.34	3.25/3.77	2.19/4.25	3.15/4.67
4000	3.72/5.62	3.92/4.08	2.97/4.03	3.31/5.18
6000	4.89/5.10	4.25/3.54	5.99/6.25	5.47/5.63

* Anything below approximately +20 to +30 is in the normal hearing range.

Appendix I

Approximate Instructions Given to Children During the Emotion Recognition Task

Note: The following procedures should be considered a guide only.

Procedures

1) Description of Task

Each child will be told that **we want to learn about how children recognize emotion in speech.**

They will be shown pictures of happy and angry faces (Baltaxe, 1991) and asked to point to each one. For example, say:

You see these pictures? I'd like you to point to the picture that shows a woman who is angry (or happy).

If child points to the correct picture say **Very good.**

If the child points to the other picture ask child what they think the word "angry" (or "happy") means. For example, one might say: **What does the word angry mean?**

Now point to the other picture and say to the child: **What do you think this person feels?**

If child indicates something similar to happy (or angry) say **Yes. This person feels very happy.**

If the child says something different ask child what they think the word "happy" means. For example, one might say: **What does the word happy mean?**

Complete the task whether the child points to the correct pictures or not.

Describe the task procedures by saying something like: **"You are going to hear a woman speaking. You**

don't need to pay attention to the words. Listen to how she says things. Some of the things she says will sound happy, some angry, and some neither of these. I want you to listen to each one and let me know how you think she feels. This is not a test. I just want to know what you think. Is that okay with you?

If the child indicates assent continue on.

If not, determine what "is not okay" and deal with any issues. If the child simply does not want to do the task, the family should be allowed to leave.

Tell the child how long the task will take and that they can take breaks if they want to.

The whole thing should take about 21 minutes. So that's not very long. There are 6 pages of the woman speaking. Each page takes about 3 minutes to listen to. If you need to, or want to, you can take a break in between the pages. But I don't want to take any breaks during the pages. Of course, every time you take a break it makes the whole task longer.

2) Training Procedures (First Several Children)

The child will then be shown the response sheet with the pictures on it. The experimenter will explain to the child how to use the scale. I want to show you how you will let me know what you think. Point to response sheet. See this? The way you will let me know what you think is by pointing to the colour which you think best shows the way she feels.

So, let's say I were to play a voice for you and you think that the voice sounds happy and like the speaker's feeling good. In that case you would point to (pause for the child to answer and congratulate them on a correct answer). E.g.

Right, you would point to this side of the sheet.
 Point to yellow side. Respond to any other answer
 (or lack thereof) by just finishing the original
 sentence with: **this side of the sheet.** Point to
 yellow side.

**But if you think the voice sounds angry or feeling
 bad you would point to** (pause for the child to
 answer and congratulate them on a correct answer).
 E.g. **Right, you would point to this side of the
 sheet.** Point to grey side. Respond to any other
 answer (or lack thereof) by just finishing the
 original sentence with: **this side of the sheet.**
 Point to grey side of sheet.

**And then, depending on how you think the voice
 sounds you will point to only one of these squares.**
If you think that the speaker is very angry you
will point to the end of the grey side Point to
 black square **but if you think the woman is only**
"sort of" angry you would point to one of these
squares Point to grey squares.

Now, if you think the woman is very happy you
should point to (pause for the child to answer and
 congratulate them on a correct answer). E.g.
Right, you would point to this end of the yellow
side. Point to bright yellow square. Respond to
 any other answer (or lack thereof) by just
 finishing the original sentence with: **this end of**
the yellow side Point to bright yellow square.

But if you think the woman is only "sort of" happy
you would point to (pause for the child to answer
 and congratulate them on a correct answer). E.g.
Right, you would point to one of these squares.
 Point to light yellow squares. Respond to any
 other answer (or lack thereof) by just finishing
 the original sentence with: **one of these squares**

Point to light yellow squares.

Assess Comprehension (If necessary)

So what would you do if you heard a "sort of" angry voice?

If participant points to a medium grey square say **"Terrific"**. If participant points to only one medium grey block or to some other square say **"These squares here** (Point to all medium grey squares) **indicate "sort of" angry voices."**

Now show me what you would do if you heard a very happy voice.

If participant points to bright yellow square say **"That's right"**. If participant points to some other square say **"This square here** (Point to bright yellow square) **is the one that indicates a very happy voice.**

2) Training Procedures (All other children)

"You're going to use this sheet here to let me know what you think. Point to sheet. Where do you think you would you point if the woman sounds really, really angry?"

If child points to a dark grey or black block say **Good**. If the child points to any other block say: **This is what you would do. If you think that the speaker is really, really angry you would point to the end of the grey side Point to black square.**

"And what do you think you would you do if you heard a "sort of" angry voice?"

If participant points to a medium grey square say **"Terrific"**. If participant points only 1 medium grey block or to some other square say **"Right. These**

squares here (Point to all medium grey squares) **indicate "sort of" angry voices."**

"Now show me what you would do if you heard a very happy voice."

If participant points to bright yellow square say **"That's right"**. If participant points to some other square say **"This square here** (Point to bright yellow square) **is the one that indicates a very happy voice.**

Then say to child **Where would you point if the woman sounds kind of happy?**

If child points to a medium yellow block say **Good**. If the child points to any other block say: **Right. You would point somewhere in the middle of the yellow side.**

Then say to child **And what would you do if you heard the voice and you didn't think the speaker felt any emotion?**

If child points to the white block say **Good**. If the child points to any other block say: **If you think that the speaker doesn't feel happy and doesn't feel angry you would point to the white block.**

Ask if the child has any questions. Answer questions and go on to the Demonstration/Training Sentences regardless of response.

Demonstration/Training Sentences

The first six sentences will be training sentences and will portray each of the five categories. This will allow the experimenter to continue to train the child in the use of the response form. The response sheet with the pictures of the

happy, and angry faces at the top will be placed in front of the child. The experimenter will sit where the response sheet can be clearly seen.

"You put the headphones on now. I'll play the tape of a woman speaking."

Review if necessary by saying: **"When you hear the first voice, if you think that the voice sounds happy and feeling good, you'll point to this side of the sheet."** Point to yellow side. **"But if you think the voice sounds angry or feeling bad you would point to this side."** Point to grey side of sheet.

"So I will play a voice on the tape recorder and you will point to one of these colours. Do you understand?"

If participant indicates understanding continue with demonstration training utterances. The tape will be started and whenever the child does not respond promptly the tape will be turned off and the experimenter will say something like:

"Does it sound like this woman feels happy, angry or neither? Point to the colour that you think shows how she feels."

This will allow the child to take as long as needed. If the child is still having difficulties after the six training utterances have all been played the training will begin again using the same training utterances and will continue until they understand the procedures.

3) Experimental Task

When the participant is ready to proceed the response sheet without faces will be placed in front of the child and they will be told **"We're going to do a whole bunch of sentences now. I will sit behind you and you can show me how you think the woman feels? Does she feel angry, happy, or neither?"**

The experimenter will start the tape, sitting behind the

child, and recording their responses. During the task the experimenter will watch for behavioural signs that the child is becoming tired or bored. This will be marked down and the child will be given a break to stretch if necessary.

4) Thanks

After this task the child will be thanked and told to wait in a room with several books or toys while their mother performs her task. For example, one might say:

"I wanted to thank you very much for your work here today. It was a very good thing to do and you worked very hard."

Appendix J

Approximate Instructions to Mothers During the Emotion Portrayal Task

Note: The following procedures should be considered a guide only.

Procedures

1) Description of Study and Task

The mother will be taken to the recording room. Once there she will be thanked again. (e.g. **I wanted to thank you again for coming.**)

"Most people experience a wide range of emotions. Parenting is an especially emotion-laden job. So all mothers experience strong anger and happiness in their parenting. This is natural. What I hope this study will do is to give me is a picture of the emotion expressions children hear.

Specifically, I am examining the possibility that the ability of children to recognize emotion is related to their experience of emotion. Every child has a lot of experiences with emotion, both their own and the emotions they see expressed by others. All people feel emotion and the expression of it is a very important form of communication. We've decided to examine this relationship by asking you and other mothers to show us the way you express emotion.

I'd like to record you while you say various sentences with a strong emotional content. This recording will then be filtered electronically before anyone hears it so that no-one can recognize your voice or understand what you're saying. Finally, I'll ask others to listen to these filtered signals and to judge them as to what emotion is being portrayed.

For example, I might ask you to say something like

"You're such a good boy" as if you were really happy. Different people would say this sentence differently. These differences are what I am interested in. So I would just want you to say that sentence the way you would if you were really happy. Do you have any questions? Any questions should be answered.

2) Training Procedures

Give the mother a sheet with the sentences she will record on it. The sheet will contain each sentence in order and describe the way she should say it.

"This sheet holds sentences which some people would say if they felt extreme emotion."

If mothers ask why the sentences are so extreme say: I chose the sentences you see here because the people who are recording them are not actors. Thus, sentences which carry strong emotion in the content may be easier to say with emotion.

What I want you to do is to record the sentences as if you feel either a lot or just some emotion. The first one is read the first sentence. Next to it you see that it says read the type of emotion to be expressed emotion of read the level of intensity to be expressed intensity. This means that I would like you to say that sentence the way you would if you felt it insert the level of intensity.

You can practice the sentence as much as you want. When you're ready you can let me know and I will turn on the tape recorder.

Once I've recorded your speech you can let me know if you think that you would have said the sentence like that if you truly were insert the level of intensity and emotion (e.g. very angry). " If you

think this is a good example we'll go on. If not, we'll record it again. Does that sound all right?"

If the mother has any concerns these should be dealt with. If not, show her the equipment and where she will be sitting to record. For example, say:

"You will do this sitting in this chair. I will put this microphone in front of you and you can just speak as you think you would naturally. When you're ready you can signal me by waving to me or just telling me and I will turn on the tape recorder. Let's try one."

3) **Experimental Task**

The mother will be given the opportunity to ask questions. All of these will be answered. When she is ready the recording will begin.

After each utterance ask the mother if she approves of her performance by saying something like **"How do you feel about that one?"** or **"Was that okay?"** If the mother is not happy with the emotion portrayal redo it until she is. Follow the same procedures with every utterance.

NO FEEDBACK WILL BE GIVEN ON ANY EMOTION PORTRAYAL.

4) **Thanks**

Appendix K

Notes on Filtering the Emotion Judgement Tape

The original plan for this part of the study was to filter the speech at a level which would make the verbal content unintelligible. Because the words were intended to be unintelligible the researcher chose to use verbal content which would reflect the emotion mothers were supposed to portray. That is, angry words were used when mothers were asked to portray anger. The use of concordant content and emotion would presumably make it easier for mothers to portray the selected emotion.

Filtering the voice involves deteriorating certain frequencies from the recorded signals, as chosen by the researcher. It is a procedure which has been used often in speech, personality, and vocal emotion recognition research. A search of the PsycLit database (APA, 1995) located 26 studies which had filtered speech to deteriorate verbal content. Of these studies 11 had utilized low-pass filtering and 7 band-pass filtering. Another 8 studies did not indicate the manner of filtering utilized. In addition, of those 26 studies 4 had low-pass filtered the speech at 400 Hz (both low-pass and band-pass filtering include low-pass filtering), 3 had low-pass filtered at 450 Hz, 2 at 500 Hz, and 8 at some unique level. Another 9 studies did not indicate the level at which the speech had been filtered.

Therefore, the first step of the emotion judgement task was to determine what filtering level would best deteriorate verbal content while leaving as much nonverbal emotional information as possible. Two filtering options were tested: low-pass filtering and band-pass filtering. Low-pass filtering involves deteriorating all frequencies of sound above some cutoff value. Band-pass filtering means setting 2 cutoff values: a high-pass filtering cutoff, which indicates the value below which frequencies of sound are deteriorated, and a higher value (low-pass filter level) above which

frequencies of sound are deteriorated. Band-pass filtering allows through a band of sound; sound which is below one cutoff but above another.

Studies have shown that emotional speech varies in many ways (e.g. tempo, pitch (the acoustic correlate of which is fundamental frequency: F_0), variability of pitch, and voice timbre). Fundamental frequency is one of the most important clues to vocal emotion (Lieberman & Michaels, 1962). Because of this it was necessary to balance the need to remove a confounding variable (verbal content) with the need to retain an important vocal clue (F_0). Happy and angry emotional speech has a higher mean F_0 and F_0 standard deviation than does non-emotional speech (Breznitz, 1992; van Bezooeyen, 1984). For example, van Bezooeyen (1984) found that the range of the F_0 of emotional speech varies from approximately 178 to 537 Hz with the F_0 of neutral (non-emotional) speech varying only from 178 to 211 Hz. These values are higher than those found by Breznitz (1992) but in both cases emotional speech has a higher and more variable F_0 . Neither of the studies found a minimum F_0 of female speech lower than 116 Hz. Thus, high-pass filtering frequencies lower than 100 Hz (i.e. deteriorating frequencies below 100 Hz) is unlikely to affect the mothers' voices. In addition, the results of these studies suggest that low-pass filtering frequencies higher than 550 Hz (approximately 2 standard deviations above the mean F_0 of joy according to van Bezooeyen, 1984) would impact little upon the use of F_0 as an emotional clue. However, low-pass filtering at frequencies lower than 435 Hz (one standard deviation above the mean F_0 of joy described by van Bezooeyen, 1984) would presumably impact noticeably upon the amount of emotional information available from the F_0 .

Levels of filtering were examined in several steps. Three people (friends of the researcher) were asked to listen to filtered sentences and to tell the researcher what words were spoken. These sentences varied in filtering (high-pass

from 100 to 200 Hz; low-pass from 390 to 570 Hz). Filter cutoffs of 100 and 550 Hz were then used to make the first emotion recognition tape. Mothers' voices saying three sentences each were then recorded on a Sony UX Pro audiotape three times each and in a random order. This tape was then judged by a single participant who recognized all of the words early in the tape. Another tape was made, deteriorating all frequencies except those between 100 and 400 Hz. However, some identification of content was again found by the 9 participants who judged it. This meant that verbal content provided a strong contextual clue to the intended emotion and therefore was confounded with the variable being tested. In addition, filtering speech at this level would interfere with important clues to emotion. Because of this, it was decided not to further attempt to eliminate the speech content.

Therefore, it was decided to play the mothers' emotion portrayals in blocks by verbal content. It was assumed that playing the mothers' emotion portrayals in blocks by content would mean that, while content would probably effect ratings, the effect of content would be the same (or approximately so) for both groups. In addition, the use of two different emotion orders and three different random orders within each emotion by verbal content cell would tend to diminish any order or context effects.

However, a further aspect of filtering the voices was that it would make speaker identification difficult, if not impossible. The mother participants were told that their contributions to the research would be kept confidential. Some degree of filtering, for the sake of maintaining this confidentiality, was therefore felt to be necessary.

Speaker recognition was then examined with the participation of 5 adults; these adults were asked to make emotion recognition judgements on 45 utterances. The procedures used approximated the procedures which would later be used in the emotion judgement task. The utterances varied

in filtering as follows: frequencies of sound under 100 Hz were attenuated for every utterance, and the low-pass filtering varied between 400, 600, 1000 and 2000 Hz. The emotion recognition task took approximately 6 minutes. Judges heard each mother 3 times and they heard 15 mothers. After they had finished rating the utterances, judges were asked to listen to 10 pairs of mothers saying a different sentence and to tell the researcher which mothers they had heard previously. The utterances of these 10 pairs of mothers were randomly chosen, randomly ordered, and filtered at 100 and 1000 Hz. In each pair there was one mother the judges had heard previously. Each pair was separated from the other pairs by 10 seconds of silence. Each member of the pair was separated from the other member by three seconds of silence.

Only voices which were band-pass filtered at 100 and 2000 Hz were recognized above chance level (more than 1/2 of the time). Voices which had originally been filtered at 100 and 2000 Hz were recognized 9 out of 10 times, while those filtered at 100 and 1000 Hz were recognized 2 out of 10 times, those filtered at 100 and 600 Hz were recognized 7 out of 15 times, and those filtered at 100 and 400 Hz were recognized 8 out of 15 times. Thus, the results of this test argue against the use of band-pass filtering at 100 and 2000 Hz; at all other cutoff levels speakers were recognized at or below chance level.

Therefore, to maintain as much of the signal as possible it was decided to band-pass filter the utterances at 100 and 1000 Hz. This, based on previous research, (Breznitz, 1992; van Bezooeyen, 1984) would be expected to leave more than five standard deviations above and almost two standard deviations below the mean F_0 of the mothers' emotional speech to act as emotional cues.

In addition, in a review of Japanese research which looked at voice identification, Furui (1986) found that the higher frequencies of speech (those above 2000 Hz) are among

the most valuable in speaker identification when more than vowels alone are tested. These frequencies were among those deteriorated from the recorded signal on the final emotion judgment tapes. Finally, studies have shown that the conditions under which the voices were judged in this research were not conducive to speaker identification. Speaker identification is less accurate when short speech samples (Bull & Clifford, 1984), and many voices are presented (Bull & Clifford, 1984; Deffenbacher et al., 1989; Legge, Grosman, & Pieper, 1984). Therefore, the decision to band-pass filter at 100 and 1000 Hz resulted in preserving as much of the signal as possible while enhancing speaker confidentiality.

Nevertheless, because the voice recognition studies cited above were concerned with the recognition of unfamiliar voices, any voices which were likely to be familiar were not recorded on the emotion judgement tape. Two participant mothers were connected with the University of Calgary Psychology Department. They were felt to be at greater risk of recognition and were, therefore, not recorded on the emotion judgement tape.

Appendix L

Results of the Hearing Screening of Adults Participating in
the Emotion Judgement Task: Average Value of 4 Judgements*

Tone Frequency (in Hertz)	Left Ear (Mean/S.D.)	Right Ear (Mean/S.D.)
250	5.00/4.19	5.39/5.94
1000	1.84/3.89	1.71/2.33
2000	2.83/4.06	2.70/3.49
4000	4.14/3.82	4.08/3.48
6000	10.29/7.09	7.89/7.28

* Anything below approximately +20 to +30 is in the normal hearing range.

Appendix M

Approximate Instructions Given to Participants During the Emotion Judgement Task

Note: The following procedures should be considered a guide only.

Procedures

1) Introduction of Administrator

The session introduction will generally be informal, brief, and include the following information: (a) the name of the administrator, and (b) appreciation for coming.

For example, one might say "Hi. Thanks for coming."

"As you know, I'm Sandy Large, and I'm a graduate student in the Programme in Clinical Psychology."

2) Description of Task

The administrator will then give the subjects a general description of what they will be doing.

"I probably told you over the phone that what I'm doing is looking at how children recognize emotion. Specifically, I'm looking at two groups of children: children diagnosed as having Attention Deficit Disorder and their normal peers. I also want to see how children's emotion recognition relates to the emotion their mothers express."

To look at this I asked several mothers to demonstrate the way they express emotion. I gave each mother 6 different sentences to say, and asked them to say them in different emotional tones of voice.

What I'm asking you to do today is to listen to these sentences and rate how clearly the mother has portrayed the given emotion."

Prior to doing this I will ask you to perform a quick hearing test. Altogether these tasks should take approximately an hour.

Do you have any questions? Any questions should be

answered.

3) Explain Consent Forms

"This would be a good time for you to read the consent form."

When the participant has finished reading the consent form say: **Do you have any questions about this form?** (Answer questions). **If you're still willing to participate please sign the form in the space marked "Participant's Signature" and enter today's date."**

If potential subject has decided not to sign the form say: **Thanks for listening.**

I appreciate the time you've given me and the interest you've shown in psychological research.

Do Hearing Screening Now!!

4) Demographic Information

Point to relevant section. **"The first thing I would ask you to do is to answer the questions found on the first page."**

5) Training Procedures

As I said before you will be listening to tape recordings of mothers' voices saying sentences I've given them. I'm not interested in your judgements of the sentences because I determined these. What I am interested in is your judgements of the way mothers have said these sentences.

To help you focus on the emotion the sentences have been electronically filtered to make the words and voice unclear.

Every mother was asked to say the following sentences: two sentences in an angry tone of voice "You're a Complete Idiot" and "You're Hopeless. You're Completely Hopeless"; two sentences in a happy tone of voice "You Really did a Fine Job" and

"That's Good. That's Really Great"; and two sentences which carry no emotion in a neutral tone of voice "That Really is a White Dove" and "It's a Tree. It's a Little Tree".

Not all mothers' portrayals will be equally clear. This is to be expected as different people express emotion differently. It is this difference that I would like to get at.

Now I have 12 examples for you to listen to. I would like you rate them in two ways. I want you to rate how strongly the mother feels and how clearly she has expressed the emotion she intended to express.

Thus, you'll always be answering two questions. For instance, if the sentence is an angry one you'll ask: 1) "Is the mother furious, or is she mildly angry?" and 2) "Does she sound angry, or is it some other emotion she's expressing?"

Continuum

The administrator will describe how to use the rating scale. Each time a specific section of the rating scale is described that section should be pointed to. One possible way to do this is as follows:

When you're rating for strength you'll rate the sentences on a 9-point scale. A rating of -4 means that you think the voice sounds extremely negative\angry and a rating of +4 means that you think the voice sounds extremely positive\happy.

If you listen to the voice and think that it does not express either positive or negative emotion you will mark 0.

Some sentences may sound negative but not angry. In those cases rate them on the negative side of the continuum.

You will always be making this rating based on how

it sounds, not on how it was intended to sound. Thus, if an utterance sound positive when it's supposed to sound angry you will rate it as positive.

Clarity Scale

I also want you to rate these examples as to how clearly you think the mother has portrayed the emotion she intended. If the mother sounds realistically angry when she intends to sound angry then you'll rate it as clear. However, if the mother sounds depressed or unrealistic when she's trying to sound angry you'll rate it as less clear. This is a little more confusing when you're rating the neutral emotion sentences. In those cases, if the mother sounds like she feels strong emotion, you would rate the portrayal as unclear, because she's trying to sound like she feels no emotion.

If it seems valuable say: To do this you might ask yourself questions like 'If I heard this voice, and could not hear the words would I know what she felt?' Or 'This woman is supposed to sound angry? Is this what angry sounds like?'

You will make this rating on a 7 point scale with a rating of 0 meaning that you think the intended emotion sounds extremely unclear or unrealistic and a rating of +6 meaning that you think the predetermined emotion sounds extremely clear and realistic.

You will be given 8 seconds in which to perform these two ratings."

Okay, I'll turn on the tape recorder now.

6) Experimental Task

"Okay. Now that you have had some practice we will begin. The rest of your ratings will be done on the

following pages.

The pages have the same number of judgements as the tapes do. You'll have approximately 6 seconds to rate each utterance. After the page is full you'll have 15 seconds to turn the page.

Different sentences will have different numbers of judgements.

If, when you're turning the page you realize that you've lost your place, don't try to go back and fix it. Just make a note of this on the sheet and start anew on the next page.

Also, if you realize at some point that you've missed an utterance, don't go back to try to find it. Just make a note of this on the sheet and start anew on the next sentence. Do you have any questions before we begin?"

Answer any questions.

"Okay. I will now start the tape."

Turn on the tape recorder. Say nothing during the play of the tape.

After the final utterance is played stop the tape recorder.

7) Thanks

"We are finished with the ratings. I would like to thank you again for your participation.

Use feedback forms now.

Appendix N

ANOVA Summary, A Priori and Post Hoc Significance Tests:
Emotion Recognition Experiment

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	p
Group (Gp)	1.72	1,30	1.72	9.9	.004
Emotion Type (ET)	1.23	2,60	1.23	6.6	.003
Emotion Strength (ES)	0.39	1,30	0.39	5.6	.025
Gp X ET	0.84	2,60	0.42	4.5	.015
Gp X ES	0.38	1,30	0.38	5.4	.027
ET X ES	1.27	1,30	1.27	15	.001
Gp X ET X ES	0.14	1,30	0.14	1.7	.209

A prior comparisons corrected using the Bonferroni correction
(alpha level calculated separately on each data set)

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	p
Gp X ES High	1.23	1,30	1.23	6.29	.07
Gp X ES Moderate	0.055	1,30	0.055	1.07	>.10

Correlated Variables	r	p
Child's SSRSss ¹ X Average Difference Score	-.28	.12
Child's Average Difference Score X Mother's Average Clarity Score	-.12	.53
¹ Social Skills Rating System (Gresham & Elliott, 1990): Average score on the Social Skills scale.		

Appendix O

ANOVA Summary: Emotion Portrayal Experiment

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Square	F	p
Group (Gp)	0.50	1,17	0.50	2.64	.122
Emotion Type (ET)	21.64	2,34	10.82	8.01	.001
Emotion Strength (ES)	13.72	1,17	13.72	11.38	.004
Gp X ET	0.81	2,34	0.41	3.24	.052
Gp X ES	0.57	1,17	0.57	5.21	.036
ET X ES	3.38	1,17	3.38	22.58	.000
Gp X ET X ES	3.48	1,17	3.48	33.63	.000