# CHILDREN'S PROJECTIVE DRAWINGS FROM A NEUROPSYCHOLOGICAL PERSPECTIVE

by

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A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy,
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## Abstract

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by

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Family and Peer drawings were obtained from 88 children (boys = 59) between the ages of 7 to 9 years, 11 months as part of a comprehensive neuropsychological battery. Many participants in this parent/teacher referred sample evidenced language/reading impairments and behavioral disturbances such as Attention Deficit Hyperactivity Disorder were common.

A series of graphic features including use if color, number of family and friends depicted and overall organization of the drawings were examined and their association with developmental, cognitive, graphomotor or behavioral variables were determined. Several of the analyses reached significance most notably: boys using few colors to complete their Peer drawings received higher CBCL parental rating of Anxiety/Depression; realistic use of color was most highly associated with the sex and age of the drawer; the depiction of few friends was associated with social problems as measured by the SSRS; and disorganization of figure placement was highly indicative of CBCL ratings for internalizing and externalizing behaviors.

General conclusions were derived from the specific findings. A narrow focus on developmental, cognitive or projective orientations do not adequately explain a child's depiction of internal representations of family and friends. Drawing is a complex task with the depiction of various graphic elements differentially associated with sex, age,

cognitive and graphomotor ability as well behavioral and adaptive functioning. Additionally, simply because a given graphic feature rarely occurs, such as the omission of a maternal figure, does not necessarily indicate the presence of psychopathology.

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Although the list of mentors, family and friends who have helped me complete this dissertation are numerous, one-person stands apart from the rest, my husband, Philip. Phil was beside me when I first contemplated applying to graduate school and remained a steadfast supporter throughout the many up and downs of the process. He never expressed disappointment when I decided to discontinue my graduate studies and yet was beyond encouraging when, later in life, I returned to finish my Ph.D. He, above everyone, always understood.

Phil was more then just a loving partner and cheerleader extraordinaire. With characteristic good humor he carefully and critically edited and re-edited each lengthy dissertation draft and revision despite his own considerable workload. When I was in New York, Phil juggled a tight work schedule to make sure our daughters, Erin and Carrie, always had an available parent. He did more then his share of the housework while I was locked away "writing", ate way too many pizza dinners when I stayed overnight in the city and without complaint drove an hour back and forth from work to feed and walk the dog. It is no exaggeration to write that in many ways this is as much Philip's dissertation as it is my own since without him its completion would not have been possible. It will remain my greatest sorrow that he is not with me to share in this achievement.

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## Table of Contents

## List of Tables

# CHAPTER 1

# INTRODUCTION, BACKGROUND AND OBJECTIVES

## Introduction

Children's drawings are most frequently used for the assessment of intellectual ability or for determining the presence of behavioral and psychopathological conditions yet research has consistently been equivocal regarding its validity for either purpose. One possible explanation as to why both of these orientations often fail to produce robust empirical support may be their narrow, overly simplistic rationales. Developmental factors commonly have been overlooked and although there has been the acknowledgement that artist aptitude impacts on an adult's drawing (Feher, Vandecreek, & Teglasi, 1983) there has been little attention paid to the role of visual-motor and graphomotor ability in children's drawing performance. Additionally, how specific neuropsychological deficits in language, memory and/or executive control influence a child's ability to represent the human figure has largely been ignored.

Although projective drawing tasks have their weaknesses, they continue to be popular tools in assessment perhaps, in part, for practical reasons. Most considered drawing tasks quick, nonverbally mediated, culture-free tasks making them ideal instruments. More importantly, many individuals are poorly equipped to be unbiased, objective historians regarding their emotional and adaptive functioning. This statement is even more relevant for children who possess immature cognitive capabilities, making it difficult for them to fully articulate their current emotional state as well as independently assess their level of adaptive functioning. Due to these limitations, parents frequently are asked to provide information regarding their children's emotional, behavioral and

adaptive functioning. However, although parents are somewhat accurate in identifying externalizing behavior problems such as aggression, they are notoriously poor at recognizing issues concerning faltering self-esteem, anxiety and depression in their child (Kamphaus & Frick, 1996).

Although observations by teachers and experienced clinicians play a critical role in the evaluation of children these observations are also prone to bias and may occur in situations that lack ecological validity.

Given that the behavioral assessments of parents, teachers and clinicians have real limitations there remains a need for the continued development of child-centered instruments. A better understanding of the cognitive and behavioral factors that influence a child's drawing would hopefully make this technique a more powerful tool.

The series of studies, which comprise this dissertation, are based on the premise that drawing is a complex task with a variety of variables influencing a child's final graphic product. Some features of drawing may be directly linked to maturation, sex, graphomotor or intellectual ability, while other features are more likely projective in the sense that a child's emotional state may influence how they depict themselves and others. It is only by understanding how each of these variables impact on drawing performance that we can better identify which if any features have projective significance and begin to assign them meaning.

The following overview will first discuss the historical use of drawings for the assessment of problematic behavior. This will be followed by an examination of intrinsic and extrinsic factors, recognized as influencing figure drawing performance. Attention will then turn to how maturation and neuropsychological functioning, although often

overlooked, impact on drawing performance. This discussion will conclude with a description of two of the more frequently occurring developmental disorders, attention deficit hyperactivity disorder and specific language impairment and discuss how the cognitive and behavioral deficits associated with each disorder might mediate drawing performance.

## Background

### *Drawings for the Assessment of Personality and Psychopathology*

Drawings are considered one of the purest of the projective techniques. The Rorschach and the Thematic Apperception Test, two of the more frequently used projective tasks, tap perceptional processing abilities and from an individual's verbal responses to the presented stimuli (inkblots or pictures respectively) cognitive and emotional functioning is inferred. Drawings, in contrast, are believed to be a pictorial representation of what actually exists within the mind of the drawer and since they are not bound to language they tap primitive and less differentiated levels of the unconscious (E. F. Hammer, 1958)[1]. This makes them especially sensitive to detecting psychopathology since they are self-generated, affectively laden, preverbal outputs (Zucker, 1948). Drawings are an especially useful technique for children since they have fewer effective defenses and are developmentally closer to preverbal thought than adults.

Buck (1949) offered the observation that a "*large number*" of individuals experienced strong emotional reactions either while they were drawing or during an inquiry phase suggesting, "*areas of real sensitivity have been tapped*". He found the drawer made "*spontaneous associations to omissions and distortions, verbalizing*

[1] Subsequent neuropsychological and cognitive research has raised questions as to whether drawing ability can be totally dissociated from language.

*emotional reactions*" which often remained elusive during standard therapy sessions. Despite Buck's claims there has been limited evidence that drawings tap either unconscious or preconscious processes.

The projective nature of drawings received some empirical support from a study conducted by Van Dyne and Carskadon (1978) who instructed undergraduates to rate their same and opposite sexed figure drawings using a semantic differential rating scale. Two weeks later these same students were asked to rate themselves "*now*", as their "*ideal self*", and as their "*least liked self*" using the same semantic scale. Ratings were positively correlated with same sexed figures for "*real*" and "*ideal self*" while no significant correlation was found for ratings of the opposite sexed figure or the same sexed "*least liked self*". The authors argued these findings provided evidence that individuals project their personality onto the same sexed figure of their "*real*" or "*idealized self*".

Schaefer (1975), however, conducted a similar study but interpreted his findings quite differently. Using a semantic rating scale, participants were found to rate themselves and their drawings similarly. He proposed that since projective drawings were expected to reveal "*unconscious*" aspects of the personality, independent judges should differ in their semantic ratings of these same drawings. Judges, however, agreed with the drawers' ratings. Schaefer concluded that drawings were not "*projective*" but rather were reality based and therefore the product of conscious processes. Black (1976) also found that the drawings of children were reality driven. In a group of learning disabled children, the actual height of the drawer was the best predictor of the size of the drawn figure, accounting for 67% of the variance.

As Swensen (1957) in his review of figure drawing research wrote, "…*the most outstanding conclusion that can be drawn is that definitive research on the basic meaning or significance of human figure drawings is lacking"* (p. 435). Although written over fifty-years ago, little has changed in this regard.

Several of the studies, which comprise this dissertation, begin to tackle this important concern as well as attempting to tease apart conscious verses unconscious processes impact on children's graphic representation of family and friends.

### *Single Figure Drawings*

Although many projective drawing tasks have been developed such as Animal Drawings and Draw a Person in the Rain, single figure drawing tests have been the most popular and have generated the most research.

***Machover's Draw-A-Person Test*** - Although the analysis of artwork for personality and behavior assessment predates (e.g. Brill, 1937; Elkisch, 1945; Springer, 1941; Williams, 1940) the publication of Machover's *Personality Projection in the Drawing of the Human Figure* (1949) she is widely credited with being the first to present a formal, theoretically driven system for the interpretation of human figure drawings and this seminal work continues to be a major influence. Machover, while administering the Goodenough Draw-A-Man Test (a cognitive measure), was struck by the idiosyncratic nature of the drawings she collected and undertook a systematic analysis.

Although Machover (1949) admitted that her interpretation of figure drawings lacked empirical validation she believed her technique had much to offer as a clinical tool. The underlying premise of Machover's method was that when a person was

presented with a blank sheet of paper and instructed to draw a human figure, he or she relied on an internal representation which was formed not only by reality but by internalized needs and conflicts. Much like dreams, many graphic elements could be viewed as archetypal; therefore there was universality to the styles and symbols a person incorporated into his or her drawing.

Machover (1949) further hypothesized that the drawn figure was a representation of the drawer while the paper represented the environment. Drawing styles such as figure size, line intensity, placement, proportion, symmetry, completeness, erasures and shading related to personality structure and therefore remained constant. Hands, legs and feet received special attention because these were areas where there was direct contact between the person (figure) and his/her surrounding world (paper). Content features, such as facial expression and clothing, were indicative of the drawer's current affective state thus making them subject to a high degree of variability both within and across individuals.

As originally conceived, interpretation should be derived from a systematic global analysis of drawing styles and content. Machover (1949) warned against naïve interpretation based on individual features and considered the Draw-A-Person technique best reserved for advanced clinicians. She stressed that there were infinite conscious and/or unconscious reasons why an individual might choose to include some graphic elements while omitting others. The true meaning of a drawing can only be derived when it was used in conjunction with knowledge of the drawer's history, personality patterns reflected in other tests and not infrequently from the individual's verbal associations to their drawings. However, it is not surprising that what is commonly referred to as a "*sign*

*approach*" became Machover's legacy. In *Personality Projection in the Drawing of the Human Figure* the various styles and specific graphic features are described along with suggested interpretations, leading to a tendency to analyze figure drawings item by item, an approach which is at odds with Machover's stated position.

***Projective Styles and Features*** - It is beyond the scope of this paper to discuss all of the various graphic styles and features that Machover (1949) and others have assigned projective significance. However, two styles, figure size and placement, are directly relevant to the following studies and will be discussed in detail.

**Figure Size** - Various body types and their relationships with personality characteristics have long been considered archetypal. Whether these associations are innate or acquired, there is almost universal acceptance that large figures embody power while smaller figures denote weakness. These internalized representations of morphology are considered the source of the projective significance of figure size.

There, however, has been considerable variability in the assignment of "*meaning*". Small figures have been considered to be the projection of a shrunken ego and feelings of inadequacy, as well as, low self-esteem and energy (Machover, 1949); or shyness, timidity and withdrawal (Koppitz, 1966c) while enlarged figures have been associated with self-importance (DiLeo, 1983) or aggression (Koppitz, 1966c).

Although a considerable body of research exists on figure size, findings largely are equivocal. As is true of most of the projective drawing research, methodology and experimental rigor varies widely between studies. Some of the variability in findings has had to do with differences in the task (i.e. figure drawings, family drawing, or House-Tree-Person), materials (pencil or crayon) and how the figure was measured. Height

(Black, 1972), age and sex of the individual producing the drawing (Lehner & Gunderson, 1953) as well as intelligence (Zuk, 1962) all have been shown to influence figure size. Additionally, extremes in size (i.e. > 7 inches or < 3 inches) have been found to be unstable on retesting (M. Hammer & Kaplan, 1966). However, the greatest challenge in understanding the existing literature arises from differences in the interpretation in the meaning of figure size.

Using a traditional psychoanalytic interpretation of small figures representing insecurity and enlarged figures evidencing projected aggression, Koppitz (1966c) compared drawings produced by children characterized as shy or aggressive. Although there was a tendency for shy children to draw smaller figures, no significant association was observed between aggressive behaviors and the production of enlarged figures. Quantitatively, seven shy children produced figures of reduced size while none drew enlarged figures and three aggressive children's figure sizes were greater than 9 inches.

McHugh (1966) also found that children diagnosed with conduct disorder drew significantly larger figures compared to those classified as neurotic. However, the clinical utility of this variable remained questionable since in a sample of 100 learning disabled children extremes in figure size were rare and when they occurred were not associated with any specific type of psychopathology (Black, 1976).

Others have proposed a relationship between figure size and one's self-concept. Gray and Pepitone (1964) manipulated male undergraduates' sense of self-esteem by providing them with either deceptive positive or negative feedback based on previous psychological testing. Figure drawings were obtained following feedback and size was found to be unrelated to manipulated levels of self-esteem. Further analysis, however,

revealed that many participants drew backgrounds and when total page usage was considered those who had experienced negative feedback drew isolated figures and used significantly less page area.

The findings of a figure size / self-concept relation in adults has not been replicated in typically developing children (Bennett, 1966) and findings in clinical samples frequently have been in an unexpected direction. Physically handicapped children (Wysocki & Whitney, 1965) as well as those designated as mentally retarded (Ottenbacher, 1981) both drew enlarged figures. Prytula and Leigh (1972) conjectured that the development of a positive self-concept was fostered by parental attitudes and that the absence of this influence would effectively lower a child's self- esteem. They found, however, that institutionalized orphans drew significantly larger figures compared to those made by children living in traditional, intact homes. These unexpected findings were interpreted as evidence of defensive overcompensation.

Diminished figure size has also been associated with depression and anxiety. Gordon, Lefkowitz, & Tesiny (1980) examined the size of figures drawn by children evaluated for depression using self-reports and peer and teacher ratings. Girls rated depressed by teachers drew significantly smaller figures but given the large number of correlations performed in this study there was some concern that this finding was specious. Studies examining the drawings of pediatric oncology patients (Paine, Alves and Tubino, 1985) and those of children with cardiac conditions (Green & Levitt, 1962) found these clinical groups produced smaller figures compared to typically developing controls, suggesting that diminished size was possibly a byproduct of anxiety. However, no independent measure of anxiety was used to confirm this interpretation and factors

such as fatigue due to illness were inadequately controlled.

Since it is apparent that little agreement exists on the projective "*meaning*" of variations in figure size some have chosen a different approach. Rather than observing clinical groups investigators have examined the drawings of well-adjusted children and attempted to ascertain which factors influenced size fluctuations. Fox and Thomas (1990) replicated Craddick's (1963) original findings that children drew the "*threatening*" figure of a witch smaller the day before Halloween compared to drawings made one-week before and one-week after the holiday. In a second experiment, children were grouped as either "*afraid"* or "*not afraid*" of witches. Drawings of both a witch and a woman were then obtained with the relative height of the witch to the woman significantly smaller in the "*afraid*" of witches group.

Using a similar approach, Burkitt, Barrett and Davis (2003) presented children with an outline drawing of a man, a dog or a tree. Participants were first asked to copy the stimulus form (baseline) and then asked to draw the outline of the same object after it had been characterized it as either "*nasty*" or "*nice*". The drawings were measured for height, width and overall area. All age groups were found to draw the outlines of "*nice*" figures larger and the "*nasty*" figures smaller when compared to baseline drawings. Since there was a large variation in the size that individual children draw their figures, the use of a repeated measures design helped to reduce error variance in the analysis leading these researchers to surmise further that the failure by others to control for individual differences might be one reason why much of the research in this area has produced inconsistent results.

As Burkett (2004) points out in her review of children's art, figure size appears to

have meaning although exactly what it means and whether it means the same thing for all children remains elusive. Children tend to draw figures that they feel favorably towards larger than neutral figures while reductions for negatively charged figures have been inconsistent. An appetitive-defense mechanism has been proposed to explain the findings, with favorable feelings tending to increase figure size while reductions were considered defense against negative or frightening emotions.

The association of figure height with graphomotor and cognitive variables as well as parent rated behavior were examined in the following studies that comprise this dissertation but given the findings of the reviewed research no associations were expected. However, the relative height of the self-figure with the maternal figures was expected to reveal behavioral differences with children drawing themselves larger than the "*mother*" more likely to be rated higher on externalizing behaviors such as aggression and rule breaking. If correct, these findings would lend support the projective nature of figure height.

**Use of Space** - Much attention has been given to where on the page a child places his or her drawing. E. F. Hammer (1958) wrote, "*Anthropological investigations concur in indicating the universal equating of 'up' with ideation or fantasy or the world of ideas and 'down' with the terrestrial, the firm, the solid, and the concrete* (pg. 70)." DiLeo (1983) proposed that optimistic and possibly narcissistic individuals produced upward displacements while small figures on or close to the bottom edge of the paper signaled inadequacy and insecurity. Buck (1974) further hypothesized that with each degree of upward or downward displacement the greater the likelihood of psychopathology.

Vertical shifts of the figure away from the midline have also been infused with

meaning. Placement to the left of the midline occurred in the drawings of impulsive individuals according to Buck (1974) while Machover (1949) regarded it as a sign of self-involvement. Others have viewed leftward shifts as the unconscious depiction of fleeing into the past with Bolander (1977) going the farthest in her interpretative leap, suggesting that the left side of the paper represented the "*female principle*".

In contrast, Buck regarded right-sided figure placement as the product of an individual who was reflective, introspective, controlled and stable while for Machover this displacement was more likely produced by someone outward-looking, engaged with his or her surroundings. Bolander (1977) interpreted the right side of the page as representative of the "*male principle*".

The various interpretations of horizontal space were reminiscent of early folklore associating left with evil (i.e. the word "*left*" is derived from "*lyft*" which is old English for worthless) or being unnatural. The conscious and unconscious meanings assigned to "*left*" and "*right*" were therefore considered archetypal having universal in symbolic meaning.

Although figure placement often has been cited in case reports as a relevant feature in children's drawings (e.g. DiLeo, 1983), empirical evidence has been inconsistent. M. Hammer and Kaplan (1966) examined the test-retest reliability of three placement variables: midline shifts; upward and downward displacement; and placement in one of nine equal quadrants in the drawing of 1,304 children. Quadrant placements as well as upward and downward figure displacements were found to be unreliable on retesting. Vertical shifts away from the midline were found to have adequate retest reliability but only for left sided placement.

In addition to being of questionable reliability, the child's use of space appeared to be influenced by developmental variables. Very young children tended to prefer the upper left corner of the page for their drawings with figures dropping to a more central position over the course of maturation (Jolles & Beck, 1954; Weider & Noller, 1950). Placement also appeared to be related to handwriting training. Those taught to write from left to right were more likely to use the left-side of the paper while the reverse was true of right to left writers (Dennis, 1958; Dennis & Raskin, 1960).

Attempts to validate figure placement with criteria based measures and clinical groups also have provided mixed results. W. E. Martin (1955) examined figure placement in children rated as secure or insecure using both an objective measure as well as teacher ratings. While admitting to a small sample size, neither secure nor insecure children were distinguishable by the spatial characteristics of their drawings. Further, Coopersmith, Sakai, Beardslee and Coopersmith (1976) found that the child's use of space was not correlated with self-reports or behavioral ratings of self-esteem.

As is true of extremes in figure size, observations and empirical investigations conducted with clinically defined groups have been more successful in obtaining positive results. Alschuler and Hattwick (1943) observed that off-center paintings were often the work of uncontrolled, dependent children while those who were self-directed and controlled tended to place their figures at the midline. Empirically, conduct disordered children draw their figures closer to the bottom of the page (McHugh, 1966) while withdrawn, disruptive and academic underachievers tended to place their figures to the left of the midline (Bradfield, 1964). Gordon et al. (1980), however, reported that children's figure placement was unrelated to depression.

Although there appears to be little objective evidence that figure placement was directly related to self-esteem or depression in children as will be discussed later, figure placement was one of the variables included in the Draw-A-Person: Screening Procedure for Emotional Disturbance, a global index of psychopathology for use with children. Since the emotional indicators of this scale were empirically derived it may well be that severe shifts of figures away from the midline and edging (placement of the figure on the edge or off the edge of the paper) are suggestive of overall disorganization but are nonspecific as to the underlying causal factors.

Studies of the association of figure placement, both in terms of overall organization as well as shifts off midline, with cognitive and behavioral variables will be examined as part of this dissertation.

***Koppitz's Empirically Derived Draw-A-Person*** - In general, the assignment of a specific personality dimension to a particular graphic feature met with limited success leading to the development of alternative methods for figure drawing interpretation. Koppitz (1968) can be credited with several important contributions in this regard. Moving away from a sign approach, she attempted to empirically quantify human figure drawing analysis and demonstrated that many graphic features considered to be suggestive of psychopathology were developmentally appropriate at certain ages. Additionally, for a feature to be diagnostically relevant, she proposed that its occurrence must be uncommon in typically developing children.

Through extensive study, Koppitz (1968) identified 30 rarely occurring features she classified as Emotional Indicators (EI). Since it was common for well-adjusted children to include one and sometimes two EIs in their figure drawings a cut-off criteria

was established with two EIs considered to be suggestive and three or more to be highly suggestive of emotional disturbances and "*unsatisfactory interpersonal relationships*".

Koppitz (1966a) validated the ability of EIs to identify emotional disturbances through a comparison of teacher identified behaviorally adjusted children with those receiving services in a child guidance clinic. Of the well-adjusted children, 95% drew none or one EI while 75% of those in the clinical group included two or more in their figures. These findings were replicated in a group of hearing impaired children with those scoring highest on an independent measure of stress including more EIs in their drawings (Johnson & Delavan, 1989). However, a later study using a similar population failed to find differences in the number of EIs included in normal and maladjusted children's drawings (Cates, 1991).

Catte and Cox (1999) extended Koppitz's (1968) findings by comparing children identified as being emotionally disturbed with chronological and mental age-matched controls. Although the clinical group included significantly more EIs into their drawings there was a striking lack of specificity. Seventeen EIs appeared in the drawing of all three groups, six EIs did not appear in any drawings and only seven indicators (i.e. tiny head, long arms, hands cut off, clouds, no eyes, mouth and/or feet) appeared differentially in the disturbed children's drawings.

In a study frequently cited by critics of projective drawing techniques, Pihl and Nimrod (1976) also failed to demonstrate a relation between the number of EIs and the scores obtained on the child completed Children's Personality Questionnaire. However, self-reports are notoriously unreliable when used with young children, especially those with reading impairments. Seldom mentioned was the finding that the personality ratings

of the children made by clinical psychologists were significantly correlated with EIs.

Although Koppitz's method was the beginning of a systematic global approach to the analysis of figure drawings she did not move entirely away from considering the interpretive significance of specific features and hypothesized that the pattern of EIs contained within a drawing were indicative of varying forms of psychopathology (Koppitz, 1966c). For example, impulsivity would lead to specific EIs (e.g. big figures, transparencies) while shy children would include a different set of indicators (e.g. small figures, short arms). To examine this proposal children were grouped as aggressive or shy based on clinical history. Aggressive children were found to include gross asymmetry of limbs, teeth and big hands in their drawings with significantly greater frequently. Shy children included cut-off hands and no mouth significantly more often while tending to draw their figures smaller with no nose compared to aggressive children. However, subsequent studies using similar samples have failed to replicate these results (Lingren, 1971; Norford & Barakat, 1990).

*In summary*, although EIs appear to have some validity in identifying school-aged children with emotional disturbances they are, at best, a gross screening method with limited ability in distinguishing different diagnostic subtypes. The fact that well-adjusted children include EIs into their drawings and that many of these features seldom occur in any drawings are significant limitations for this technique. It is also important to note that although a graphic indicator may occur in only a small percentage of children drawings it does not necessarily mean it is indicative of psychopathology.

***The Draw-A-Person: Screening Procedure for Emotional Disturbances*** - The Draw-A-Person: Screening Procedure for Emotional Disturbances (DAP:SPED; Naglieri,

McNeish, & Bardos, 1991) is the most recently developed instrument for using children's drawings as an assessment tools for uncovering psychopathology. The DAP:SPED is quite similar to Koppitz's method in that graphic features are identified as pathognomonic if they occur in less than 16% of the normative sample. Several features discarded by Koppitz were reintroduced into the DAP:SPED and additional items were identified.[2] The developers abandoned any attempt to place interpretative significance onto individual items but rather aimed to provide a screening instrument from which a global impression of dysfunction could be derived. This limited goal has not dissuaded either the original authors or subsequent researchers from attempting to use the DAP:SPED for differentiating various forms of psychopathology.

In one of the few published validity studies, scores obtained on DAP:SPED by students placed in special education for serious emotional problems were significantly higher compared to mainstream students matched for age, race and intelligence (McNeish & Naglieri, 1993). The DAP:SPED, however, produced many "*possible*" false positives with 32% of the mainstream students identified as disturbed. False negatives were also quite high with 51% of the emotionally disturbed children's scores falling below the clinical range.

In contrast, Matto (2002) demonstrated that the DAP:SPED possessed adequate predictive ability for children with internalizing disorders over and above information obtained from a parent rated Child and Adolescent Adjustment Profile while quite poor at identifying those with externalizing behaviors. One might presume that McNeish and Naglieri's (1993) failure to identify disturbed students may have been because many of the children in their sample were suffering from externalizing disorders. This may also

[2] See Appendix A for a list of EIs and DAP:SPED items.

be the reason that Wrightson and Saklofske (2000) found the DAP:SPED less accurate in classifying three groups of adolescents (mainstream, alternative and behavior problems) compared to teacher completed behavioral checklists.

*In summary*, the DAP:SPED is the most psychometrically sound of the various scoring techniques. Despite that fact that its intended use was as a general screening instrument, it appears to be more successful identifying internalizing compared to externalizing disorders. This is an important finding needing further replication since anxiety and depression in children are notoriously under-recognized and/or underreported by parents. The DAP:SPED, however, suffers from being divorced from any theoretical orientation. No explanation is offered as to why children with emotional and behavioral disturbances might draw their figures differently than more typically developing children.

### *Family Drawings*

The projective value of family drawings was suggested as early as 1931 by Appel, but it is Hulse (1951, 1952) who is generally credited with popularizing this technique. Using a case study approach, Hulse proposed that the analysis of family drawings offered the clinician additional material, not readily obtained from single figure drawings, regarding the child's perspective on the dynamics of his/her family life.

Although the use of family drawings had numerous proponents (DiLeo, 1983; Koppitz 1968) a review of the literature uncovered little published research and this instrument has largely been replaced by the Kinetic Family Drawing technique. Recent interest in the use of family drawings to assess children's attachment patterns has generated resurgence in its use for research purposes.

***Kinetic Family Drawings*** - Burns and Kaufman's Kinetic Family Drawing (K-

FD; 1970) technique is a theoretical extension of work by Machover (1949) and Hulse (1951, 1952) in that interpretation is grounded in psychoanalytic theory. Analyzing over 10,000 drawings collected during eleven years of clinical work, Burns and Kaufman (1970) present the K-FD in a series of illustrative case reports.

These authors believed that much could be gleaned with regard to the dynamics of family relationships by the incorporation of action into the drawing (Burns and Kaufman, 1972). They argued that the addition of movement enlivened the drawing, enabling one to better understand the child's self-concept and role within the family. The addition of kinetics, although never explicitly stated, was reminiscent of the movement determinant used for Rorschach analysis and shares with it a similar significance. Weiner (1998) writes, "[Rorschach] *content themes in movement responses often provide valuable clues to how people view themselves, how they regard others, and how they feel about interpersonal relationships" (p. 181).* Just as movement responses to the inkblots have been interpreted as cooperative, aggressive (Liebman, Porcerelli, & Abell, 2005) or malevolent (Ornduff, Centeno, & Kelsey, 1999) so too were the activities incorporated into K-FDs.

Burns and Kaufman's (1970) original scoring system identified four dimensions of K-FDs as relevant for understanding a child's sense of themselves in the context of his or her family. Physical Characteristics are formal, static aspects of a drawing and include features such as the omission of body parts, elevated figures and arm extensions. Actions refer to the movement of energy between figures and symbolized positive interactions such as harmony and cooperation or negative forces such as competition or anxiety and are likened to Freud's concept of libido. Styles are graphic features which isolate figures

and include compartmentalization, encapsulation, lining at the top or bottom of the page, underlining individual figures, folding and edging as well as evasions such as drawing stick figures or figures devoid of action. In general, Styles are considered a graphic analog of defense mechanisms and since they are highly individualistic they must be interpreted in a manner similar to dream analysis.

As is true of research on all projective drawing techniques, attempts to compare research findings are hampered by poorly defined criteria and idiosyncratic scoring methods. Handler and Habenicht (1994), in a review of the K-FD literature, reported acceptable inter-rater reliabilities although much depended on the graphic variable under investigation. Features that were easy to objectify, such as omission of body parts verses facial expression, generally produced the highest inter-rater agreement.

Research on test-retest reliability has been limited. Mostkoff and Lazarus (1983) administered the K-FD to 50 learning-disabled elementary school children and found mixed stability for a two-week interval. Twenty individual drawing features were examined with stability in self portrayal, omission of body parts on self, arm extensions, rotated figures, elevated figures, evasions (i.e. stick figures or all figures drawn standing), barriers and drawing on the back of the page. However, all variables related to figure size and inter-figural placement were found to be unstable on retesting.

Research using the K-FD technique has primarily focused on four areas: validation of specific graphic features using clinical and non-clinical groups; examination of family disruption and attachment patterns; and cultural differences. Each of these bodies of research will be briefly reviewed.

**Validity Studies** - Validity studies have focused most extensively on inter-figural

distance, figure height and various Styles. American children most often draw figures of themselves closest to the mother while the largest size, most activity and greatest strength is attributed to the father figure (O'Brien & Patton, 1974). This pattern changes over the course of development. Holtz, Moran and Brannigan (1986) found male undergraduates drew the self-figure as close to the mother as to the father figure and sized all figures relatively equally while attributing the most strength and activity to the self-figure. Females, however, continued to draw the self-figure closest to the mother and continued to size the father figure largest. These changes were attributed to a growing sense of "*equality within the family*", with males experiencing a greater pressure to assert themselves.

Research with various clinical groups has generally supported Burns and Kaufman's (1972) assertion that actions, figure height, inter figural distance and some Styles were important variables in K-FD analysis. In attempting to develop a quantitative scoring system for the K-FD, O'Brien and Patton (1974) reported that variables associated with action, distance and size were predictive variables in their equations for identifying general self-concept, social self and withdrawal while barriers were associated with aggression.

Social acceptance also appeared to exert an effect on children's K-FD. Peer rejected boys drew themselves closer to parental figures while the reverse was true for girls. Peer accepted girls also drew a more cohesive family unit (Rabinowiz, 1991). In a second study, peer accepted girls were found to draw the mother figure taller than rejected females (Rabinowitz, 1992).

Styles have been examined in several different clinical groups. Insulin dependent

diabetic children drew themselves isolated from family members significantly more often than did a comparison group of more typically developing children (Sayed & Leaverton, 1974). Raskin and Pitcher-Baker (1977) found that children identified as having perceptual motor problems depicted greater isolation in their self figures while Stawar and Stawar (1987) observed that boys referred for mental health services included significantly more edging and encapsulation compared to typically developing peers.

McPhee and Wegner (1976), however, questioned the validity of several of the stylistic features that Burns and Kaufman identified as indicative of defensiveness and isolation since they found the total scores for folding, edging, bottom lining, top lining, underlining individual figures, encapsulation and compartmentalization were significantly higher in well-adjusted children compared to those identified as emotionally disturbed. Adjusted children were also found to spend a greater time on their drawings suggesting that several Styles such as bottom and top lining might actually be artistic embellishments. Stawar and Stawar (1987) also found more underlining of figures and compartmentalization in a typically developing comparison group.

Finally, lack of kinesis has been noted in the drawings of delinquent boys' K-FDs when compared to those produced by community dwelling boys of similar age (Sobel & Sobel, 1976) as well as boys referred to a community mental health clinic (Stawar & Stawar, 1987) and by children raised in households of alcoholic parents (Gardano, 1988).

Many of the significant findings in children's K-FDs have also been observed in the family drawings of adults hospitalized with depression (Wright & McIntyre, 1982). Organization, detail, empty space, size of figures, size of the self-figure, isolation and lack of energy all significantly differentiated those suffering from depression from

normal controls. Size of self verses others, isolation variables and energy all improved in the expected direction as individuals experienced clinical remission of their depression.

**Family Disruption** - The K-FD technique has also been used to examine children's perception of family turmoil due to marital discord, parental substance abuse or neglect and most recently attachment patterns.

Not surprisingly, parental separation impacts on a child's depiction of his or her family. In a comparison of the K-FDs of Swedish children from intact homes with drawings made by those with divorced parents significant differences were found in the latter group with turmoil expressed by omission of hands and feet, figures drawn in profile and omission or distancing of family members. Many children from "*broken*" households continued to include the father in the family portrait, scaling him as large or larger than the mother, which suggested that he continued to play an important role for these children (Spigelman, Spigelman, & Englesson, 1992). In contrast, Lawton and Sechrest (1962) found few meaningful differences in the family drawings of fatherless boys compared to those living in a two-parent household. These two studies suggested that it was the disruptive nature of divorce rather than the lack of a fraternal influence projected onto the drawings.

Further evidence that family turmoil influences K-FDs comes from studies of the impact of parental substance abuse on children's drawings. Children of alcoholic fathers depicted significantly greater inter figure distance in their K-FD and less interaction between family members compared to controls (Gardano, 1988 as cited by Handler & Habenicht, 1994). These findings were partially replicated by Holt and Kaiser (2001) who observed increased isolation of self and family members in the K-FDs of children

that lived with a substance-abusing parent.

Perhaps nothing is more disruptive to a child's mental well-being than parental abuse. Neglected boys living in a group home were found to include major distortions in their kinetic drawings including irregularly shaped figures and disorganization in the placement of family members (Reddy, Bhadramani, & Samiullah, 2002). Child incest victims also produced troubling family scenes with 92% depicting parents not interacting; 82.5% drawing family members engaged in different activities; 70% including barriers; 62.5% drawing themes of isolation and anxiety indicators; and 55% of the drawings including aggressive acts directed towards the father figure. Although sexual elements occurred significantly more often in the drawings of incest victims, they were not diagnostic since they were not evident in all maltreated children's drawings and on occasion were found in the drawings of well-adjusted controls (Hackbarth, Murphy, & McQuary, 1991).

Some have suggested that K-FDs offer an objective method for detecting physical and/or sexual abuse in children (West, 1998). However, it clearly remains an unreliable measure in this regard as further demonstrated by Veltman and Browne (2000) who found that mental health workers and teachers were unable to identify maltreated children based on K-FDs, producing significantly more false alarms than expected by chance.

**Attachment** - The infant's level of attachment and relatedness with his or her primary caregiver influences the development of self-regulation. Since the child internalizes a representation of this early attachment figure, all future interactions with others is to some degree a reenactment of this first relationship.

Several studies have examined individual features contained in drawings that may

be indicative of poor attachment. McKay (1970) studied the spontaneous paintings of institutionalized compared with family reared mentally compromised children and found those from intact families portrayed a better body image and were more peopled leading to the conclusion that drawings offer a valid measure maternal deprivation. A more recent study found securely attached 4-year olds drew themselves closer to the maternal figure compared to those who were insecure (Janus, Middlebrook, & Simmons, 1993 as cited by Madigan, Ladd, & Goldberg, 2003).

The general hypothesis, that drawings were a useful window into a child's internal representation, was given additional support. Drawings of secure 6-year olds evidenced a greater degree of figure individuation than those produced by insecure children while Milne, Greenway and Best (2005) found that same/different representations were related to behavioral ratings in boys although not girls. Boys with few similarities between self and mother representations were rated as higher in externalizing behaviors while boys who drew themselves as similar to the father figure displayed less psychopathology.

Although individual graphic features have been illuminating in their ability to identify distressed children, Kaplan and Main (1986 as cited in Fury, Carlson, & Sroufe, 1997) identified a series of theoretically derived graphic markers they believed help in distinguishing attachment patterns. They proposed that a securely attached child's family drawings would contain realistic elements and that the figures would be portrayed as happily interacting. Drawings made by children with insecure – avoidant attachment would give an overall sense of invulnerability. Figures would be unrealistically happy with large, brightly colored smiles but there would also be a lack of individuation with

little interaction between family members. The insecure – resistant child's drawings would emphasize vulnerability. Facial features would depict a worried or fearful affect and the self-figure would be isolated from the family group. Finally, the family drawing of the disorganized child would give the viewer a sense of foreboding with dark clouds, blood, child or mother missing or would be so disorganized as to be uninterpretable. Since one problem in studying attachment in older children is the lack of well-validated measures, Kaplan and Main suggested that family drawings offered a means for the expression conscious and unconscious thoughts and feelings, which might be beyond the child's verbal capabilities.

Fury and colleagues (1997) examined the validity of Kaplan and Main's attachment markers with the family drawings produced by children from high-risk families for whom early attachment patterns had been previously ascertained. Each drawing was evaluated using Kaplan and Main's markers as well as a Global Rating Scale. Few of Kaplan and Main's individual markers were successful in identifying a child's attachment status while the global assessment approach was significantly related to attachment patterns even after controlling for IQ, current socio-emotional functioning and life stress.

Pianta, Longmaid and Ferguson (1999), used a slightly different methodology. Kaplan and Main's markers were used to evaluate the family drawings of kindergartens and each was assigned an attachment pattern. Teachers rated children classified as "*secure*" as more social and task oriented with fewer behavior problems compared to those identified as "*insecure*" or "*disorganized*". However, once again, overall global impressions proved to be more powerful in discriminating "*secure*" from "*insecure*"

children compared to individual markers.

Elaborating on the previous findings of others, Madigan, Ladd and Goldberg (2003) evaluated the family drawings of children with known attachment status with four different scoring methods: a method based on K-FD interpretive techniques (Janus et al., 1993); a checklist of Kaplan and Main's markers; Fury's method of global assessment; and independent judgments made by raters well-versed in attachment theory. The K-FD approach successfully identified resistant children based on their use of overlapping and encapsulated figures as well as their more frequent depiction of "*floating figures*". Significant features found in avoidant children's drawings included exaggerated heads, negative or neutral facial affects and emphasis on facial features (previously identified as a resistant sign). Using Fury's global ratings, avoidant children's drawings incorporated significantly less creativity and more emotional distance; secure children's drawings displayed a significantly higher rating of family pride and lower global pathology; and resistant children's drawings evidenced significantly more vulnerability and role reversals. Finally, experienced judges were found to be as successful in classifying children as Fury's method. Although 80.5% of children were correctly classified, additional analysis revealed that a child's current socio-emotional functioning made a more important contribution to the global ratings of the drawings than did early attachment patterns.

Behaviors commonly associated with insecure attachment include an inability to self-regulate, poor impulse control and failures with self-regulation, behaviors that are also characteristic of children with attention deficit hyperactivity disorder (ADHD). Secure attachment is associated with increased attention span, flexibility and the ability to

delay gratification. Clarke, Ungerer, Chadoud, Johnson and Stiefel (2002) hypothesized that the symptoms of ADHD were likely to develop in the context of insecure attachment and so collected drawings from boys with ADHD and typically developing peers. Using Fury's global assessment method for scoring, the ADHD group received significantly lower scores compared to the comparison group on Family Pride and significantly higher scores on Vulnerability, Anger/Tension, Role Reversal, Bizarreness/Dissociation and Global Pathology. Groups did not differ on ratings of Emotional Distance/Isolation. In general the ADHD group's drawings reflected a high degree of family disharmony with themes of anger, confusion, low self-esteem and anxiety. Although comorbid conditions such as conduct disorder and learning disabilities modified some of these associations, overall findings remained unchanged and significant. However, a serious limitation of this study was the lack of control for IQ or graphomotor ability.

Research on family drawings and attachment is notable for several reasons. First, it is based on theoretically driven testable hypotheses. Second, researchers have taken a systematic approach, attempting to build on the previous findings. Third, controlling for confounding variables such as IQ and drawing ability is the standard rather than the exception.

**Cross Cultural Research** - The influence of culture on family dynamics and social values as depicted in K-FDs has been the focus of several published reports and numerous doctoral dissertations. Much of this research, although interesting, lies outside the scope of this review. A sweeping generalization is that culture appears to influence many K-FD variables including the number of figures and family members depicted, inter figural distance, differentiation of figures and actions and activities depicted

(Cabacungan, 1985; Nuttall, Cheih, & Nuttall, 1988).

Wegman and Lusebrink (2000), however, have argued that the observed cross-cultural differences may be due to the variability in the ratings for various features across different cultures. After developing a detailed scoring manual, they found that sexual differentiation in K-FDs of Swiss and American children was unreliable while judges were able to reach 83% agreement for this same feature in the drawings of Taiwanese children. They cautioned that much more work still needed to be done on the psychometric properties of the K-DF before it would yield truly meaningful cross-cultural data.

*In summary***,** K-FDs are one of the most frequently used assessment tools with adolescents (Archer, Maruish, & Imhof, 1991) despite the continued lack of adequate scoring criteria, normative information and low test-retest reliability. Handler and Habenicht (1994), however, argued that the lack of retest reliability was actually strength since the goal of the K-FD technique was to assess the child's perception of his or her place in the world. A measure that remained stable over time lacks sensitivity because it would fail to reflect affective change. As anyone who has ever lived with children in the household will readily recognize, their perceptions and affect can change quite suddenly and dramatically within a short time frame.

### *Color*

The colors used in drawings and paintings have long been considered to have emotional significance (Brick, 1944; Burkitt, 2004; Waehner, 1946; Zentner, 2001) with some suggesting they provide the clearest insight into a child's emotional life by enabling the expression of feelings toward the people and objects depicted (Alschuler & Hattwick,

1943; Malchodi, 1998). Given the emotional valance often assigned to color, it has played a surprisingly small role in projective drawings and by extension has received little systematic study.

This lack of attention to color in drawings is in contrast to its major role in Rorschach interpretation where it is considered a reflection of the respondent's ability to handle affect and impulses (Rapaport, Gill, & Shafer, 1968). Color responses on the Rorschach and in drawings may share a fundamental relationship as Ruesch and Finesinger (1941) demonstrated that a high number of color responses were positively correlated with the number of colors used in drawings. Girls, aged of 10- to16-years, who typically were found to use more color variation in drawings also produce more Rorschach responses integrating color and form compared to boys of similar age (Ames, Metraux, & Walker, 1971).

In addition to the Rorschach literature, a number of diverse studies point to a connection between color and emotion (Adams & Osgood, 1973; Frank & Gilovith, 1988; Schaie, 1961; Terwogt & Hoeksma, 1995; Wexner, 1954). The color – emotion connection appears to be not only universal in humans (Adams & Osgood, 1973) but color plays an important role for numerous other species in physiologic arousal and is related to mating, feeding and prey/predatory behaviors[3].

### *General Developmental Trends in the Use of Color*

There is a systematic progression in children's use of color in their drawings. At the earliest stages, children do not appear to be conscious of color, grabbing whatever

[3] Red often is the color of danger in nature signaling poisonous berries, frogs and insects. Red coloration is equally important in mating. For example, female baboons' genitalia become bright pink when they are most sexually receptive.

crayon or marker is within reach (Malchiodi, 1998). Color becomes increasingly important to children aged 4- to 7-years with some as young as 4 able to use color for the representation of specific objects (e.g. red for apples; Milne & Greenway, 1999). As the child matures there is movement away from an idiosyncratic to a more systematized and somewhat rigid, rule-governed approach to how objects are depicted (e.g. apples **must** be red) and it is only at this point that unusual color choices are considered to be significant with regards to the child's emotional stability (Burkitt, 2004). As the child matures into adolescence colors may no longer correspond to the real world becoming increasingly artist specific and are used to denote feelings and emotions (Gardner, 1980).

### *Number of Colors*

Sex and age both exert an influence on the number of colors individuals use in their drawings. Tuman (1999), in an examination of sex differences in children's drawings, found that girls focused on human content using significantly more colors compared to boys who incorporate more expressive lines in their depiction of aggression and adventure. Milne and Greenway (1999) also found that girls used a wider color palette compared to similarly aged boys and as males reach puberty they become increasingly color restrictive. These findings in children lend credence to earlier observations that adults use less color in their drawings than do children (E. Hammer, 1958). However, the association of a decline in color use with better modulation of emotions in adults has not been empirically verified.

### *Color Preference and Meaning*

Children have been found to prefer bright colors to darker ones (Eysenck, 1941;

Guilford & Smith, 1959) with this predilection increasing with maturation (Boyatzis & Varghese, 1994; Hemphill, 1996). Although boys show a somewhat more positive reaction to darker colors than do girls (Boyatzis & Varghese, 1994), in general, color preferences do not appear to be greatly affected by sex (Guilford & Smith, 1959).

Despite a universal preference for bright colors, young children's specific color preferences differ from those of adults (Zentner, 2001). Children between the ages of 30-months to 11-years ranked red as their most preferred color compared to dark blue for adults. Pink was ranked second by the youngest children but quickly became one of the least preferred colors of older children and adults. In terms of least preferred, children younger than 11-years rank brown and black as least favored while for adults this position was held by pink and brown. These findings replicated earlier studies that have demonstrated increasing preference for blues and greens over the course of maturation (Eysenck, 1941; Garth & Porter, 1934).

The emotional significance of specific colors has received considerable attention and speculation (E. F. Hammer, 1958; Klepsch & Logie, 1982) and although several theories regarding the underlying nature of the relationship between colors and emotions have been proposed (Gerard, 1957; Overton, 2000; Valdez & Mehrabian, 1994: Wexner, 1954) much remains speculative (Malchiodi, 1998).

Red is considered to have the greatest impact on arousal (Gerard, 1957) and is associated with both strong positive emotions such as love and affection as well as the negative feelings such as aggression and hate. Younger children preferred red for painting, which suggested to Alschuler and Hattwick (1943) that these preschoolers were functioning at an impulsive level. They also noted that as children matured and gained

better affective regulation interest in red decreased and was replaced by cooler colors denoting increased control. A study by Rosenbloom (2006), finding that "*high experience seekers*" used significantly more hot colors such as red and orange in their paintings of the human figure compared to "*low sensation seekers*" also lends some support to the arousing properties of red

The excessive use of black has been tied to negative emotions such as anxiety and fear (Gregorian, Azarian, DeMaria & McDonald, 1996; Mumcouglu, 1991). When children were asked to draw pain or feelings associated with chronic illness red and/or black was the most frequently chosen colors (Jerrett, 1985; Scott, 1978).

Aside from red and black there is little empirical evidence linking specific color choices with a given emotion. When asked to make forced choice color/emotion pairings children aged 6- to 13-years associated: **red** – anger; **orange** – excited; **yellow** – happy; **green**- lonely; **blue** – sad; **brown** – bored; **black** – scared and **purple** – choice (Ammen et al., 1996). Burkitt, Barrett, and Davis (2003), examining this same issue, instructed children to first rank order their color preferences. Each child was then given a line drawing of a dog, man or tree characterized as "*negative*", "*neutral*" or "*positive*". Preferred colors were more frequently used for the completion of "*positive*" drawings and least preferred colors for "*negatively*" characterized figures. This was true even for the youngest group, suggesting that even preschoolers were cognitively capable of using colors symbolically.

In a recent review, Burkitt (2004) nicely sums up the current understanding of how children use color to denote affect. Children across educational and cultural groups tend to use darker colors to depict topics they feel negatively towards. However, on an

individual level, much of color choice is dependent on color preference in that if a given child "*likes*" dark brown he or she will tend to use it instead of bright, light colors to represent positively laden topics.

### *Variables Affecting the Use of Color*

As mentioned, both age and sex appear to influence color preference and use. However, culture, topic depicted and the medium used to produce a drawing or painting also exert some degree of influence. Research has suggested strong universal trends for a negative association to black, an energizing effect for red as well as a preference for lighter colors. The use of black to depict negative topics has been observed in Native American (Nelson, Allan, & Nelson, 1971); British and Finnish (Burkitt, 2004); Armenian (Gregorian et al., 1996) and Israeli children (Mumcuoglu, 1991). However, some color preferences and affective associations are likely learned and culture specific (Burkitt, Barrett, & Davis, 2005; Nelson et al., 1971).

Not surprisingly, the theme of a drawing influences color usage. Children used more colors when requested to draw a garden compared to people, leading Golomb (1990) to propose that differences in color usage were related to detail, with greater detail associated with less color. Van Krevelen (1975) observed that children used the same colors for drawing of self and parents to represent a warm caring relationship.

Finally, the medium used appears to exert an influence on both the number of colors used and the final quality of the drawing. Alschuler and Hattwick (1943) observed that young children tended to use more red and black in paintings as opposed to their crayon drawings. Koppitz (1965) compared children's drawings of the human figure

obtained with achromatic pencils or crayons. Although crayon drawings contained more representations of clothing there were no significant differences on developmental scoring. However, the use of crayons did affect the number of EIs in "*unexpected*" ways with shading; omission of body parts; and inclusion of a baseline, sun and clouds all significantly more likely to occur compared to drawings made with achromatic pencils. Koppitz admitted it was unclear as to why these differences between mediums existed but warned against interpreting crayon drawings in the same manner as those obtained from traditional pencil administration.

Observed differences in achromatic verses chromatic drawings led J. T. Payne (1949) to suggest that the House-Tree-Person produced with crayons revealed a deeper level of personality functioning when compared to those obtained with monochromatic pencils. This view was supported by E. F. Hammer (1958) who demonstrated the regressive nature of crayons in a series of pencil verses crayons drawings made by clinical patients. However, subsequent research has called into question this interpretation. Whether completed with pencils or crayons, drawings obtained first were of a better quality and "*regression*" may simply have been a function of fatigue (Bieliauskas & Heffron, 1960).

### *Use of Color by Clinical Groups*

Analysis of adult clinical case reports led E. F. Hammer (1958) to conclude that the use of one color for drawings was restricted to individuals who were unable to make warm, sharing relationships while J. T. Payne (1949) observed that the excessive, unconventional use of color ("*color clash*") often occurred in those unable to regulate emotional impulses.

Similar observations have been made in children. Children suffering severe emotional abuse often use one or two colors in their drawings (Malchiodi, 1997) and Thomas and Silk (1990) noted that artistic autistic savants seldom work in color: "*…they do not seem concerned with depicting feelings and moods on paper, for which color is often used by talented youngsters*" (p 135).

Empirically based studies have largely supported clinical observations in both adult and pediatric samples. Gray and Pepitone (1964) examined the use of color in the figure drawings by male undergraduates who received experimentally manipulated negative or positive feedback following psychological testing in an attempt to influence subsequent feelings of self-esteem. Those receiving negative feedback used significantly fewer colors in their drawings compared to students receiving positive feedback.

Studies sampling populations with psychopathological conditions consistently demonstrate differences in color usage compared to controls. Zimmerman and Garfinkel (1942) found the paintings of psychotically disturbed inpatient adults characterized as "*functionally*" impaired used significantly more color than those with "*organic*" pathology. More specifically, mania was associated with the use of contrasting reds and yellows, the incorporation of sexual themes and scant attention to detail while schizophrenia resulted in a preoccupation with detail, somber colors and sharp, angular figures. Berger and Bliss (1954) also found one color drawings were more frequently observed in those whose pathology was "*organic*" in nature.

Diminished use of color was also related to depression and although other graphic variables showed improvement following treatment (e.g. increased depiction of involvement with family members, increased use of page) color use remained restricted

(Hoshino, Silbert, Knapp, & Weaver, 1998; Wright & McIntryre, 1982). Finally, although one-color drawings were more frequent in depressed psychiatric inpatients while rare in controls, a lack of warm colors also was found to be a distinctive feature of the clinical group (Miljkovitch de Heredia & Miljkovitch, 1998).

Findings in pediatric populations largely concur with those obtained in adults. In an early study by England (1952) delinquents, "*mental defectives*," those with "*problem behaviors*" and more typically developing children were asked to color a standardized outlined figure. Compared to control children, delinquents left more items uncolored; mental defectives re-outlined the figures or added new ones; and problem children used one color or inappropriate colors. Unfortunately, how these clinical groups relate to current DSM-IV diagnoses is unclear; nonetheless differential use of color by clinical groups has been supported by other studies. For instance, Gulbro-Leavitt and Schimmel (1991) found a tendency for self-rated, depressed children and adolescents to use less than one-third of paper and idiosyncratic color with an increased use of shading. Geometric shapes and animals, but not people, also tended to be more common in the drawings of those experiencing depression.

This dissertation will examine children's use of color in several different ways. First, it will attempt to replicate previous findings that girls use a greater number of colors to complete their drawings compared to boys. It will also examine whether a child's use of color is an effective, child-centered measure of internalizing and externalizing behavior problems. Finally, idiosyncratic use of color will be evaluated as a marker for psychopathology and problematic behaviors.

## *Drawing Research: Methodological Issues*

Despite the extensive body of research examining projective drawings definitive conclusions regarding their efficacy for cognitive or personality assessment remain unwarranted since many of these studies suffer from serious methodological flaws. Poorly defined samples of inadequate size, a lack of appreciation for developmental differences between children's abilities and those of adults, idiosyncratic methods for identifying and scoring graphic variables and little regard for extraneous variables are all too common.

Most disturbing is that few studies have an empirically verifiable theoretical orientation and there have been few attempts to systematically build on previously research[4]. Machover's (1949) underlying theoretical position, that one projects their unconscious needs and desires onto drawings, has largely gone untested in either adult or pediatric populations. As Thomas and Silk (1990) point out, even Koppitz's system for figure drawing analysis, although empirically derived, lacks a coherent theoretical basis.

The following is a brief discussion of several often overlooked factors, known to influence children's drawings.

### *Participant Variables*

***Artistic Ability -*** Proponents of figure drawings have largely accepted Goodenough's (1926) early claim, later reaffirmed by E. F. Hammer (1958) that figure drawings are not subject to artistic ability or training. This assertion has been called into question by numerous researchers who have examined the influence that the artistic

[4] Notable exceptions to these criticisms are the theoretically driven research on children's graphic representation of attachment patterns and Burkitt and colleagues' body of work on the significance of color and figure size.

quality of a drawing has on a rater's subsequent interpretation. Feher et al. (1983), reviewing ten earlier studies, found all provided evidence that clinicians were influenced to varying degrees by esthetics when making an interpretation. Feher and colleagues went on to determine if explicit instructions warning experienced clinicians about judgment errors caused by the artistic quality of the drawings would be an effective method in reducing this tendency. Despite the cautions, artistic quality continued to influence clinical ratings of pathology. However, even though the quality of the drawings influenced judgments, both the naïve and cautioned raters continued to be moderately successful in distinguishing those produced by psychiatric inpatients verses controls. These authors concluded that although raters "*mistakenly assess artistic ability*" projective drawings continue to demonstrate clinical validity in adult populations.

Although artistic ability may be irrelevant when using a global approach in drawing analysis it may still present a major source of error when interpreting individual graphic features (Cressen, 1975). Certain body parts such as hands and feet are particularly challenging to draw and ability needs to be considered before too much interpretative significance is placed on them (Swensen, 1968). This caveat may be particularly true when interpreting children's drawings.

Artistic ability maybe less relevant when evaluating children's drawings since many graphic components that go into evaluating this dimension such as harmonious use of color and form, proportionality and perspective are not fully developed. However, it is an underlying assumption in the studies to be presented that graphomotor ability as measured by the Beery's Visual Motor Integration task is, for children, a developmentally appropriate analog of artistic ability in adults. In many of the studies conducted for this

dissertation, graphomotor ability will be examined as a possible extraneous variable and when appropriate controlled.

***Culture*** - Figure drawings, and in some respect all drawing measures, are touted as being culture free instruments whether used for cognitive or behavioral assessment. In fact, one reason Goodenough chose the human figure and Buck (1949) a house, a tree and a person was because of their presumed universality. However, universality does not mitigate the influence of culture. Artistic ability and training (Cox, Koyasu, Hiranuma, & Perara, 2001; Martlew & Connolly, 1996); sex of first figure drawn (De La Serna, Helwig, & Richmond, 1979); representation of sex and gender (M. A. Payne, 1990); assigned gender roles (Koppitz & Casullo, 1983; Zaidi, 1979); social scaling (S. B. Anderson, 1995; Oliverio, 1973); activity (Cabacungan, 1985); omission of body parts (Gonzales, 1982); inclusion or exclusion of family members (M. A. Payne, 1996; Zaidi, 1979); and how clothing and everyday objects are represented (S. B. Anderson, 1995) all have been shown to be influenced by cultural forces.

Since drawings may be especially sensitive to regional and ethnic differences they have become a popular tool of social psychologists and anthropologists. In addition, the very act of testing, no matter what the task, is suffused with varying cultural expectations.

***Motivation/Compliance*** - Drawing tasks are often described as attractive and non-threatening for young children and are considered to be especially useful with guarded adolescents. Although widely repeated, this claim has received little empirical validation and may actually be nothing more than clinical lore. Certainly one can envision the child with a significant graphomotor weakness being overwhelmed by a drawing task and disheartened by his or her final product. Since many children with learning difficulties

also experience co-occurring graphomotor problems, the use of a drawing task as an "*icebreaker*" may be exactly the wrong choice serving to disengage the child from the testing process.

Few published reports have made note of how many children refused to complete drawing tasks. Snyder and Gaston (1970) reported 3 of over 700 (.4%) first graders refused to produce a human figure during group testing while W.E. Martin (1955) found only 1 child in a sample of 31 (3%) would not draw a picture of her family. Reddy et al., (2002) reported that neglected boys, living in juvenile homes, were more reluctant to draw family members, as were low income black children who "*felt they did not draw well*" perhaps due to lack of exposure to drawing materials (McNight-Taylor, 1974 as cited by Handler & Habenicht, 1994).

***Sex*** - As previously discussed, differences have been observed in the drawing ability and in the use of color by boys and girls. Sex differences have also been observed in the angularity or curvature of scribbles in preschoolers (Boyatzis & Eades, 1999) and preferred motifs, with boys drawing moving objects and girls flowers and human figures (Minamoto, 1985 and Mikami, 1995 as cited in Iijma et al., 2001). Boys' drawings are also judged to be more dynamic and realistic compared to the drawings made by girls (Iijima et al., 2001).

### *Situation Variables*

***Contextual Factors*** - Klopfer and Taulbee (1976), in a review of projective techniques, made the observation that little attention had been directed at the factors, other than personality, that help shape one's internal representation. They cite a study by Dmitruk (1972) in which figure drawings were obtained from undergraduates enrolled in

either an introductory anthropology or a psychology course. The anthropology students' human figures were rated significantly more "*novel*" suggesting that this difference was influenced by their recent exposure to the aesthetics of other cultures.

Perhaps more relevant for this discussion is the finding that children excluded themselves from a family drawing and included more emotional indicators and aggressive signs after viewing a violent movie compared to drawings obtained following exposure to a non violent film (Perez-Olmos, Pinzon, Gonzalez-Reyes, & Sanchez-Molano, 2005). Mangold (1982 cited by Handler & Habenichet, 1994) also reported that the administration of the WISC-R prior to obtaining drawings suppressed unconscious processes while the Rorschach exerted a priming effect, releasing primary process thinking resulting in an increase in the number of graphic pathological indicators.

As Klopfer and Taulbee (1976) noted, "…*the concept of drawings as representing basic personality traits independently of situational and transient factors is not justified* p. 558." The effects of context are so poorly understood that graphic elements considered to be "*red flags*", such as inclusion of genitalia, may no longer be valid, as children raised in the United States are exposed to increasing levels of sexually explicit material (Hagood, 1992).

***Drawing Materials*** - The type of drawing materials provided appears to influence the quality of drawings but, aside from an early study by Koppitz (1965), different drawing media has received little attention. Based on extensive experience as an art therapist, Malchiodi (1998) observed that children often shun broken crayons and some were hesitant to touch chalk. Broken pencil points, mixed paint colors and dried markers are all likely to discourage a child from fully expressing himself/herself on paper.

Malchiodi also conjectured that the type of drawing material provided would influence the child's use of color. For example, vividly colored markers may encourage their use while the dullness of colored pencils may be inhibitory.

### *Examiner Variables*

***Presence of Examiner*** - Cassel, Johnson and Burns (1958) proposed that drawings obtained in the absence of an examiner represented a truer reflection of underlying conflicts and personality since ego defenses were relaxed. Examiner absent drawings, therefore, would contain more interpretable features as well as being smaller when compared to those obtained with an examiner present. They tested these hypotheses using the House-Tree-Person with two groups of employment applicants equated for age and intelligence. Interpretable features for the House and Person differed significantly between groups; with more pathological features found in the examiner absent condition while the Person drawing was found to be significantly smaller in the examiner present group. The authors note that these findings were obtained from a non-clinical sample and they suspected that the impact of an examiner absent condition might be even greater in disturbed populations. Pihl and Nimrod (1976), however, found no significant differences for either Koppitz's scoring of EIs, global assessment of personality dimensions, or GH-DAM scoring of figures drawn by children with examiner present or absent in a repeated measures design.

There are, however, obvious differences between the methodologies and participants sampled in these two studies. One can imagine that children, compared to adults, are less self-conscious with regards to drawing in the presence of an examiner. The loss of detail in adults' drawings may also occur because compliant individuals hurry

their drawings so as to not make the tester wait while embellishments are added. At best, all that can be concluded is that the effects of an examiner's presence during projective drawings remains poorly understood and should be kept constant within a given research protocol.

***Experience*** - Arkell (1976) examined whether a rater's training and experience with the projective drawing technique affected their ability in differentiating those produced by typically developing children from those classified as emotionally maladjusted. Judges included teachers; school administrators and secretaries; seventh grade students and trained personnel. No significant differences were found in sorting ability leading to the conclusion that training offered no advantage in drawing interpretation. This finding was confirmed by Falk (1981) who after reviewing a number of studies examining the effects of experience on projective drawing analysis stated, "*No studies conclude diagnostic superiority by experienced judges" (*p. 466).

***Personality Characteristics*** - As early as 1949 Goodenough warned, "…*too often, the observer has confused his own projection with those of the child*." The reality of this caution was confirmed when interpretation of aggression in the drawings of school-age children was found to be correlated with the level of independently assessed rater aggression (E. F. Hammer & Piotrowski, 1997).

Scribner and Handler (1987) also investigated how the personality of the rater may influence the interpretation of a drawing. Sixty-six undergraduates completed the Minnesota Mutiphasic Personality Inventory and the Interpersonal Checklist. They were then asked to rate the figure drawings obtained from psychotherapy patients using a forced choice checklist that included statements such as, "*trusts others or distrusts*

*others*". Raters demonstrating good interpretative skills for drawings were found to have an "*affiliative*" interpersonal style while those who did poorly possessed a "*disaffiliative*" style. Others have observed that raters who are most empathetic and are able to place themselves "*into the picture*" tend to be the most accurate in their interpretations (Hackbarth et al., 1988). The current research, therefore, does suggest that raters are not equal in their interpretive abilities but the relevant variable may not be "*clinical experience*".

## *Alternative Perspectives for Understanding Children's Drawings*

### *Developmental Perspective*

Longitudinal and cross-sectional studies of drawing ability in children raised in Western cultures reveal a progression through a series of distinct stages and, much like Piaget's system, are biologically predetermined (Thomas & Silk, 1990). Malchiodi (1998) identified six stages in the development of artistic ability.

***Stage I: Scribbling*** (18-months to 3-years) - When provided with appropriate materials, children make their first marks on paper at approximately 18-months of age. Although this stage of drawing is often referred to as "*scribbling*" these marks are not random but rather give the overall impression that the child has an awareness of pattern and placement (Kellogg, 1970). This earliest stage coincides with Piaget's sensorimotor period and it is believed that at this young age the child's goal is not representational but rather the pleasure derived from rhythmic motor outputs and visual feedback. Not only does the motion of scribbling appear to provide enjoyment but also the visual input provided by the marks since if the materials provided no longer mark the paper most children lose interest (Kellogg, 1970).

Scribbles soon give way to recognizable shapes with the circle considered to be an especially pleasurable form (Arnheim, 1956). Freeman, (1980), however, argues that the circle appears with a high frequency in early drawings simply because it is relatively easy to produce and processes a high degree of versatility.

As young children become increasingly verbal they will begin to label their output. Referred to as "*fortuitous realism*" by Luquet (1927), this is "*after the fact*" labeling since the child does not set out to draw something meaningful but once a form is drawn it represents whatever he or she would like it to be at any given moment. Recent research, however, suggests that children younger then 18-months may actually be attempting to produce true representations (Adi-Japha, Levin, & Solomon, 1998; Yamagata, 2001) but are limited by their immature motor and verbal abilities.

***Stage II*: *Basic Forms*** (3- to 4-years) - Scribbles quickly give way to recognizable forms such as circles, squares, triangles and crosses (Kellogg, 1970). The young child will often combine several of these forms on the same sheet of paper with the circle especially important since it is from this shape that the human figure emerges.

Most children of this age are firmly in the early phase of preoperational thinking and although still essentially egocentric are beginning to master an understanding of cause and effect relationships as well as symbolic thought. Children often name their drawings and some, with encouragement, will provide long narratives referred to as "*romancing*" (Gardner, 1980). Two types of narrative forms predominate with "*patterners*" primarily interested in describing their drawings in terms of form, size and color and "*dramatists*" who tell involved stories of action and adventure often with little relationship to what is actually depicted.

***Stage III: Human Forms and Schemata*** (4- to 7-Years) - This stage of artistic development coincides with the end of Piaget's preoperational period, during which the child evidences an increased capability to engage in symbolic thought; the ability to classify and see relationships; and a rudimentary understanding of numbers. Many have started to draw representational human figures although they may fail to integrate various body parts due to a lack of graphomotor control and organizational immaturity. For example, the trunk and body parts may be drawn disconnected from heads. Facial features may also float in space alongside a circle "*head*".

As the child's skills develop there is an increasing ability to integrate forms. A circle may to be combined with a line to represent a human figure and is so common a schema that it has been christened the "*tadpole*" figure. Since these early drawings do not depict how objects and people appear in reality this stage of drawing is also referred to as a period of "*symbolic realism*" (Barrett & Light, 1976). Children appear to intent on the content of their drawings and experimentation with materials than attempting to depict reality (Malchiodi, 1998). There are also few attempts at composition or design. Figures and objects often float on the page with little concern for correct spatial placement or directionality.

As the child progresses through Stage III the human form becomes increasingly realistic with most children using two circles, one to depict the head and the other the trunk. Over time, arms, hands, legs, feet and facial detail are included although omission of "*essential*" body parts is quite common. Children draw much less of the human form than they know to exist since when asked to name body parts they seldom forget to mention arms although these may be omitted in their drawings (Golomb, 1990). In fact,

when requested to draw a picture of an activity requiring arms, children are more likely to include them. Also observed is the beginning of size scaling with children drawn smaller than adult figures.

***Stage IV: Development of Visual Schema*** (7- to 9-Years) - There is increased cognitive development during this period as the child moves from the later stages of preoperational thought into concrete operations. As children become less egocentric, they begin to depict objects in relation to each other rather than separately and disconnected. Children at this age are often rule-bound as they try to make sense of their environment and this adherence to structure extends to their drawings (Malchiodi, 1998). They develop schemas for people and animals as well as objects such as houses, the sun and vehicles. The human form has moved well past the earlier tadpole figure with both head and trunk depicted along with increasing use of detail. However, there are still no successful portrayals of depth with a ground line seldom meeting a skyline. Three-dimensional objects are often depicted from a bird's eye in a phenomenon known as "*folding-over*" or objects on a table may float above it.

As children strive to depict what they know about the world it is considered developmentally appropriate to see the inclusion of transparencies. Two types of transparencies have been identified (Winner, 1982). "*X-rays,*" show objects that exist but despite changes in the viewer's orientation would never become visible (e.g. baby inside the mother's womb). It has been suggested that the child is very aware of this distortion but intends to show his or her knowledge regarding what is concealed. The other type of transparency occurs when the child fails to occlude an object, for example the body outline underneath clothing.

Several studies have directly examined the cognitive underpinning of children's use of transparencies. When younger children were asked to draw a picture of a whole apple transected by a hatpin they tended to draw a circle bisected with a line, while older children occluded the portion of the pin inside the apple (Thomas & Silk, 1990). It had been assumed that the younger child was attempting to provide structural information. However, when additional information was added to the pin, such as color changes or two pins coming from opposite sides and meeting in the middle, rather than including this additional information into their drawings younger children produced fewer transparencies (Crook, 1984 as reported by Thomas & Silk, 1990). Clearly, the underlying reason as to why young children include transparencies remains poorly understood but the findings thus far suggested that they were grappling with issues of depicting what they knew to be true verses what was actually seen. It is, in part, the use of transparencies and folding over that have led some to label this stage "*intellectual realism*" since the child depicts what they know about the world but still does not possess the cognitive nor graphic skills necessary to depict the world is it visually appears.

***Stage V: Realism*** (9- to 12-years) - Most children, firmly in the Piagetian stage of concrete operations, have moved away from egocentric thinking and have shifted to considering the thoughts and feelings of others.

This shift from "*self*" to "*others*" is reflected in drawings where schematic or prototypical representations are replaced by a depiction of the world as it truly appears (Toomela, 2003). In general, drawings become more conventional as the child attempts to achieve a "*photographic effect*" (Malchiodi, 1998). The use of primitive perspective (e.g. baseline meeting the sky) and naturalistic use of color with shading (e.g. leaves of a

tree different shades of green) is common. Human figures are increasingly realistic with refinement in facial details, clothing and sexual differentiation commonly observed.

Since there is also sensitivity to how others might judge their drawing, many children will omit or hide details they find technically difficult and will place hands behind the figure or into pant pockets while some revert to drawing cartoon figures since they are often stereotypical, less detailed and generally require less technical skill (Malchiodi, 1998).

Many adults do not move past this stage of development. The reason remains unclear but it has been conjectured that verbal abilities are more highly valued both in school and in social relationships (Gardner, 1980).

***Stage VI: Adolescence*** - Referred to as the "*period of decision*" at this stage there is either continued growth and sophistication in artistic expression by those who possess special abilities and interest or a failure to further develop artistically due to lack of encouragement, technical skill or the ability to critically evaluate drawings (Malchiodi, 1998; Thomas & Silk, 1990). Those who continue to develop artistically demonstrate increasing proficiency in the use of perspective; refinement of detailing; attentiveness to the use of color and design; and mastery of a wide range of materials. During middle to later adolescence there is a movement away from convention and the development individualistic styles (Gardner, 1980). In contrast to younger children, who tend to focus on content, the adolescent is cognizant of the communicative nature of drawings and uses content to express "*ideas about issues, personal philosophies and themselves*" (Malchiodi, 1998 p. 98).

Over the last few decades, developmental psychologists have become increasingly

interested in the maturation of children's mental representations and the cognitive processes underlying their graphic productions. Thomas and Silk (1990) effectively argued that by focusing only on the final product (i.e. the drawing) most have failed to appreciate the importance of the development of cognitive abilities for the planning and organization that go into shaping a child's drawings. Luquet and Piaget, although attempting to provide a framework for understanding cognitive progression, remained largely descriptive and not process oriented.

More recent studies of children's figure drawings from a cognitive developmental perspective begin with the question "*how [do] children employ various strategies for retrieving the information which they have previously stored in a structured way, in order to achieve a coherent output; and what rules do they follow when the output fails to attain its goal… [since] one cannot make inferences about production-processes simply by inspection of the finished product.*" (Freeman, 1976 p. 345).

Most "*process*" investigations present the child with a representational challenge and then deconstruct elements of the drawings in an attempt to identify the related cognitive components. Particular attention has been given to object- to viewer-centered depiction of objects (Bremmer & Batten, 1991; Hodgson, 2002; Picard & Durand, 2005) and children's understanding of spatial depth relationships (i.e. how the child deals with drawing a 3-dimensional world on a 2-dimensional piece of paper; Cox, 1978; Ingram & Butterworth, 1989).

A developmental perspective allows for alternative explanations as to why some children include what from an adult perspective might be considered "*unusual*" elements. Transparencies, routinely considered a sign of pathology, might be little more than a

child struggling to represent the world as he or she knows it to be while omissions may simply reflect a child paying more attention to some features while ignoring others in a particular drawing. Certainly, interpretation of children's drawings necessitates greater latitude in assigning "*pathology*" than should be given a similar drawing produced by an adult. Alternatively, if progression through the various stages of graphic representation is stunted (e.g. tadpole drawing by a 9-year old) cognitive delays may be a more parsimonious explanation rather than assuming psychopathology.

### *Neuropsychological Perspective*

Drawing, from a neuropsychological standpoint, is a complex two-dimensional construction task requiring the integration of a multitude of cognitive functions including attention, perception, gnosia, praxia and executive monitoring for planning and regulation of motor output (Lezak, 1995). Unfortunately, little is known regarding constructional ability compared to the domains of language and memory either in adults or children and is likely due to "*critical role of verbal communication within our culture [leading to its] preferential study*" (p 111; Temple, 1997). Additionally, although verbal deficits are readily apparent, one must "*test*" for the presence of constructional apraxia.

***Constructional Apraxia in Adults*** - Much of what is known regarding brain – behavior relationships of constructional ability have been derived from the observations of those with known cortical lesions. Drawing tasks are well recognized as being sensitive to a wide range of cerebral dysfunctions because they are so cognitively complex. In fact, drawing tasks are particularly sensitive to the widespread cognitive decline associated with dementia (Lezak, 1995) and closed head injuries. Recent imaging studies have supported these clinical observations with bilateral parietal lobe, ventral pre

motor area and the posterior part of inferior temporal sulcus activation associated with a simple drawing task (Makuuchi, Kaminaga, & Sugishita, 2003).

Adults with documented right hemisphere lesions, especially when the damage encroached on the parietal lobe, appeared to be the most severely impaired on drawing tasks (Kolb & Whishaw, 2003). The overall contour of their drawings was often distorted and although details were "*slavishly*" reproduced, parts often did not flow together. Frequently these individuals displayed left lateral neglect and either "*ignore*" the left side of the paper or vaguely drew the left side of the object being depicted (Gardner, 1982). Studying professional artists following right hemisphere damage Gardiner observed that their paintings became more primitive and emotionally raw.

Characteristic distortions have also been observed in the drawings of those suffering from left hemisphere damage. In general, lesions to the left side of the cortex result in drawings in which the overall contour or gestalt was retained but with a significant loss of detail. There was also evidence that adults with left-hemisphere damage, although ultimately producing a superior copy compared to individuals with right hemisphere damage, approached their drawings in an usually fragmented fashion (Binder, 1982). Gardner (1982) considered the drawings made by individuals with left hemisphere lesions to be regressive, resembling those produced by young children.

In addition to these more global deficiencies, Jones-Gotman and Milner (1977) found that nonverbal fluency, the ability to draw a series of self-generated abstract designs, was most severely compromised following right frontal lobe lesions. Those affected produced significantly fewer forms, which were often perseverative and lacked spontaneity when compared to those of cortically intact controls. The ability to view

one's own art work critically and profit from an objective evaluation has also been associated with early frontal lobe dysfunction (Goldstein & Scheerer, 1941).

***Constructional Disabilities in Children*** - Young children with documented cerebral damage present with similar patterns of drawing deficits to those observed in adults. Stiles-Davis, Janowsky, Engel and Nass (1988) examined both copied and free drawings of four children with cerebral damage (2 left hemisphere and 2 right hemisphere). While the performances of the children with left hemisphere damage was comparable to those of typically developing peers those with right hemisphere injury were impaired on the copying task and their free drawings lacked coherence. However, Cromer (1983) noted that in a small sample of severely aphasic children, although displaying adequate performance in constructional tasks requiring a serial solution, there was evidence of impaired ability when a hierarchical approach was needed. Akshhoomoff, Stiles, & Wulfeck (2006) also found that children with language impairments were less accurate and tended to use a piecemeal, immature approach when copying complex figures (e.g. Rey-Osterreith Complex Figure Test).

Unlike the effects that adults' artistic ability has on subsequent evaluation of their figure drawings few studies directly examined how children's graphomotor or visual-motor integrative abilities impact on their figure drawing performances. One of the more methodologically sound examinations of the association of graphomotor ability and figure drawings was by Dykens (1996). Human figure drawings were collected from a large sample of individuals with mental retardation and scored using both the DAP:QSS (cognitive) and DAP:SPED (behavioral) methods. Scores obtained on these measures were then correlated with IQ (K-BIT), visual motor integration, behavior and adaptive

functioning scores. The DAP:QSS scores were most highly correlated with the visual motor integration scores. Further analysis revealed that 23% of the variance was uniquely accounted for by visual motor integration scores and only 10% by the IQ scores. The DAP:SPED was more highly correlated with adaptive functioning than were behavioral scores although neither of these correlations reached significance.

***Specific Pathognomonic Features of Drawing*** - Many of the formal features and styles identified as being indicative of various personality characteristics and functional disturbances have alternative explanations. A neuropsychological perspective posits a direct link between cerebral dysfunction and particular graphic elements rather than being "*projections*" of personality characteristics or underlying psychopathology. For example, Reznikoff and Tomblem (1956) identified several features of human figure drawings that were indicative of organicity in adults and include lack of detail, poor integration of body parts, shortened and thinned limbs, poorly sized and shaped body parts and petal-like or scribbled fingers. These findings begin to suggest that certain "pathological" features may be driven by neuropsychological deficits in visual-motor integration and executive functioning.

**Figure Asymmetry –** Machover (1949) recognized the relationship of figure asymmetry to overt brain damage although her explanations for this association remained well within a psychoanalytic framework. She wrote, "*Large, empty, poorly portioned, and weakly synthesized figures are often seen in the mentally deficient or organic cases, reflecting the shallow emotionality, lack of insight, and poor reasoning powers characteristic of these individuals*."

Asymmetry of features has been observed in the figure drawings of adults experiencing right cerebrovascular accidents with deficient performance highly correlated with an independent measure of adaptive functioning (Chen-Sea, 2000). These findings suggest that asymmetries in figure drawings, rather than being "*projective,*" were the direct result of impaired cerebral functioning that extends well beyond a drawing task. This conclusion is further supported by the fact that individuals with brain damage commonly included asymmetries in their drawings of clocks, flowers and cubes.

**Uses of Space -** There are numerous explanations as to why a child might shift his or her human figure off the midline of the paper other than some of the commonly cited psychoanalytic explanations. From a neuropsychological perspective "*poor*" placement can be due to either planning deficits associated with executive impairments or may be evidence of lateral neglect.

Spatial neglect is a failure to report or respond to stimuli presented in the space contralateral to the hemispheric lesion and although the underlying cognitive mechanism remains controversial it is not due to either a primary sensory or motor deficit (Heilman & Valenstein, 1993). Although neglect along the horizontal axis following right cerebral injury is the more commonly reported presentation, right sided neglect following left hemisphere lesions (Nagafuchi, 1990) as well as radial and vertical neglect following unilateral and bilateral hemispheric injury have been documented (Kim, Yoon, Jeong, & Na, 2001).

Although lateral neglect has been extensively studied in adults this is not the case for pediatric populations. Laurent-Vannier, Pradat-Diehl and Chevignard (2003) reported on spatial neglect in eight children with documented cerebral damage compared to

typically developing peers. Left lateral neglect was evidenced on both a cancellation task and drawing task as well as in adaptive functioning in children with cerebral damage.

There is also evidence that children with certain types of developmental disorders exhibit deficits on clock face drawing. Recently, a scoring system for clock face drawing has been developed for use with children and developmental trends established (M. J. Cohen, Ricci, Kibby, & Edmonds, 2000). A stepwise progression in skills from 6- to 10-years was found with regard to the construction of the clock face with children younger than 8-years of age frequently found to neglect the upper left hand quadrant while none were found to neglect the upper right hand quadrant. Since few children demonstrated the full pattern of left unilateral neglect these researchers suggested that rather than a true "*neglect*" this type of error was a function of poor planning due to developmentally immature frontal lobe functioning.

It is purely speculative that clock errors could be related to human figure drawings. However, these findings do suggest alternative, empirically verifiable cognitive explanations as to why some children might shift their figures off the central axis of the paper.

**Transparencies** - It is common from a psychoanalytic orientation to interpret transparencies as indicative of anxiety (Koppitz, 1966b) although others view this feature as a sign of aggression (Montague & Pryula, 1975). As mentioned, children normally go through the stage of intellectual realism when drawing transparencies are considered to be developmentally appropriate. Since transparencies are often included in the drawings of young children they may, when seen in older children's drawings be indicative of cognitive delays or deficits. Since both anxiety and aggression are common

comorbidities with learning disabilities it is conceivable that the occurrence of transparencies in these children is correlative with their behavior problems while the underlying causative agent is cognitive immaturity.

**Omissions and Distortions** - Aside from projective interpretations there is little explanation in the literature as to why some children omit important elements in their figure drawings (for exception see L. R. Johnson, Perlmiutter, & Trabasso, 1979). The suggestion, by Freeman (1980), that young children omit parts because they forget them has been discounted. Boyatzis, Michaelson, and Lyle (1995) found that body part identification prior to obtaining figure drawings did not alter young children's inclusions of features.

Developmentally, it is well documented that increasingly more elements are added to the human figure as the child matures (Goodenough, 1926; Koppitz, 1968) and that core features (e.g. roof on a house) are depicted earlier than are peripheral features (e.g. chimney; Boyatzis et al., 1995; Picard & Vinter, 2005). Some children, however, continue to omit essential elements (e.g. mouth, eyes, and hands) well past the age where it would be considered developmentally appropriate. Poor integration of essential features is also common for very young children although this tendency appears to become developmentally inappropriate quite early.

As previously mentioned the adult literature suggests that simplified and poorly integrated drawings are characteristic of individuals with cerebral damage. As Lezak (1995) points out, many of individuals with left sided lesions produce sparse drawings frequently lacking important components while damage to the right hemisphere can lead to drawings that are very elaborate and detailed but fail to "*hang together*".

Whether or not failures in drawing are associated with various forms of learning disabilities has not been investigated. One might hypothesize that children experiencing language impairments might present in a similar fashion to adults with left hemisphere lesions (i.e. omitting details) while those with non verbal learning disabilities, a presumed failure of right hemisphere functioning, may have difficulty integrating body parts to form a whole.

In addition, since omissions in children's drawings have not been examined from a neuropsychological perspective it is unclear if failures to include essential details represent a failure of initial encoding or retrieval from verbal and/or visual memory and whether or not performance improves when drawing to a model. In a study by Cox and Maynard (1998) the figure drawings of children with Down's syndrome did not improve over baseline when they were presented with a model while the drawings of mental age-matched controls showed improvements. The authors concluded that children with Down's syndrome manifested a different developmental pattern in drawing ability compared to those of typically developing children. Might the same be true of children with learning disabilities? Related to this is the finding that although drawing to a model improves the performance of adults with left hemisphere damage this is not the case for those with right cerebral damage (Lezak, 1995).

**Slanted Figures/Rotations** - The production of slanted figures is commonly interpreted as evidence of insecurity. However, the link of slanted figures to impaired cognitive functioning appears to be a more parsimonious explanation. Jordan (1970) reports on the case of a 9-year old boy with a history of encephalitis resulting from chicken pox two years prior to testing for poor school achievement and conflicts.

Although some elements of the testing protocol were suggestive of residual encephalitis the results of the House-Tree-Person drawing task were remarkable in their appearance with all three drawings tilted approximately 30 degrees to the right. Jordan, however, interprets this graphic feature from a psychodynamic viewpoint, claiming that the child was "*feeling off balance*" due to his illness.

Koppitz (1966a, 1966b) found that slanted figures frequently occurred not only in the figure drawings of children identified as emotionally disturbed or academically challenged but also in those with documented brain damage.

Although these studies suggest a link between figure rotation and brain damage a study by Weiss (1971) provides some evidence that this feature may also be linked to development. The tendency to rotate Bender-Gestalt figures was examined in a large group of third, fifth and seventh grade school children. Although overall rotations were uncommon it was most frequently observed in third graders. S. Martin, Turnbull and Venneri (1999) also report on two children over the age of 7-years who spontaneously rotated the Rey-Osterreith Complex Figure with no other cognitive impairments evident during extensive testing.

### *Developmental Disorders*

Although there are a number of developmental disorders, such as Williams syndrome (Dykens, Rosner, & Ly, 2001; Stiles, Sabbadini, Capirci, & Volterra, 2000), Turner syndrome (Alexander, Ehrhardt, & Money, 1966), autism (Thomas & Silk, 1990), Tourette syndrome (Schultz et al., 1998) and non-verbal learning disabilities (Pennington, 1991) with co-occurring constructional and graphomotor impairments as well as emotional/behavioral disturbances this study will focus on children diagnosed with

ADHD and/or specific language impairment.

### *Attention Deficit Hyperactivity Disorder*

ADHD is a neurodevelopmental disorder of early onset that is characterized by age-inappropriate and impairing levels of hyperactive, inattentive and impulsive behaviors (Durston, 2003). Prevalence rates for ADHD fluctuate widely depending on both sample selection and diagnostic method necessitating the formulation of a consensus estimate that 3% to 5% of school-age children have sufficient impairment to warrant the diagnosis (APA, 1994).

***Diagnosis of ADHD*** - A diagnosis of ADHD requires not only the presence of behaviors associated with the disorder but that these symptoms appeared early in the course of the child's development and that they be pervasive across situations.

**Core Features** - Inattention, hyperactivity and impulsivity are the core features of ADHD. Attention is a multidimensional construct referring to arousal, alertness, selectivity, sustained attention or distractibility. Children with ADHD are frequently described as being *"in a fog", "unable to concentrate"* and *"confused"* (Barkley, DuPaul, & McMurray, 1990) with inattentive behaviors observed in both free-play and in classroom settings (Abikoff, Gittelman, & Klein, 1980; Routh & Schroeder, 1976), although empirical evidence remains inconsistent. Barkley (1998) describes the distractibility experienced by children with ADHD as a lack of persistence or a failure in sustained responding to tasks having little intrinsic appeal, minimal consequences for noncompliance or a delay in reward.

Hyperactivity is considered to be present when a child exhibits developmentally inappropriate levels of motoric or vocal activity that are irrelevant to the task at hand.

Empirically, increased motor activity of the head (Teicher, Ito, Glod, & Barber, 1996); ankle and wrist (Barkley & Ullman, 1975); and total body movements (Dane, Schachar, & Tannock, 2000) have all been demonstrated to differentiate hyperactive children from normal controls.

Impulsivity in ADHD is a failure to inhibit inappropriate responses rather than a heightened sensitivity to reward (Barkley, 2003). Qualitatively, impulsive children often respond before listening to instructions or make careless errors, while quantitatively impulsivity is often operationalized as rapid, inaccurate responding (Barkley, 1998).

When parent and teacher checklist responses regarding a child's inattentive, impulsive and hyperactive behaviors were submitted to factor analysis, a two-factor solution generally emerges (DuPaul et al., 1997; Lahey et al., 1994). One factor was associated with inattentive behaviors while the other was related to hyperactivity and impulsivity, which collectively have been referred to as disinhibition.

**Symptom Assessment** - Currently, there is no objective measure that definitively identifies the presence of ADHD. Diagnosis relies on historical data regarding the behavioral manifestations, age of symptom onset and the degree of functional impairment since direct observations can often be misleading (Dulcan & Benson, 1997).

The presence and severity of symptoms are assessed using rating scales completed by both the child's parents and teacher. Unfortunately, research consistently demonstrates low parent – teacher agreement for evaluating specific symptoms, identifying the presence of ADHD or for determining subtype (Amador-Campos, Forns-Santacana, Guàrdia-Olmos, & Peró-Cebollero, 2006; Gadow et al., 2004; Mitsis, McKay, Schulz, Newcorn, & Halperin, 2000). Attempts to correlate neuropsychological measures

with behavioral ratings have met with limited success (Marks, Himelstein, Newcorn, & Halperin, 1999).

**Age of Onset** - The requirement of onset prior to 7-years of age reflects both the developmental nature of the disorder and helps to distinguish ADHD from other conditions which often manifest with a similar cluster of symptoms but tend to emerge later in childhood. There is also evidence that age of onset is related to the severity with children experiencing impairing symptoms before age 6-years tending to have a more persistent and severe form of the disorder (McGee, Williams, & Feehan, 1992).

**Pervasiveness of Symptoms** - In order to mitigate situational reactions and rater bias, pervasiveness of impairment must be demonstrated. Although conceptually this criterion is an improvement from previous diagnostic requirements (e.g. DSM-III) it is also problematic since agreement between raters is generally quite poor (Amador-Campos et al., 2006). This low inter-rater reliability may be due to inherent differences between raters or the fact that dissimilar situations (home vs. school) entail varying behavioral expectations of the child. Compounding the problem is that observations by the clinician may not be a true representation of the child's usual activity level or attentiveness (Dulcan & Benson, 1997).

The difficultly in obtaining agreement between raters is highlighted in an early epidemiological study where prevalence rates dropped to 1.2% when agreement was required across three raters (parent, teacher and physician; Spreen, Tupper, Risser, Tuckko, & Edgell, 1984). As Barkley (1998) notes, the difference between "*one-rater*" and "*multiple-rater*" ADHD may be a function of severity rather than being indicative of the presence of the disorder.

***ADHD Subtypes*** - Three subtypes of ADHD are recognized: ADHD: Predominantly Inattentive Type (ADHD:I); ADHD: Predominantly Hyperactive /Impulsive Type (ADHD:H) and ADHD: Combined Type (ADHD:C). Despite the clinical difficulties associated with subtyping (Mitsis, et al., 2000) some cognitive, behavioral and social differences have emerged.

In general, symptoms of hyperactivity/impulsivity emerge earlier than inattentiveness. Children categorized as ADHD:I or ADHD:C are more likely to experience academic problems with the inattentive subtype associated with higher rates of language difficulties (Tirosh & Cohen, 1998; Weiss, Worling, & Wasdell, 2003) and executive deficits being more prevalent in the combine subtype (Klorman et al., 1999). Behaviorally, internalizing problems and social withdrawal are more frequent for children with ADHD:I (Lahey, Schaughency, Hynd, Carlson, & Nieves, 1987) while externalizing behavioral problems are more commonly observed in those with ADHD:C (Gadow et al., 2004; King & Young, 1982).

Differences in age of onset and cognitive/behavioral profiles have led some to consider ADHD:I to be a fundamentally different disorder (Milich, Balentine, & Lynam, 2001). However, a longitudinal study examining symptom stability demonstrated considerable shifting across subtype classification (Lahey, Pelham, Loney, Lee, & Willcutt, 2005).

***Neuropsychological Profile of ADHD*** - A number of neuropsychological profiles have been associated with ADHD. Two of the most common are deficits in executive function and right hemisphere dysfunction.

**Deficits in Executive Functions** - The premise that symptoms associated with

ADHD are related to frontal lobe dysfunction has been based on the observation that both humans and animals with anterior lesions often exhibit inattention, distractibility and hyperactivity (Pennington & Ozonoff, 1996).

Integrity of the frontal lobes is necessary for a diverse range of cognitive and meta-cognitive abilities collectively referred to as executive functions (Lezak, 1995). Although there are numerous ways of defining the executive construct, most consider it to encompass initiation, planning, shifting of thought or attention, organization, inhibition of inappropriate responses and sustained or sequenced behaviors necessary for the execution of purposeful, goal-directed behaviors (V. A. Anderson, 1998; Mahone et al., 2002).

When discussing performance on tasks identified as tapping frontal lobe functions it is important to consider that most rely on the integrity of a multitude of cognitive domains and their subcomponents. In addition, the developmental trajectories of "*elemental*" abilities across cognitive domains are unequal as are the executive functions monitoring these abilities. Generally, executive abilities are thought to be the last to develop and may be inextricably associated with the gradual maturation of language, attention, processing speed and memory (V. A. Anderson, 1998).

Keeping these caveats in mind, individuals with ADHD have been found to have deficiencies in a wide range of tasks mediated by the frontal lobes including attention (Boucugnani & Jones, 1989), verbal and nonverbal working memory (Martinussen, Hayden, Hogg-Johnson, & Tannock, 2005), mental computations (Murphy, Barkley, & Bush, 2001), time discrimination and reproduction (Bauermeister et al., 2005), adhering to instructions (Danforth, Barkley, & Stokes, 1991), applying self-

monitoring strategies (C. Clark, Prior & Kinsella, 2000) and social functioning and emotional regulation (Maedgen & Carlson, 2000) although there are significant inconsistencies as to the nature and scope of these impairments.

Barkley (1997) believes the behavioral deficiencies observed in ADHD can be explained by a single core executive deficit, lack of inhibitory control. Others, however, have argued that the behavioral and cognitive dysfunction appears to be more widespread. It is also repeatedly demonstrated that not all children with ADHD exhibit executive impairments and there has been a fair degree of inconsistency in the type of impairment observed. As Willcutt and colleagues (2005) pointed out, "…*executive function deficits are neither necessary nor sufficient to cause all cases of ADHD*" (p. 1343).

**Right Hemisphere Deficits** - In 1988, Voeller and Heilman reported that boys with ADHD tended to miss visually presented targets occurring on the left side of the page. They speculated that some children with ADHD have a developmental form of left unilateral neglect. Subsequently, others have demonstrated a right-sided bias for visually presented stimuli in children with ADHD (Dobler, Manly, Verity, Woolrych, & Robertson, 2003). Findings have included relatively slower reaction times for left- verses right-sided computer generated, visually presented stimuli (McDonald, Bennett, Chambers, & Castiello, 1999; Nigg, Swanson, & Hinshaw, 1997), right-sided shifts on line bisection (Sheppard, Bradshaw, Mattingly, & Lee, 1999) as well as left-sided inattention on cancellation tasks in both children (Malone, Couitis, Kershner, & Logan, 1994) and adults with this disorder (Sandson, Bachna, & Morin, 2000). These findings, however, were by no means universal. Ben-Artsy, Glicksohn, Soroker, Margalit, &

Myslobodsky, (1996) failed to demonstrate left-sided neglect on either a cancellation or line bisection task in a well defined group of children with ADHD.

Clock face drawing ability, a well-established test of spatial neglect in elderly populations, has also been assessed in individuals with ADHD. Stern and colleagues (1998 as cited in Kibby, Cohen, & Hynd, 2002) reported that children with ADHD performed significantly below developmental expectations for sequencing and positioning of numbers independent of visuospatial and visual motor integrative performance with errors in number placement occurring more frequently in the disordered group. However, when children with ADHD were provided with anchoring numbers of 3, 6, 9, and 12 their constructions improved dramatically suggesting that the errors in the free drawings were due to planning rather than visuospatial deficits. Kibby, Cohen and Hynd (2002) also found clock-drawing deficits in children with ADHD. Neglect, defined as omission of numbers from a quadrant, although not observed in typically developing children 7-years of age and older was observed in the drawings of children with ADHD up until 8-years of age. In those evidencing "*neglect*" all omitted numbers were from the upper left quadrant with 67% neglecting both left quadrants while none neglected the right quadrants. This pattern was again interpreted as evidence of a planning deficit related to executive dysfunction rather than as a hemineglect associated with right parietal dysfunction. In addition, poor spacing of numbers, also considered a planning error, occurred to a greater extent in the ADHD group.

***Comorbidity*** - An important component in the diagnosis of ADHD is the assessment of comorbidity since it is estimated that 50% to 70% of these children also evidence one or more coexisting conditions (Pennington & Ozonoff, 1996). In fact,

comorbidities are so pervasive that it has been considered rare to find a child with "*pure*" ADHD (Voeller, 2004). The more common co-occurring psychiatric disorders include Oppositional Defiant Disorder and Conduct Disorder (Barkley, Fischer, Edelbrock, & Smallish, 1990) while major affective disorders, anxiety disorders, Obsessive Compulsive Disorder and Tourette's syndrome are present at rates higher than those observed in the general population (Masi et al., 2006; Sverd, Curley, Jandorf, & Volkersz, 1988).

**Comorbidity of ADHD and Language Impairment** - Moderate to severe language deficits are observed in 28% (N. Cohen, Davine, & Meloche-Kelly, 1989) to 97% (Camarata, Hughes, & Ruhl, 1988) of children whose primary referral is for emotional or behavioral disturbances. In a systematic narrative review of twenty-six studies examining the prevalence of language disorders in children first identified as emotionally or behaviorally disturbed, Benner, Nelson, & Epstein (2002) calculated an average co-occurrence rate of 71%.

Most disturbing is that many of these children's speech and language problems go undetected (N. Cohen, Davine, Horodezsky, Lipsett, & Isaacson, 1993; Giddan, Milling, & Campbell, 1996). This is highlighted by Cohen and colleagues (1993) who reported that over 30% of children referred for mental health services had previously unidentified moderate to severe language impairments.

When children with ADHD are isolated from those with other forms of behavioral or emotional disturbance high rates of co-occurring language difficulties remain. In a study of children referred for mental health services, 45% who were diagnosed as having ADHD (DSM-III R criteria) also exhibited at least one compromised language function

(Tirosh & Cohen, 1998). The types and rates (not mutually exclusive) of impaired language functions independent of IQ performance and sex observed in this sample included: vocabulary (10%); syntax (26%); impaired reading fluency (29%); text recall deficits (27%); and pragmatic difficulties (16%).

**Coexisting Motor Deficits and ADHD** - Many children with ADHD evidence impaired development of motor functioning (Barkley, 1998) with 8% to 52% having severe enough impairments to also meet criteria for developmental coordination disorder (Foulder-Hughes & Cooke, 2003; Parry, 1996).

Although there has been contradictory evidence for delays in crawling and walking (Barkley, 1998) relatively consistent gross (Harvey & Reid, 1997; Yochman, Ornoy, & Parush, 2006) and fine motor control (Foulder-Hughes & Cooke, 2003; Steger, et al., 2001; Whitmont & Clark, 1996) as well as sensory-motor integration (Iwanaga, Ozawa, Kawasaki, & Tsuchida, 2006) and bimanual coordination problems (Klimkeit, Sheppard, Lee, & Bradshaw, 2005) have been reported, with complex motor tasks requiring sequenced responses often considered the most severely affected (Meyer & Sagvolden, 2006).

Children with varying subtypes of ADHD appear to be differentially affected since those with the Combine type were more severely impaired on tests of dexterity and gross motor coordination compared to the Inattentive type (Meyer & Sagvolden, 2006). It remains unclear, however, whether motor deficits are secondary to inattention and impulsivity or are the direct result of motor programming and control issues (Doyle, Whalen, & Whitmont, 1995).

***Drawing Ability in Children with ADHD*** - Particularly relevant for this

discussion is that graphomotor ability in children with ADHD has been found to be deficient (Barkley, 1998; Marcotte & Stern, 1997; Schoemaker, Ketelaars, van Zonneveld, Minderaa, & Mulder, 2005) and although stimulant medication has been found to improve qualitative aspects of handwriting, such as legibility and accuracy of form, they did so at the expense of fluency of motion (Tucha & Lange, 2001; Tucha & Lange, 2004).

Studies examining drawing ability in children with ADHD have been limited but the Bender-Gestalt (Allen, 2005; Raggio, 1999) and the Rey-Osterreith Complex Figure Test routinely demonstrated impaired performance for children (Cahn et al., 1996; Raggio, 1999) as well as adults with the disorder (Schreiber, Javorsky, Robinson, & Stern, 1999). Performance deficits, rather than being related to perceptual and/or constructional deficiencies, were primarily described as executive failures and include poor attention to detail (Cahn et al., 1996), faulty planning and organization (Olsen, 1997) and lack of overall "*neatness*" (Cahn et al., 1996; Schreiber et al., 1999).

Unfortunately, most of the studies that document gross and fine or graphomotor deficits in children with ADHD have inadequately controlled for co-occurring language impairments. As will be discussed, children with developmental language deficits also have higher than expected rates of motoric difficulties. One notable exception, a study conducted by Kooistra, Crawford, Dewey, Cantell, & Kaplan (2005), examined children with "*pure*" ADHD or reading disability as well as ADHD children with comorbid Oppositional Defiant Disorder and reading disability. Only those with reading disability, suggestive of an underlying language disorder, were found to have impaired motor control while the performance of children with "*pure*" ADHD was comparable to

typically developing controls.

### *Specific Language Impairment*

Specific language impairment (SLI) is defined as "*slow, limited or otherwise faulty development of language in children who do not otherwise give evidence of gross neurological or psychiatric disability, and where language difficulty is not due to deafness*" (Bishop, 1997 p. 21). Prevalence estimates for SLI range from 1% to 19% for preschool to elementary school-age children with boys consistently found to be affected in greater numbers than girls in both clinical and community samples (Tomblin et al., 1997).

***Diagnosis of SLI*** - Defining SLI has proven to be challenging since it remains elusive as to where to draw the boundary between normal and deviant communicative ability. One of the first attempts to standardize the diagnosis of SLI was made by Stark and Tallal (1981) and although their criteria continue to be standard practice it has not been without critics (Bishop, 1997; M. Lahey, 1990; Plante, 1998). Reliance on age-equivalence scores, relatively high Performance IQ cut-offs, utilization of statistical deviance without acknowledging the importance of functional impairment and the exclusion of reading impaired or behaviorally problematic children have been found to make the criteria overly restrictive.

Some of these concerns have been addressed in the current DSM-IV although reliance on questionable psychometric practices such as cognitive referencing (Plante, 1998) and problems regarding exclusionary criteria remain (Bishop, 1997).

***Subtypes of SLI*** - Heterogeneity in the linguistic profiles of children with SLI is considerable with differing patterns observed in expressive and mixed receptive/

expressive language processing in the areas of phonology; morphology and syntax (grammar); vocabulary development; word finding; higher order functions such as narrative recall and production; and pragmatics (Friel-Patti, 1999). The DSM-IV recognizes three subtypes of developmental communication disorders: Expressive Language Disorder, Mixed Receptive/Expressive Disorder and Phonological Disorder (APA, 1994). This classification system, however, was derived by consensus and therefore has more to do with distinctions that were widely accepted rather than identifying features most relevant for clinical, research or intervention purposes. Additionally, the sharp distinction between receptive and expressive impairments are not as common in children as they appeared to be in aphasic adults, since most children with SLI, including those with primarily expressive problems, have been found to have some degree of impaired comprehension (Bishop, 1997).

***Neurobiology of SLI*** - Although both hemispheres appear to be involved in language processes it has been well established that the left hemisphere plays a dominant role in the majority of normal right-handed adults. Sex also impacts on language with females demonstrating less dramatic laterality (Foundas, 2001).

Similarities in the deficits observed in the developmental forms of language impairments to those of adult aphasics led early researchers to hypothesize the existence of structural differences or cortical lesions as a possible common etiology. This hypothesis has been tested primary using two methodologies, assessing language ability in children with documented cortical damage in areas associated with language or by identifying neural lesions in children with language deficiencies (Bishop, 1997). To date, neither of these approaches has yielded definitive results.

**Early Cerebral Injury** - Children who experience *in utero* or very early damage to the left cerebral hemisphere do not go on to develop severe language impairments. In cases of early left hemisphere damage, both plasticity and cerebral reorganization allow language development to be relatively spared at the expense of right hemisphere visual-spatial abilities (Nass, Peterson, & Koch, 1989). Language, however, is not totally unaffected in children with early left hemisphere damage since delays in babbling, communicative gestures and single words are common (Rapin, 1996) as well as persistent although subtle deficits in processing complex syntax (Bishop, 1997).

Left hemisphere damage later in childhood tends to produce a milder and a more varied clinical picture compared to adults suffering the same damage (Rapin et al., 1992). While left subcortical axonal damage in children leads to more persistent deficits (Aram & Eisele, 1992) localized cortical lesions produce a clinical picture grossly similar to that seen in adults, with more frontal lesions producing expressive impairments and posterior lesions affecting comprehension.

That children's language functions are largely spared in cases of early cerebral insult is considered evidence that SLI is not routinely etiologically related to a peri- and post-natal neurological insult (Bishop, 1997).

**Evidence of Cerebral Pathology in SLI** - Another approach has been to link SLI with lesions or structural malformations in areas similar to those that give rise to aphasia in adults. Studies employing computerized tomography (Rosenberger & Hier, 1980; Harcherik et al., 1985) and MRI techniques (Jernigan, Hesselink, Sowell & Tallal, 1991) consistently have found no evidence of gross structural pathology in well-selected groups of children with impaired language functioning.

Although no gross tissue abnormalities have been uncovered, neural imaging has revealed distortions in the expected patterns of cerebral asymmetry, primarily in the plana temporale, an area comprised of both the primary and secondary auditory cortices. In a landmark post mortem study, Galaburda, Sherman, Rosen, Aboitiz, & Geschwind (1985) found symmetry of the plana temporales in four adults males diagnosed with developmental dyslexia. This region is typically found to be larger in the left hemisphere due to its presumed association with language functioning. The equality in size of the plana temporales was due to the left being unusually small while the right was larger than normal. This unusual pattern of symmetry was later replicated in a post mortem study of a single child with SLI (M. Cohen, Campbell, & Yaghmai, 1989) and most recently in a series of MRI studies conducted by Plante and colleagues (Plante, 1991; Plante, Swisher, & Vance, 1989; Plante, Swisher, & Vance, 1991).

To date, differences in the usual pattern of asymmetry have been found in the perisylvian region and the smaller area lying within it, the plana temporale. These findings suggest a lack of left dominance for language (right > left) or lack of dominance (left = right). However, as Leonard (1998) points out in his review of the neurobiological literature, "… *the correspondence between atypical configurations and language status was certainly not perfect*." He goes on to write, "…*these atypical findings imply a constitutional basis that may contribute to the later development of SLI but as of now cannot be considered a total explanation for the development of this disorder*."

***Co-occurring Impairments Commonly Associated with SLI*** - The label of SLI is a misnomer since it is well recognized that these children suffer from a plethora of limitations that may be directly and indirectly related to their deficient communicative

abilities. Observed co-occurring impairments include attention and perceptual problems (Powell & Bishop, 1992); short-term and working memory deficiencies which although largely confined to the verbal domain (Archibald & Gathercole, 2006; Van der Lely, & Howard, 1993) have been demonstrated for nonverbal stimuli (Bavin, Wilson, Maruff, & Sleeman, 2005); nonverbal cognitive deficits as represented by significant declines in PIQ scores with maturation (Botting, 2005; C. J. Johnson, et al., 1999); and motor impairments (Mandelbaum, et al., 2006).

**Coexisting Emotional and Behavior Disturbances** - In addition to the more cognitively based impairments, children with communication deficits have an unusually high rate of co-occurring emotional and behavioral problems with prevalence estimates ranging from 50% to 70% (Aram, Ekelman, & Nation, 1984; Beitchman, Nair, Clegg, Ferguson, & Patel, 1986; Cantwell, Baker, & Mattison, 1979; Stevenson, Richman, & Graham, 1985). The high co-occurrence of language and behavioral problems has been observed in both clinic-referred (Cantwell, Baker, & Mattison, 1981) and community samples (Beitchman et al., 1996) across all age groups (Cantwell, Baker & Mattison, 1980; Caulfield, Fischel, DeBaryshe, & Whitehurst, 1989) including young adults (Beitchman, Wilson, Johnson et al., 2001).

Some observed that the more global and severe the SLI the more serious the co-occurring emotional and behavior problems (Cantwell & Baker, 1987a; Cantwell & Baker, 1987b). Others, however, found that neither the type nor the severity of the language impairment was predictive of psychopathology and improvements in communication skills at long-term follow-up were unrelated to changes in psychiatric status (Beitchman, Hood, Rochon, Peterson, 1989).

Problem behaviors commonly observed in children with impaired communication ability include general immaturity, hyperactivity, impulsivity, inattention (Gallagher, 1993), aggression, conduct disorders, social withdrawal, depression and anxiety, poor self-esteem (Jerome, Fujiki, Brinton, & James, 2002), impaired peer relationships (Gallagher, 1993) and increased victimization (Conti-Ramsden & Botting, 2004). Although children with poor articulation appeared to fare better than those with combined speech and language problems (Baker & Cantwell, 1992; Beitchman et al., 1989), those with pure speech impairments evidenced increased rates of somatic complaints in addition to elevated social and behavioral problems when compared to typically developing peers (Baker, Cantwell, Mattison, 1980; McCabe, 2005).

ADHD is the most common psychiatric diagnosis given to children who first present with SLI (Cantwell & Baker, 1991). When children with Oppositional Defiant Disorder and Conduct Disorder were added to those with ADHD, a total of 26% of SLI children evidenced disruptive behaviors. This association does not diminish with maturation. Beitchman, Wekerle, and Hood (1987) found that although 32% of children with language impairments received a co-diagnosis of ADHD, at follow-up the rate had increased to 48%.

**Coexisting Motor Problems** - Hill (2001) believed coexisting fine and gross motor impairments were the rule rather than the exception in children with SLI while Estil, Whiting,Sigmundssun and Ingvaldsen (2003), using a carefully identified sample, reported a co-occurrence rate of approximately 50%.[5] In a review of studies linking motor ability in children with SLI, gross motor difficulties were largely restricted to

[5] Hopping, line walking and balance are frequently used to assess gross motor capabilities while peg moving, finger opposition and bead threading are typically used to assess fine motor performance.

difficulties in coordination and balance while deficits in fine motor movements were related to speed rather than accuracy (Hill, 2001).

Studies examining the association of motor deficits with specific subtypes of language have been limited. Children with comprehension and formulation difficulties performed significantly better on tasks of fine motor ability compared to those who were primarily expressively impaired (Wiznitzer, Rapin, & Allen, 1986). However, even though impaired, children with SLI performed better on motor tasks and exhibit superior adaptive motoric ability compared to low functioning children with or without autism. Motor capabilities also appeared to improve with maturation (Bishop & Edmundson, 1987).

Theories as to why language and motor problems co-occur in the same child abound and although certainly more nuanced can be broadly categorized as caused by delayed neuromaturational development (Locke, 1997); general cognitive slowing (Kail, 1994) and more specifically information-processing capacity deficit (Hill, 2001); or impaired cerebellar functioning (Diamond, 2000).

***Drawing Ability in Children with SLI*** - Drawing ability in children with SLI has not generated much research interest, even though deficits in nonverbal working memory (Hoffman & Gillam 2004) and graphomotor ability have commonly been described. However, a small literature on the graphic representation in adults with aphasia does exist. Rumble and Whurr (1998) examined five graphic features previously identified as common in aphasic individuals' drawings: small size, placement on the left-side of the page, reduced detail, right-field neglect and mixed perspective using the GH-DAM and Draw a Clock tasks. All aphasic participants made errors in their drawings, the most

frequent being reductions in detail, reduced size and left-sided placement. Drawing previously presented objects was also found to be impaired in aphasic adults compared to normal controls even after constructional apraxia was controlled, suggesting retrieval and/or visual working memory impairments were common (Gainotti, Silveri, Villa, & Caltagirone, 1983).

Another approach is to review what is known regarding the graphic abilities of individuals with learning disabilities (LD) since this group is comprised largely of children with language impairments. Impaired performance on drawing tasks was a common finding in children with LD whether cognitive (Carter, 1973; Colligan, 1967; Prewett, Bardos, & Naglieri, 1988) or "*projective*" scoring (Bachara & Zaba, 1976; Bachara, Zaba, & Raskin, 1976; Eno, Elliott, & Woehlke, 1981; Koppitz, 1968) was used.

Examining cognitive differences, children with LD scored significantly lower on the DAP:QSS than typically developing peers on their self-drawings and total drawing scores but not on those obtained for either the drawings of a man or woman. Across groups, the DAP:QSS scores were significantly correlated with composite reading scores but not with composite math scores (Prewett et al., 1988) suggesting an association between depressed drawing performance and language functioning. Cox and Cotgreave (1996) compared the figure drawings of children with mild LDs to those matched for either chronological or mental age. The LD group received comparable Koppitz developmental scores, as did mental age-matched controls with both groups scoring significantly lower than chronological age-matched controls. Therefore, rather than displaying a deviant pattern, the children with LDs evidenced a slower developmental

trajectory in their figure drawing ability.

Examining figure drawings from a projective standpoint, children classified as LD included significantly more omissions of hands and feet while paying particular attention to the eyes in their figure drawings compared to typically developing controls matched for sex and age (Bachara et al., 1976). These findings were interpreted from a purely projective standpoint and were felt to be indicative of increased levels of "*helplessness*". Interestingly, LD classification was based on the child's performance on tasks of visual-motor integration (e.g. Beery) which presented a significant confound.

Eno et al. (1981) examined Koppitz's EIs in the drawings of school-age children referred for psychological testing. Children were identified as LD, educationally handicapped (ED), behaviorally disordered (BD) or requiring no additional referrals (i.e. presumed to be "*normal*"). Referred children (LD, EH and BD) included significantly more EIs in their figure drawings when compared to those produced by non-referred children. Indicators that discriminated the referred from the "*normal*" group were shading of face, gross asymmetry of limbs, teeth, long arms and no body. EIs associated with each of the referred groups were also examined with only the indicators, no neck and crossed eyes, associated with LD reaching significance. Using a discriminate function analysis, 82.2% of non-referred children were correctly classified, as were 45.6% of referred children for an overall correct classification rate of 63.72%. Additionally, drawings were sorted using gross inspection and overall raters demonstrated a poor ability to discriminate drawings made by referred verses non-referred children. However, the criteria used to classify children were not reported nor was any explanation given as to why "*normal*" children were referred for psychological

testing. Methodological flaws once again made interpretation of the findings suspect.

A study by Cox and Catte (2000), although not directly applicable to the topic of LD, is relevant since unlike Bachara and colleagues (1976) they recognized that graphic ability presents a significant confound in studies of drawings. They hypothesized that unusual figure drawings were really just poor drawings. Their control for this confound, however, was questionable. Severely emotionally disturbed boys were matched to well-adjusted peers based on the scores obtained on the GH-DAM. This matching was done to control for differences in drawing ability between the clinical and control groups. Next, each figure drawing was scored for the presence of Koppitz's EIs with no significant differences in the number of EIs found between groups. However, there was significant overlap between items scored on both the GH-DAM and EIs (e.g. omissions). Cox and Catte recognized this confound and removed overlapping items from the EI list, reducing 30 items to 13 with many of the remaining items being those that have been found to occur very rarely in any drawing (e.g. grotesque figures, multiple figures). In attempting to control for drawing ability, the technique used by these researchers unfairly biased the dependent variable.

In a second experiment, naïve raters were unable to discriminate the figure drawings matched for GH-DAM scores made by emotionally disturbed boys from controls (Cox & Catte, 2000). Once again, although there is evidence that novice raters were no different than "*professionals*" in evaluating drawings there are those that have found this not to be the case. In fact, as previously discussed, training does not appear to be as important as an empathic approach to figure drawing analysis. Of some note in this

regard is that one of Cox and Catte's naïve raters was able to sort the drawings at better than at chance levels.

Overall, the research on the figure drawings of children with LD is disappointing both on methodological was well as on theoretical grounds. Koppitz's original work in this area remains the most enlightening. In a series of studies Koppitz (1966b, 1968) consistently found that whether scored for developmental level or number of EIs, children with learning problems performed poorly compared to typically developing peers. The figure drawings of children identified as brain injured, academically challenged or behaviorally disturbed demonstrated large areas of overlap regarding the EIs contained in their drawings suggesting that this scoring technique was sensitive to generalized developmental disturbances but was rather nonspecific. For this mixed group of children, the greatest difficulties appeared to be with integration, slanting figures, hands cut-off or shaded and omission of various body parts. These were also some of the features commonly observed in the figure drawings of neurologically impaired adults.

Koppitz's interpretation of her findings was primarily psychoanalytically driven, although she did recognized that organic impairments might be the underlying reasons that academically and behaviorally impaired children included an increased number of EI's into their figure drawings. Based on improvements in diagnosis and a better appreciation of the high rates of comorbidity in developmental disorders one can only assume that if this investigation were replicated today there might be an even greater degree of overlap in EIs observed across groups. Finally, Raskin and Pitcher-Baker (1977) examined the K-FDs of children with LD compared to those of typically developing peers. Children were classified as LD based upon scores obtained for either

the Beery-Visual Motor Integration Test or the Martin Screening Test for Motor Disabilities. The K-DFs were scored for 1) *Isolation/Rejection*, defined as separation of family members; 2) *Body Concern*, defined as poor integration of body parts, inclusion of conflict indicators, omissions or exaggerations of body parts; and 3) *Sibling Rivalry*, indicated if aggressive or competitive behaviors directed towards siblings were depicted. Significant differences were found between groups for *Isolation/Rejection and Body Concerns* while comparable scores for Sibling Rivalry were obtained. The overall conclusion was that projective drawings demonstrated sensitivity in for screening for emotional disturbances in LD populations. Unfortunately, children were identified as LD based on poor performance on a drawing task so that the only conclusion one can safely derive is that depressed graphomotor or visual-motor integration leads to poorly drawn figures. Since there was no independent measure of emotional disturbance, the LD group's higher *Isolation/Rejection* scores, although compelling, was certainly not definitive evidence that these children suffered from elevated rates of disenfranchisement relative to typically developing peers. However, if one presumes there were no underlying cognitive or motoric reasons for children with LD to include "*barriers*" in their K-FDs one can start to imagine that there were some elements of drawings that were truly projective in nature.

## Conclusions

In reviewing the literature on children's figure drawing one cannot help but be reminded of the popular Indian fable about six blind men describing an elephant. As each examined a different part of the animal, they argued whether it was most like a fan, a tree, a snake, a spear, a wall or a rope. All were correct in their limited descriptions yet

none grasped the true nature of an elephant. The same can be said regarding children's drawings. It is clear from the literature that drawings tell us something about a child's intellectual abilities as well as his or her emotional status but maturational, cognitive and psychodynamic viewpoints each, in and of itself, fails to provide a full explanation as to why a child might represent the human form in an idiosyncratic manner.

Except in very rare circumstances, the internal representation of the human form and the ability to graphically depict that image requires the integrity of motor, visual spatial, language, memory, creative and executive abilities, with limitation in any of these areas likely to influence graphic productions. Therefore, children with specific cognitive impairments frequently do poorly on figure drawing tasks for different reasons. One child may have difficulty with the graphomotor aspects of the task; another may be unable to recall all the parts of the body, while still another may have difficulty organizing what he or she knows to be true into a coherent whole. Some of these children, nonetheless, perform well on tasks of general intelligence while others do not, leading to the rather modest correlations that have been observed between scores obtained for figure drawing tasks with those obtained from more valid measures of cognitive ability.

The harshest criticism for the use of drawings as an assessment instrument is reserved for its use as a projective instrument. Although overwhelming evidence does not exist for the relationship of drawings and personality, significant associations between certain graphic features and behavior have been found across varying methodologies in both clinical groups as well as in typically developing children. These findings cannot be entirely discounted. What is relatively clear is that many emotionally

disturbed children tend to draw poor quality human figures compared to their peers. The dilemma remains whether these poorly executed drawings are the result of a "*projection*" of internal conflict or are graphic deficiencies observed across differing drawing tasks?

As discussed, many children identified as emotionally and behaviorally disturbed have coexisting motor and cognitive impairments. "*Pure*" disorders in children are the exception rather than the rule with sharp distinctions between disorders often an artifact of clinical orientation, pragmatic necessities of research and current diagnostic practices (Gilger & Kaplan, 2001; Hill, 2001).

The following study makes no attempt to tease apart the nature of the causal relationship that exists between "psychological" and "cognitive" but is rather based on the premise that these disorders are bidirectional as well as multidimensional, coexisting in the majority of children who come to the attention of various professionals. As Botting (2005) succinctly wrote, "*diagnosis captures a child's needs at a given time.*"

Even though many of the usual features that troubled children incorporate into their drawings such as omissions, poor integration and asymmetries may be driven by neuropsychological factors there are likely other elements that are representations of internal conflict or an inability to regulate arousal. It is hard to imagine reasons other than displaced aggression as to why a child might include teeth and fangs into their "*self*" drawings or the rejected, ambivalent child drawing barriers when graphically depicting his or her family. If this is the case, then the question becomes, is it possible to separate the neurologically driven elements of drawing from those that are more psychologically driven? The studies, which comprise this dissertation, are a broad first attempt at answering this question.

## Objectives and Specific Hypotheses

The studies that comprise this dissertation have two primary objectives. Since drawing is viewed as a complex task the following studies will attempt to delineate which graphic aspects of children's drawings are most closely tied to cognitive process, graphomotor ability or problematic behaviors recognizing that age and sex are important considerations. Obviously, the number of graphic elements that one could examine is quite large. Therefore the variables investigated have been limited to those associated with color, number of figures and use of space.

The second goal is to begin to identify elements of drawings that provide one with the ability to objectively evaluate a child's emotional and social functioning since currently reliable and valid assessment tools for use with children are limited.

### *The Use of Color*

#### *Hypothesis One*

Previous research has demonstrated sex differences in children's use of color. This study will attempt to replicate these findings in an ethnically diverse sample and predicts that girls will use more varied color in completing their drawings than boys.

#### *Hypothesis Two*

Unlike many graphic elements of drawings, it is proposed that color is a true projective feature and therefore will be relatively resistant to both a child's underlying cognitive functioning as well as graphomotor ability. A restricted color palette will be related to behaviors associated with depression and withdrawal while expanded use of color will be observed in children demonstrating behaviors indicative of poor affect

regulation.

To test this hypothesis, children will be grouped as "*Low*", "*Average"* or "*High*" color users and scores obtained on the CBCL will be compared between groups. Since it is also predicted that the use of color is modified by sex a separate analyses will be performed for girls and boys.

***Hypothesis Three***

Use of color in an unrealistic fashion is considered developmentally appropriate in very young children. Some have suggested that when children continue to use unrealistic color it is indicative of psychopathology. However, because unrealistic use of color is tied to developmental maturation, it would be expected that unrealistic color usage is more likely associated with cognitive delays. To examine the association of unrealistic color and cognitive ability children will be grouped as "*Realistic*", "*Mixed*" or "*Unrealistic*" based on their how they colored their Family and Peer drawings. Cognitive ability and behavioral ratings will be compared between groups. It is hypothesized that delayed development in the realistic use of color is associated with impaired cognitive ability and not associated with behavioral problems.

## *The Significance of Number of Figures*

***Hypothesis One***

Social skills are often compromised in children with developmental disorders. Few child-centered measures of this important adaptive function currently exist. It is predicted that the depiction of few if any friends in the Peer drawing will be positively correlated with the SSRS: Social Skills Rating Score as well as the Social Problems

subscale of the CBCL.

### *The Neuropsychological and Projective Nature of Use of Space, Figure Size and Scaling*

This dissertation will attempt to elucidate graphic elements of children's drawings, which are projective versus those that can more readily be explained as derivative of adaptive and neuropsychological functioning.

#### *Hypothesis One*

Lack of organization in drawing output has been linked to overall cognitive functioning. It is hypothesized that only the most cognitively impaired children will have difficulty drawing a coherently organized picture. Disorganized output would only weakly or indirectly be associated with problematic behaviors.

#### *Hypothesis Two*

Numerous studies using varying methodologies have found that children with ADHD are inattentive to the left half of space. However, preliminary analysis of the data revealed that few children in this sample made right of midline shifts. Alternatively, shifting to the left half of the page has been associated with impulsive behavior. Therefore, it is hypothesized that shifting figures of the midline to the left will be associated with behavioral disturbances.

#### *Hypothesis Three*

Extremes in figure height have been associated with problematic behaviors both in children and adults. It is hypothesized that children drawing an extremely short or tall self-figure in the Family drawing will receive a higher rating on the CBCL.

***Hypothesis Four***

The literature suggests that the relative height of figures is a more powerful indicator of psychopathology. It is hypothesized that children who ignore social scaling (i.e. drawing self-figure $\geq$ maternal figure) will receive higher parental rating for externalizing behaviors compared to children drawing the self-figure smaller than the maternal figure. Children with social-scaling difficulties will also be more likely meet criteria for ADHD.

# CHAPTER 2

# METHODS

## Participants

The participants for these studies are a subset of children recruited for a larger National Institute on Deafness and Other Communication Disorders (NIDCD) funded project awarded to Hilary Gomes, Ph.D. at the City College of New York examining attention and language in community children. Eighty-eight children (boys = 59; 67.0%), aged 7-years 0-months to 9-years 3-months (*M* = 8-years, 3-months) enrolled between February, 2003 and July, 2006 participated in this study with behavioral and/or reading problems the primary reasons for the initial referral.

Children were excluded from the larger NIDCD study if they had a history of neurological problems, chronic illness, a previous diagnosis of schizophrenia, major affective disorder, autism or pervasive developmental disorder, if they were taking systemic medication or were not attending school. The children had to demonstrate normal hearing at the time of the evaluation and be corrected to normal vision based on parental report. Although children were excluded from the data analysis in the larger NIDCD study if they failed to attain a Performance IQ standard score of 80 or greater on the Wechsler Abbreviated Scale of Intelligence (WASI, Psychological Corporation, 1999) they were retained for the studies, which follow, so that a full range of cognitive abilities could be examined.

All children were fluent English speakers enrolled in English-only classrooms with 38 raised in bilingual households. Parent-reported race/ethnicity of the children was 3 Asians; 29 Blacks (African and West Indian descent); 8 Caucasians and 48 Latinos.

Maternal education and marital status were obtained via a questionnaire with the socio-economic status (SES) calculated based on the Hollingshead's Four Factor Index (Hollingshead, 1975). Marital status was missing for 4 (4.5%) parents and maternal education was incorrectly reported or omitted by 6 (6.8%), limiting the ability to calculate SES for 6 (6.8%) families. Demographic characteristics of study participants are shown in Table 2.1

**Table 2.1: DEMOGRAPHIC CHARACTERISITCS OF PARTICIPANTS**

Number and (%)

| | All Participants (n = 88) | Boys (n = 59) | Girls (n = 29) |
|---|---|---|---|
| Mean Age | 8 years 3 months | 8 years 3 months | 8 years 4 months |
| Ethnicity | | | |
| *Asian* | 3 (3.4) | 2 (3.4) | 1 (3.4) |
| *Black*[a] | 29 (33.0) | 16 (27.1) | 13 (44.8) |
| *Caucasian* | 8 (9.1) | 8 (13.6) | 0 (0.0) |
| *Latino* | 48 (54.5) | 33 (55.9) | 15 (51.7) |
| Bilingual | 38 (43.2) | 25 (28.4) | 13 (44.8) |
| Maternal Education | | | |
| *Less than high school* | 8 (9.8) | 7 (12.7) | 1 (3.7) |
| *High school* | 22 (26.8) | 15 (27.3) | 7 (25.9) |
| *Some college/trade* | 29 (35.4) | 19 (34.5) | 10 (37.0) |
| *College* | 16 (19.5) | 10 (18.2) | 6 (22.2) |
| *Advanced degree* | 7 (8.5) | 4 (7.3) | 3 (11.1) |
| Marital status | | | |
| *Single* | 29 (32.9) | 20 (22.9) | 9 (31.0) |
| *Married* | 41 (46.6) | 27 (45.8) | 14 (48.3) |
| *Separated* | 10 (11.4) | 7 (11.9) | 3 (10.3) |
| *Divorced* | 3 (3.4) | 1 (1.7) | 2 (6.9) |
| *Widow* | 1 (1.1) | 0 (0.0) | 1 (3.4) |
| SES | 37 (14.5) | 35 (16.6) | 38 (11.7) |

**[a] =** Comprised of both African and Caribbean descent

### *Diagnostic Classification of Participants*

From information obtained during testing and from parent, teacher and examiner completed forms and rating scales participants were classified based on standard research practices as follows:

#### *Attention Deficit Hyperactivity Disorder*

A child met criterion for ADHD based on information derived from parent, teacher and examiner completed ADHD-IV ratings using the following criteria:

1) Either parent or teacher ADHD IV z-score rating of $\geq$ 1.5 or examiner identified 6 or more inattentive or hyperactive behaviors.

and

2) One or more raters affirmed the presence of ADHD behaviors with parent or teacher, ADHD-IV z-score ratings $\geq$ 1 or examiner identified 5 or inattentive or hyperactive behaviors.

This method for identifying ADHD should be considered moderately stringent. Since it requires more than one rater identify ADHD symptoms, it minimizes single rater bias. However, it also recognizes that children's behavior is to some degree context specific with behavioral expectations differing between environments. Full agreement between raters tends to be the exception rather than the norm and may only identify children with the most severe manifestations of ADHD. See Table 2.2 for overview of participant classifications.

#### *Graphomotor Impairment*

Children receiving a VMI standard score less than 80 were considered to exhibit significant visual integration and/or graphomotor impairment (GMI). A co morbid diagnosis of SLI or ADHD was not considered exclusionary criterion for GMI. Three

boys (5%) failed to complete the VMI due to examiner error.

***Specific Language Impairment***

A child was considered to meet criterion for SLI if he or she received a standard score of less than 80 (-2 sd below the *M*) on either the Receptive or Expressive Language Indices of the CELF-4. A diagnosis of ADHD and/or graphomotor impairment was not considered exclusionary criteria for SLI. Errors in administration of the CELF-4 occurred in one or more subtests for 6 participants. These errors were considered missing scores and were replaced with the *M* of the correctly administered subtests of the particular Index.

***Typically Developing Control***

Children with VIQ and PIQ standard scores $\geq$ 80 who received a score of fewer than five inattentive and/or five hyperactive-impulsive behaviors on parent, teacher and examiner completed ADHD-IV rating scales and did not meet criteria for SLI or GMI were categorized as typically developing. It should be noted that because all participants were referred for the study, children classified as "*typically developing*" would more accurately be considered a clinical control group.

**Table 2.2: DIAGNOSTIC CLASSIFICATION OF PARTICIPANTS**

Number (%)

| | All Participants (n = 88) | Boys (n = 59) | Girls (n = 29) |
|---|---|---|---|
| ADHD | 43 (48.9) | 31 (52.4) | 12 (41.4) |
| GMI | 10 (11.4) | 8 (13.6) | 2 (6.9) |
| SLI | 27 (30.7) | 17 (28.8) | 10 (34.5) |
| Typically Developing | 32 (36.7) | 21 (35.6) | 11 (37.9) |

Categories are not mutually exclusive. High degree of overlapping diagnoses exists in this sample.

## Measures

### *Child Measures*

Each child's cognitive, graphomotor, behavioral and social functions were assessed using a variety of measures and rating scales. Assessment instruments administered to each child included:

#### *Clinical Evaluation of Language Fundamentals*

The Clinical Evaluation of Language Fundamentals-Fourth Edition (CELF-4; Semel, Wiig & Secord, 2003) is an individually administered instrument, appropriate for use with children and young adults aged 5- to 21-years, covering a wide range of linguistic abilities. A Receptive Language Index standard score is derived from two or three subtests (Sentence Structure; Concepts & Directions and Word Classes-Receptive for children aged 5- to 8-years 11-month; Concepts & Directions and Word Classes for children aged 9 and above years). The Expressive Language Index standard score is comprised of three subtests (Word Structure, Formulated Sentences and Recalling Sentences for children aged 5- to 8-years 11-month; Word Classes-Expressive, Formulated Sentences and Recalling Sentences for children aged 9 and above years). A Core Language Index is derived from a combination of receptive and expressive subtest scores. Two additional subtests, Understanding Spoken Paragraph and Word Associations, although not included in the Receptive, Expressive or Core Language Index scores, are frequently analyzed as independent measures of language ability. The CELF-4 has been used extensively for the evaluation of language impairments in both clinical and research settings (Bishop, 1997) and is considered to possess adequate reliability and

validity.

### *The Developmental Test of Visual-Motor Integration*

The Developmental Test of Visual-Motor Integration – Fourth Edition (VMI-4; Beery, 1997) is an individual or group administered test of visual-motor integration and graphomotor ability appropriate for individuals aged 3 to 17 years. It consists of a series of twenty-four geometric shapes presented in order of increasing difficulty. Early items are quite simple and include forms such as a single line or a circle, while later items are increasingly complex and include overlapping rings, diamonds and a cube. Scoring is based on objective, well-defined criteria with each design scored either 0 points indicating failure or 1 for an adequate copy. The total raw score is converted into an age-based standard score. The VMI-4, as well as earlier editions, have been extensively studied and demonstrate satisfactory interrater and test-retest reliabilities (Slatter, 2001). Acceptable correlations between the VMI-4 and other tests of visual-motor ability have been reported (Beery, 1997).

### *Family and Peer Drawings*

Each child completed two kinetic drawings. Standard administration procedures for the K-FD (Burns & Kaufman, 1970, 1972) request the child draw a picture of him- or herself "*doing something*" with family members while the examiner leaves the room. The drawing is followed by an inquiry phase in which the child is asked to identify each of the figures depicted and to describe the activity. For the current study, administration was modified in that the examiner remained in the room while the child completed the task and rather than the standard achromatic lead pencil, a new set of 12-colored pencils

were provided.

Kinetic Family drawings, although used extensively in clinical and research settings, has not been subjected to a rigorous examination of either its reliability or validity. However, there has been general consensus that interrater reliability varies considerably depending on the graphic feature under investigation. Test-retest reliability generally has been found to be poor to moderate, which may actually be a reflection of the child's changing affective state.

An additional drawing task, developed for the current study, was the Kinetic Peer Drawing. Each child was requested to draw a picture of himself or herself doing an activity with friends using colored pencils. The drawing task was followed by an inquiry phase regarding the identification of figures and the depicted activities.

***Wechsler Abbreviated Scale of Intelligence***

The Wechsler Abbreviated Scale of Intelligence (WASI; Wechsler, 1999) is a four subtest, individually administered measure of general cognitive ability appropriate for individuals aged 6 to 89 years. The Vocabulary and Similarities subtests are used to derive a Verbal IQ score (VIQ) and the Matrix Reasoning and Block Design subtests are used to derive a Performance IQ score (PIQ). The Full Scale IQ score (FIQ) is derived from the sum of the four subtests.

The WASI has demonstrated satisfactory test-retest reliabilities in pediatric samples as well as high correlations with other measures of intelligence such as the Wechsler Intelligence Scale for Children – Third Edition (Slatter, 2001).

The WASI standard scores for study participants are reported in Table 2.3. Although participants' mean WASI scores fall within the average range these results are

somewhat misleading. A standard score of ≤ 75 (-1.67 sd below the mean of 100) was obtained on the VIQ by three children and on the PIQ for four children.

**Table 2.3: WASI STANDARD SCORES OF PARTICIPANTS**
M and (sd)

| | All Participants (n = 88) | Boys (n = 59) | Girls (n = 29) [a] |
|---|---|---|---|
| Verbal IQ | 98.4 (14.3) | 99.6 (15.6) | 96.1 (11.0) |
| Performance IQ | 97.3 (14.0) | 98.0 (14.8) | 95.9 (12.3) |
| Full Scale IQ | 97.7 (13.6) | 98.6 (14.9) | 95.8 (10.6) |

[a] 1 female participant was administered the Wechsler Intelligence Scale for Children in place of the WASI.
An ANOVA of Sex x WASI IQ measures found no significant differences between boys and girls performance.

As part of the neuropsychological battery many children received the Test of Auditory Comprehension of Language, Wechsler Individual Achievement Test – Reading subtests, Rorschach Ink Blot and the Thematic Apperception Test and experimental measures of attention. These additional instruments were administered as part of the larger study being conducted by Dr. Gomes but were not considered relevant variables for the current studies.

### *Parent Measures*

Parents completed the following forms and rating scales regarding their child's cognitive, emotional, social and academic behaviors:

#### *ADHD Rating Scale – IV*

The ADHD-IV (DuPaul, Power, Anastopoulos, & Reid, 1998) is a behavioral rating scale based on the diagnostic criteria for ADHD as described in the DSM-IV (APA, 1994). The ADHD-IV lists eighteen behaviors currently associated with ADHD,

alternating between questions concerning attention and those of hyperactive/impulsive behaviors. Each behavior is rated on a 4-point scale (*0 = never or rarely; 1 = sometimes; 2 = often; 3 = very often*) with a given behavior considered to be present if a rating of 2 or greater is assigned.

Scores for each symptom cluster (i.e. inattention and hyperactivity/impulsivity) are totaled separately for parent and teacher ratings and using sex and age specific normative tables converted into z-scores.

***Child Behavior Checklist***

The Child Behavior Checklist (CBCL; Achenbach 1991) is a widely used empirically derived behavior rating scale appropriate for children and adolescents between the ages of 6- to 18-years. Parents rate the frequency and intensity of 113 behavioral and emotional problems exhibited by their child in the past 6 months on a 3-point scale (*0 = not true; 1 = somewhat true; 2 = often true*).

Factor analysis produced into eight Syndrome Scales (Anxious/ Depressed, Withdrawn/Depressed, Somatic Complaints, Social Problems, Thought Problems, Attention Problems, Rule-Breaking Behaviors and Aggressive Behavior). Raw scores on the Anxious/Depressed, Withdrawn/Depressed and Somatic Complaints scales are summed to derive an Internalizing Behavior Scale, while raw scores on Rule-Breaking and Aggressive Behavior Scales are summed to obtain an Externalizing Behavior Scale score. The subscales for Attention Problems, Social Problems and Thought Problems are considered independent syndromes, as they do not factor into either the Internalizing or Externalizing Scales. All eight subscales can further be summed to provide a Total Problem Behavior score.

All scores for the CBCL are reported as T scores with a *M* of 50 and a sd of 10. T scores of 65 to 69 are considered to be in the Borderline range while those greater than 69 (+ 2 sd above the *M*) have possible clinical significance, as they are representative of less than 2% of the normative population.

The CBCL is considered to be psychometrically sound with mean test-retest reliabilities reported to range from .95 to 1.00 while internal consistency ranges from 0.78 to .97 (Auchenbach, 1991). The CBCL has been used extensively in both clinical and research settings. CBCL characteristics of study participants are shown in Table 2.4.

**Table 2.4: CHILD BEHAVIOR CHECKLIST RATINGS OF PARTICIPANTS**

*M* T Scores and (sd)

| | All Participants (n = 86) | Boys (n = 57)[a] | Girls (n = 29) |
|---|---|---|---|
| Internalizing Scale | 55.1 (10.9) | 55.6 (11.3) | 54.3 (10.3) |
| *Anxious/Depressed* | 56.9 (7.3) | 57.3 (7.8) | 56.1 (6.5) |
| *Withdrawn/Depressed* | 56.8 (6.9) | 57.0 (7.0) | 56.4 (6.9) |
| *Somatic Complaints* | 56.8 (7.1) | 57.2 (7.1) | 56.1 (7.2) |
| Externalizing Scale | 55.6 (9.1) | 56.5 (9.2) | 53.8 (8.8) |
| *Rule-Breaking Behavior* | 57.8 (6.8) | 58.2 (7.2) | 57.1 (6.1) |
| *Aggressive Behavior* | 56.3 (6.9) | 56.8 (7.7) | 55.3 (4.9) |
| Additional CBCL Subscales | | | |
| *Social Problems* | 58.5 (6.9) | 58.7 (7.4) | 57.9 (6.0) |
| *Thought Problems* | 56.2 (7.4) | 57.3 (7.7) | 54.3 (6.3) |
| *Attention Problem* | 61.9 (8.4) | 61.6 (8.4) | 62.3 (8.6) |

[a] Due to experimenter error completed CBCL were not obtained for 2 male participants.
An ANOVA found no significant differences between boys' and girls' CBCL scores.

***Developmental, Academic and Medical History Form***

Each child's parent completed a detailed developmental, medical and academic history questionnaire.

***Social Skills Rating Scale***

The Social Skills Rating Scale - Elementary Level: Parent Form (SSRS; Gersham & Elliot, 1990) SSRS is a measure of a child's social skills, which are broadly defined as "*socially acceptable, learned behaviors that enable a person to interact effectively with others and to avoid socially unacceptable responses*" (Gresham & Elliot, 1990, p. 1). The SSRS – Elementary Level is used to evaluate school-aged children in grades Kindergarten through 6. Numerous studies support the validity of the SSRS as a measure of a child's social ability (Barron-McKeagney, Woody, & D'Souza, 2001; Farmer-Dougan & Kaszuba, 1999).

The Social Skills Rating is one domain scale of the SSRS and is comprised of 55-items assessing four subdomains of social functioning: Cooperation, Assertion, Responsibility and Self-Control.[6] Raw scores obtained on the subdomains are converted into age and sex specific z-scores and are summed to derive a Social Skills Rating standard score with a *M* of 100 and a sd of 15.

The other SSRS domain provides for the evaluation of three types of problematic behaviors: Externalizing, Internalizing and Hyperactivity, which are summed to obtain a Problem Behaviors standard score. Reliability for the Social Skills Rating is .90 and for the Problem Behaviors is .84.

Social Skills Rating z-scores for study participants are shown in Table 2.5. Similar to the WASI scores, although subtest and index scores fall within the average range, considerable variability was found in the scores obtained for individual children.

[6] Refer to Appendix A for sample questions for each of the Social Skills Rating sub-domains.

**Table 2.5: SOCIAL SKILLS RATING RATINGS OF PARTICIPANTS**

Standard Scores or z-scores and (sd)

| | All Participants (n = 82) | Boys (n = 53) [a] | Girls (n = 29) |
|---|---|---|---|
| Social Skills Rating [b] | 96.1 (16.4) | 97.4 (16.9) | 93.8 (15.4) |
| Social Skills Rating Subscales [c] | | | |
| *Cooperation* | -.22 (1.3) | -.23 (1.4) | -.19 (1.1) |
| *Assertion* | -.46 (1.1) | -.41 (1.0) | -.56 (1.2) |
| *Responsibility* | -.12 (1.1) | -.06 (1.2) | -.21 (0.9) |
| *Self Control* | -.05 (1.1) | -.07 (1.0) | -.01 (1.1) |
| Problem Behavior [b] | 103.1 (14.5) | 102.3 (15.2) | 104.5 (13.3) |

[a] = The SSRS were missing on 2 boys due to experimenter error and on 4 boys because the parents were unable to complete form in English

[b] = Scores reported as standard scores. Higher scores on the Social Skills Rating is suggestive of better adaptive functioning while higher scores on Problem Behavior is indicative of poorer functioning.

[c] = Higher z scores suggest better adaptive functioning.

An ANOVA found no significant difference between boys' and girls' SSRS scores.

### *Teacher and Examiner Measures*

The child's current classroom teacher completed the ADHD-IV Rating scale, which was identical in format and scoring to the parent version describe previously.

Following each child's assessment the examiner also completed either the ADHD-IV Rating scale or a modified version of this scale. On the modified version all behavioral items were identical to the original ADHD-IV scale with the chief differences being formatting and detailed descriptions of characteristic test behaviors associated with ratings. No normative data currently exists for converting examiner completed ADHD-IV rating into z-scores.

## Procedures

### *Consent*

The City College of New York's Internal Review Board guidelines were followed

in obtaining informed consent from each child's parent or guardian prior to testing. Informed assent was also obtained from each of the child participants.

### *Participant Assessment*

Testing was conducted in a small, quiet room by examiners experienced in working with children. Verbal encouragements, as well as stickers, snacks and breaks were used ad lib throughout test administration to motivate children to perform optimally.

Each child was administered a two-day battery of attention, language, graphomotor and intelligence tests. Order of administration was fixed and as follows:

**Day 1**: Hearing Screen; Test of Auditory Comprehension of Language; Experimental measure of attention; CELF-4: Concept & Directions and Word Structure; Experimental measure of attention; *Kinetic Drawing*; CELF-4: Recalling Sentences and Formulated Sentences; Experimental measure of attention; CELF-4: Sentence Structure and Word Association.

**Day 2**: VMI; WASI: Vocabulary, Block Design, Similarities and Matrix Reasoning; WIAT: Word Reading, Reading Comprehension and Pseudoword Decoding; *Kinetic Drawing*; CELF-4 Word Classes and Listening to Paragraphs. Based on examiner experience some children also received the Rorschach and the Thematic Apperception Test.

Administration of the two kinetic drawing tasks was counterbalanced so children with even numbered identification codes received the Family drawing on Day 1 and the Peer drawing on Day 2 while those with odd numbered identification codes received the Peer drawing on Day 1 and the Family drawing on Day 2. Since there was no systematic manner in which children were enrolled into the study this counterbalancing technique was considered appropriate.

A new box of 12 colored pencils (Crayola) was provided to each child on Day 1 of testing along with several sheets of 8 ½" by 11" white paper. Instructions for the drawings were as follows: "*Draw a picture of (everyone in your family including yourself*

*/ you with your friends) doing something. Try to draw whole people, not just stick people. Remember, make everyone doing something – some kind of action*." These instructions were repeated on Day 2 of testing prior to obtaining the second kinetic drawing.

On occasion, most often due to staffing issues, the order was reversed so that Day 2 testing actually occurred first. This reversal was random and occurred in 10 (11.4%) cases over the course of the study. Day 1 and Day 2 of testing were generally scheduled 7 days apart and occurred 64.8% of the time. On occasion, most often due to parental request, the period between Day 1 and Day 2 testing was lessened or prolonged for a *M* interval of 10.9 days (sd = 9.2) with a range of 1 to 62 days.

While the child was being tested, the biological/adoptive parent or legal guardian was interviewed and the History form as well as the various rating scales were completed. Biological mothers were most often the parent completing the forms (n = 73; 82.9%), followed by biological fathers (n = 6; 6.8%), adoptive mothers (n = 4; 4.5%), adoptive fathers (n = 1; 1.1%) or legal guardians (including grandparents, foster parent and foster kin; n = 4; 4.5%).[7]

At the time of recruitment the parents were requested to obtain a completed ADHD-IV from their child's current grade school teacher. The ADHD-IV, an explanatory cover letter addressed to the teacher and a stamped addressed return envelope were sent to each child's parent. A return rate of 88.6% for teachers' rating forms was obtained.

[7] Throughout the remainder of this paper, for reading ease, these individuals will be referred to collectively as "*the parent*".

## Data Analysis

### *Scoring Procedures*

Most instruments administered to children, parents and teachers, including the WASI, CELF, VMI, CBCL, SSRS and the ADHD-IV were scored using standard procedures. Modifications and/or additional scoring techniques unique to this study were developed for the Family and Peer drawings and are described in detail below.

#### *Measures Associated with Color*

***Number of Colors*** - The number of colors used in both the Family and Peer drawings was calculated by counting the number of unique colors used in each drawing with each having a possible raw score total of 11. Preliminary scoring revealed that the perceptible difference between the red and the red-orange was difficult making scoring highly unreliable; therefore use of either color was coded as "red".

***Realistic Use of Color*** - Each drawing was evaluated for level of realistic use of color and classified as follows: 1) "*Realistic*" - Color used realistically throughout drawing with figures, objects and background colored appropriately. If only one color was used and figures were just outlined it must have been done in black, light brown or brown. 2) "*Mixed*" - Part of the drawing, either figures or background, was colored realistically. 3) "*Unrealistic*" - Overall, color was used inappropriately with both figures and background colored inconsistent with reality. If only one color was used to outline figures it was inconsistent with reality (i.e. figures outlined in red).

#### *Measures Associated with Number of Figures*

***Figure Count*** - The number of human figures depicted in the Family and Peer

drawings were counted. Refusal to draw a picture was awarded a score of 0 for all subsequent calculations and analyses.

***Measures Associated with Figure Height***

***Figure Height*** - The height of figures identified as "*self"* and "*mother*" in the Family drawing and "*self*" in the Peer drawing were calculated based on a method described by Lev-Wiesel and Drori (2000). Using a transparent sheet divided into approximately ¼ inch squares, height was measured as the number of squares covered by the figure using the longest dimension from head to foot including hair but excluding any embellishments, such as hats. Partial occlusion of a square was included in the count.

***Measures Associated with Use of Space***

***Organization*** - Drawings were scored as either "*Organized*" or "*Disorganized*". A drawing was scored as "*Disorganized*" if figures floated off of a drawn or presumed baseline; were randomly scattered across the page or were clustered so that figures overlapped.

***Midline Shifts*** - Drawings were scored as either evidencing a "*Shift*" or "*No Shift*". A drawing was considered to have a midline "*Shift*" if all figures were displaced to one side, with no part of any figure crossing the midline of the paper.

# CHAPTER 3

# RESULTS

## The Use of Color in Children's Drawings

### *Sex Differences in Number of Colors*

It this sample of prepubescent children it was predicted that girls would use more colors to complete their drawings than the boys.

#### *Preliminary Analyses*

Family and Peer drawings scored by two raters for number of colors, demonstrated acceptable interrater reliabilities (Family drawing: Coder A: $M = 4.86$, sd = 3.05; Coder B: $M = 4.97$, sd = 3.15; r = .979, p < .0001 and Peer drawing: Coder A: $M = 4.97$, sd = 2.97; Coder B: $M = 4.98$, sd = 2.98; r = .993, p <.0001). Scoring disagreements were resolved by consensus.

Using a paired sample t-test, no difference between the number of colors used to complete the Family or Peer drawings was found (Family drawing: $M = 4.96$, sd = 3.08 and Peer drawing: $M = 4.99$, sd = 2.97; $t_{(84)} < 1$). Additionally, no effects for order of drawing administration were observed (Family Drawing - Day 1: $M = 5.08$, sd = 3.19; Day 2: $M = 4.79$, sd = 3.00; $t_{(85)} = <1$) and Peer drawing – Day 1: $M = 4.91$, sd = 3.09; Day 2 = 5.08. sd = 2.82; $t_{(84)} < 1$).

Since there were no statistically meaningful differences in the number of colors used for the Family and Peer drawings and no order of administration effects, the number of colors used for both drawings were summated to produce a total color score. Two girls' scores were excluded in the final color analysis since they refused to complete a Peer drawing as well as one boy's scores, who, due to examiner error, was not

administered a Family drawing. The final sample size of 85 had a *M* total color score of 9.95 with a sd = 5.22 and a range = 20. Unless otherwise noted, the total number of colors score was used for all subsequent analyses.

***Examination of Confounding Variables***

Because previous research has shown that when children focus on incorporating greater detail into their drawings they tend to use few colors (Golomb, 1990), the number of figures a child depicted in his or her Family and Peer drawings might influence color usage. Therefore, the total number of figures depicted in both kinds of drawings was determined. A Pearson correlation of the total number colors and the total number of figures was not significant ($r = .169$, $p = .124$) suggesting that detail, defined as the number of figures, did not influence the number of colors children used to complete their drawings. In addition, no significant relationship between number of colors and age was found ($r = .057$, $p = .607$), although it should be noted that this was a relatively age-restricted sample.

Since culture has been associated with color preference, it was of some concern that this variable might impact the number of colors used in drawings. Unfortunately, ethnic groups were highly unequal with only three children of Asian descent included in the sample. This small subgroup of Asian children was removed from the sample. A one-way ANOVA of number of colors and ethnicity with the remaining participants found no significant differences between groups on color usage although there was a trend for Caucasians to use less color than Blacks of Caribbean or African descent (Table 3.1). It should be noted that the three Asian children *X* color use was greater than any of the other groups examined.

**Table 3.1: ONE-WAY ANOVA OF COLORS x ETHNICITY**

| | M Number of Colors | sd | |
|---|---|---|---|
| Asian (n = 3)[a] | 16.00 | 2.65 | |
| Caucasian (n = 8) | 5.88 | 3.76 | |
| Black (n = 28)[b] | 10.75 | 5.35 | |
| Latino (n = 46) | 9.78 | 5.04 | $F_{(2,81)} = 2.906$ p = **.061** |

[a] = Children of Asian descent were not entered into the analysis due to extremely small sample size
[b] = African and Caribbean descent

***Hypothesis One: Girls and Boys Use of Color***

Girls were expected to use more colors than boys to complete the drawings. An independent sample t-test was highly significant with girls found to use significantly more colors compared to boys (Boys n = 58, *M* = 8.45, sd = 4.47; Girls n = 27, *M* = 13.19, sd = 5.33; $t_{(83)} = -4.28$, $p < .0001$.)

*In summary*, as hypothesized, girls were found to use a greater total number of colors in their drawings of family and friends when compared to boys of similar age. Limited sample size prevented a full exploration of the effects of ethnicity on color use.

***The Association of Color with Cognitive and Behavioral Measures***

A central hypothesis of this study was that the number of colors children used to complete their drawings would be unrelated to cognitive ability but rather would be predictive of behavioral functioning with externalizing problems associated with an expanded utilization of color while internalizing behaviors would be related to a more restricted use. It, however, was unclear if the relationship between color use and behavioral measures would be linear. Since correlations only detect linear relationships it

was decided to group the children based on the number of colors they used to complete their drawings. Boys and girls were examined separately since they had been found to differ significantly in the number of colors they used to complete their drawings.

***The Association of Boys' Color Use with Cognition and Behavior***

It was hypothesized that boys using an increased number of colors would more likely be rated with externalizing problems while those with a restricted use of color would be rated with higher levels of internalizing behaviors.

Boys were grouped based on the *M*s and sds obtained for the total number of colors used for both drawings as follows: "*Below Average*" (> 1 sd below the *M*; 2 colors; n = 6), "*Average*" (within +/-1 sd of the *M* = 8.45; 3 to 12 colors; n = 40) or "*Above Average*" (>1 sd above the *M*; 13 or more colors; n = 12).

***Examination of Confounding Variables*** - The influence of age on the number of colors boys used was examined with a one-way ANOVA of group x age. No significant difference between groups was found ($F_{(2,55)} = .106$).

In order to determine if cognitive, language or graphomotor abilities influenced color use in boys a MANOVA comparing group performance on cognitive, language and graphomotor measures was performed. Group *M* scores replaced missing data, a standard procedure in MANOVA analyses (Table 3.2). As expected, no significant group differences were found for the cognitive or language measures examined. However, the three groups differed significantly on graphomotor performance as measured by the VMI. A Tukey post hoc analysis revealed boys grouped as "*Below Average*" in their color use evidenced higher graphomotor ability compared to the "*Average*" group (p = .019) while the "*Average*" and "*Above Average*" groups and the "*Below Average*" and "*Above*

*Average*" groups received comparable VMI scores. The association of color use and graphomotor skills was not altogether surprising. However, the direction of the relationship, with superior skills being associated with less color use, was unexpected.

***Hypothesis Two: The Association of Boys Use of Color with Behavioral Variables*** - It was predicted that boys grouped as using increased number or colors to complete their drawing would receive higher parental rating on externalizing behaviors while those group as using less color would be rated with higher levels of internalizing problems.

A MANOVA examining group differences for behavioral rating on the CBCL: Internalizing and Externalizing Indices was performed with missing data replaced with *M* scores. While no significant differences were found between groups for externalizing behaviors, the groups differed significantly for ratings on internalizing behaviors. A Tukey post hoc analysis revealed that boys grouped as "*Below Average*" in their use of color exhibited higher levels of internalizing behaviors compared to the "*Average*" group ($p = .021$). The "*Average*" and "*Above Average*" groups and the "*Below Average*" and "*Above Average* " groups were found to receive comparable ratings for internalizing behavior ratings (Table 3.2).

**Table 3.2: BOYS' USE OF COLOR: COGNITIVE AND BEHAVIORAL MEASURES**

*M*, (sd), F and p Values

| | Below Average (1) n = 6 | Average (2) n = 40 | Above Average (3) n = 12 | $F_{(df)}$ | p | Post Hoc Comparison |
|---|---|---|---|---|---|---|
| WASI | | | | | | |
| *VIQ* | 101.2 (23.5) | 98.9 (15.3) | 98.9 (11.5) | $.058_{(2,55)}$ | n.s. | |
| *PIQ* | 102.0 (19.7) | 96.3 (13.8) | 99.0 (14.4) | $.482_{(2,55)}$ | n.s. | |
| CELF | | | | | | |
| *Receptive Index* | 92.0 (23.7) | 90.1 (15.2) | 94.2 (16.3) | $.295_{(2,55)}$ | n.s. | |
| *Expressive Index* | 85.5 (25.5) | 88.6 (14.1) | 90.4 (17.1) | $.184_{(2,55)}$ | n.s. | |
| VMI | 100.0 (8.8) | 88.2 (9.9) | 92.7 (8.9) | $4.36_{(2,55)}$ | .017 | 1>2; 1&2=3 |
| CBCL | | | | | | |
| *Internalizing Index* | 65.7 (12.2) | 53.1 (10.5) | 57.6 (9.1) | $4.16_{(2,55)}$ | .021 | 1>2; 1&2=3 |
| *Externalizing Index* | 61.0 (6.6) | 55.5 (9.3) | 57.6 (8.7) | 1.09 | n.s. | |
| Internalizing Subscales | | | | | | |
| *Anxious/Depressed* | 66.7 (9.0) | 55.7 (6.7) | 57.1 (5.7) | $6.83_{(2,55)}$ | .002 | 1>2&3;2=3 |
| *Withdrawn/Depressed* | 58.8 (9.9) | 55.9 (5.9) | 59.1 (8.2) | $1.19_{(2,55)}$ | n.s. | |
| *Somatic Complaints* | 65.8 (8.9) | 55.9 (6.3) | 56.2 (5.6) | $6.18_{(2,55)}$ | .004 | 1>2&3; 2=3 |
| Family Drawing | n = 17 | n = 28 | n = 13 | | | |
| *Anxious/Depressed* | 59.1 (9.1) | 55.8 (6.5) | 57.4 (7.0) | $1.09_{(2,55)}$ | n.s. | |
| *Somatic Concerns* | 59.4 (9.1) | 55.4 (5.4) | 57.5 (6.8) | $1.85_{(2,55)}$ | n.s | |
| Peer Drawing | n = 13 | n = 29 | n = 16 | | | |
| *Anxious/Depressed* | 62.8 (9.2) | 55.3 (6.0) | 55.8 (6.2) | $5.65_{(2,55)}$ | .006 | 1>2&3;2=3 |
| *Somatic Concerns* | 60.9 (9.1) | 55.6 (5.9) | 56.4 (6.1) | $2.77_{(2,55)}$ | .071 | |

In order to more fully understand the association of color and internalizing behaviors a MANOVA examining boys' color use and ratings on Anxiety/Depression, Withdrawn/Depressed and Somatic Complaints, the subscales that comprise the CBCL: Internalizing Index, was performed. While no group differences were found for the Withdrawn/ Depressed, ratings between groups on the Anxious/ Depressed and Somatic Complaints subscales were significant. A Tukey post hoc analysis of group differences for Anxious/Depressed as well as Somatic Complaints ratings led to similar findings. Boys grouped as using less color received elevated scores for Anxiety/Depression compared to the "*Average*" ($p = .001$) and "*Above Average*" ($p = .018$) groups. The "*Average*" and "*Above Average*" groups received comparable ratings. Scores for Somatic Complaints were significantly elevated for the "*Below Average*" group compared to the "*Average*" ($p = .003$) and "*Above Average*" ($p = .012$) groups, which received comparable scores (Table 3.2).

Since the number of colors used by a boy in the Family and Peer drawings were used to calculate his total color scores, it was of some interest if the number of colors used in each type of drawing would differ in its association to Anxious/Depressed and Somatic Complaints ratings. Boys were once again grouped as "*Below Average*", "*Average*", or "*Above Average*" in their use of color based on the group *M*s and sds for number of colors for each picture type[8]. A separate MANOVA was performed for the Family and Peer drawings comparing groups for CBCL: Anxious/Depressed and Somatic

[8] Family drawing groups were based on a *M* of 4.1 with a sd of 2.7 as follows: "*Below Average*" (>1 sd below the *M*, 1 color, n = 17), "*Average*" (within +/- 1 sd of the M, 2 to 6 colors, n = 27) or "*Above Average*" (>1 sd above the *M*, 7 or more colors, n = 12). Peer drawing grouping were based on a *M* of 4.4 and sd of 2.8 as follows: "*Below Average*" (>1 sd below the *M*, 1 color, n = 13), "*Average*" (within +/- 1 sd of M, 2 to 6 colors, n = 29) or "*Above Average*" (>1 sd above the *M*, 7 or more colors, n = 15).

Complaints ratings. The groups were found not to differ in their ratings on Anxious/ Depressed and Somatic Complaints for the Family drawing. However, the MANOVA performed for Peer drawing found significant differences between groups. A Tukey post hoc analysis revealed that boys grouped as "*Below Average*" for color use on their Peer drawing received significantly higher Anxious/ Depressed ratings compared to boys in the "*Average*" ($p = .006$) or "*Above Average*" ($p = .025$) groups, which were comparable in their use of color. Group differences for Somatic Complaints were not significant although there was a trend for boys grouped as using less color to have higher ratings on this subscale compared to the "*Average*" ($p = .063$) group. "Average" and "*Above Average*" groups received comparable Somatic Complaint scores (Table 3.2).

The association of number of colors and externalizing behaviors in boys was further examined using an ANOVA comparing the number of colors used to complete the Family and Peer drawings for boys grouped as either meeting or not meeting criteria for a diagnosis of ADHD. No significant differences were found between boys grouped for ADHD status and color use for either the Family or Peer drawings ($F_{1,56} < 1$) further suggesting that the presence of externalizing behaviors in boys did not result in an increased use of color (Table 3.3).

**Table 3.3: COLOR USE AND ADHD IN BOYS**
*M* and (sd)

| | No ADHD<br>n = 27 | ADHD<br>n = 31 |
|---|---|---|
| Family Drawing | 4.0 (2.8) | 4.2 (2.7) |
| Peer Drawing | 4.2 (2.5) | 4.4 (3.1) |

***The Association of Color Use with Cognition and Behavior in Girls***

It was hypothesized that girls using an increased number of colors would more likely be rated with externalizing problems while those with a restricted use of color would be rated with higher levels of internalizing behaviors.

The association of girls' color use and behavior was examined in a similar fashion to that used for boys. However, since basing girls' groups on *M* and sds led to very small group sizes for "*Below Average*" and " *Above Average*" a different method was used[9]. Frequencies of the number of colors used were obtained and girls below the 25 percentile were grouped as "*Below Average*" (n = 7) and those above the 75 percentile were grouped as "*Above Average*" (n = 5). All remaining girls were grouped as "*Average*" (n = 15).

***Examination of Confounding Variables*** - The influence of age on the number of colors girls used was examined with a one-way ANOVA of group x age. No significant difference between groups for age was found ($F_{(2,24)} = .147$).

A MANOVA was calculated comparing group performance on cognitive, language and graphomotor ability with missing data was replaced with the *M* scores (Table 3.4). No significant group differences were found for any of the cognitive, language or graphomotor measures.

***Hypothesis Three: The Association of Girls Use of Color With Behavioral Variables*** - It was predicted that girls using an increased number of colors to complete their drawing would receive higher parental rating on externalizing behaviors while those

[9] When girls were grouped based on the *M* and sds of their total color the following emerged: "*Below Average*" (1 sd below *M* = 13.2, 2 to 6 colors, n = 4); "*Average*" (within +/- 1 sd of *M*, 7 to 18 colors, n = 19) or "*Above Average*" (1 sd above *M*, 19 or more colors, n = 4).

group as using less color would be rated with higher levels of internalizing problems.

A MANOVA examining group differences for behavioral rating on the CBCL: Internalizing and Externalizing Indices was performed with missing data replaced with *M* scores (Table 3.4). No significant group differences were found for any of the behavioral measures examined. However, it should be noted that the girls' sample size was approximately one-half that of the boys and group sizes were extremely unequal resulting in greatly reduced statistical power which may have obscured relevant findings.

**Table 3.4: GIRLS' USE OF COLOR: COGNITIVE AND BEHAVIORAL MEASURES**

*M*, (sd), df, F and p Values

| | Below Average (n = 7) | Average (n = 14) | Above Average (n = 5) | df | F | p[a] |
|---|---|---|---|---|---|---|
| WASI | | | | | | |
| *VIQ* | 95.7 (12.9) | 96.7 (11.6) | 93.8 (10.7) | 2,24 | .111 | n.s. |
| *PIQ* | 104.5 (7.9) | 94.9 (13.5) | 96.8 (12.1) | 2,24 | .516 | n.s. |
| CELF | | | | | | |
| *Receptive Index* | 92.1 (12.3) | 90.6 (16.9) | 91.4 (14.7) | 2,24 | .025 | n.s. |
| *Expressive Index* | 87.7 (3.3) | 84.2 (14.2) | 82.4 (13.8) | 2,24 | .306 | n.s. |
| VMI | 93.3 (12.0) | 91.6 (8.1) | 87.6 (7.6) | 2,24 | .581 | .065 |
| CBCL[b] | | | | | | |
| *Internalizing Index* | 54.7 (13.5) | 52.7 (9.9) | 56.2 (8.7) | 2,24 | .795 | n.s. |
| *Externalizing Index* | 53.7 (7.9) | 51.7 (9.6) | 61.6 (5.4) | 2,24 | 2.47 | n.s. |

a = n.s. is p > .10
b = Elevated scores on the CBCL are indicative of poorer adaptive functioning.

The association of color and externalizing behaviors in girls was further examined using an ANOVA comparing the number of colors used to complete the Family and Peer drawings for girls grouped as meeting criteria for ADHD with those who did not meet criteria (Table 3.5). No significant differences were found between girls grouped for ADHD status in their use of color on either the Family or Peer drawings ($F_{(1,25)} = 1.59$, $p > .10$). These findings suggested that increased externalizing behaviors were not associated with an increased use of color. However, once again the small sample size may have obscured relevant findings.

**Table 3.5: COLOR USE AND ADHD IN GIRLS**
*M* and (sd)

| | No ADHD n = 17 | ADHD n = 12 |
|---|---|---|
| Family Drawing | 6.6 (2.6) | 6.7 (3.8) |
| Peer Drawing | 5.6 (2.8) | 7.6 (2.5) |

*In summary*, boys who used fewer colors in their drawings in addition to having superior graphomotor skills were rated with increased levels of internalizing behaviors especially in the area of Anxiety/Depression compared to those using an average or above average number of colors. Most notable was the association of reduced color use in boys' Peer drawing with elevated ratings on the CBCL subscale of Anxiety /Depression. In girls, the total number of colors used for drawings was not significantly associated with cognitive, graphomotor or behavioral measures.

A diagnosis of ADHD was not associated with an increased use of color for either the Family of Peer drawings in either boys or girls, again demonstrating that in this age restricted sample no association between increased color use and externalizing behaviors

were found.

These findings partially support the hypothesis that the number of colors used in drawing is related to behavioral functioning. Internalizing behaviors were associated with restricted color use in boys but not girls. These findings taken in totality begin to suggest that boys and girls may differ in some fundamental fashion in how they use color in drawings.

## *Color Realism*

It has been observed that children with behavioral issues often use color in an unrealistic, idiosyncratic fashion. Since increasing realism has empirically been linked to maturational factors, a cognitive explanation for unrealistic use of color might be more parsimonious.

### *Preliminary Analyses*

Family and Peer drawings were scored for level of color realism. Although interrater reliabilities were significant for both the Family and Peer drawings, rater scores were only moderately correlated (Family drawing, Spearman rho = .711, n = 87, $p < .0001$; Peer drawing Spearman rho = .787, n = 85, $p < .0001$) suggesting an unacceptable degree of subjectivity in the evaluation of this variable. In order to reduce error, a final score for level of realism for each of the drawings was derived by consensus. Scores across both drawings were then collapsed and children were grouped as follows: "*Unrealistic*" = both drawings unrealistically (n = 10); "*Mixed*" = one or both drawings colored with some realistic elements (n = 54); "*Realistic*" = both drawings realistic (n = 18). Three boys demonstrated an unusual pattern with one drawing rated

"*Unrealistic*" and the other rated "*Realistic*". These boys were excluded from further analysis, as were three children (boys, n = 1) who did not complete both drawings for a final sample size of 82 children (boys, n = 55).

***Examination of Confounding Variables***

As was true for the number of colors children used to complete their drawings, it was important to determine what variables might influence the level of color realism in a child's drawing. A Pearson chi square analysis of the relationship of sex and realistic use of color was not significant although there was a trend for girls to use more realistic color compared to boys ($X^2$ = .090; Table 3.6).

**Table 3.6: A COMPARISION OF REALISTIC COLOR BY BOYS AND GIRLS**

n and (%)

| | Boys | Girls |
|---|---|---|
| Unrealistic | 9 (16.4) | 1 (3.7) |
| Mixed | 37 (67.3) | 17 (62.9) |
| Realistic | 9 (16.4) | 9 (33.3) |

It was predicted that age would influence the realistic use of color. Using an ANOVA the age of "*Realistic*", "*Unrealistic*" and "*Mixed*" groups were compared (Table 3.7). As anticipated, increasing age was a significant factor in children's use of more realistic color. A post hoc Tukey analysis found that children grouped as "*Unrealistic*" where significantly younger than the "*Realistic*" group (p = .003) while no significant age differences between the "*Unrealistic*" and "*Mixed*" groups or the "*Mixed*" and "*Realistic*" groups were found. This suggested that as children matured there was an increased likelihood that they would color their drawings in a more realistic fashion.

When scoring for the realistic color variable it became apparent that when a child used a greater number of colors, his or her drawings tended to appear more realistic. In order to evaluate the effect of number of colors on realistic color use an ANOVA comparing the three groups was performed (Table 3.7). As anticipated, there was a significant difference in the number of colors used between groups. A Tukey pos hoc analysis revealed that children grouped as "*Unrealistic*" and "*Mixed*" use a comparable number of colors to complete their drawing but both groups used significantly fewer colors when compared to the "*Realistic*" group ("*Unrealistic*" and "*Realistic*" p = .018; "*Mixed*" and "*Realistic*" p = .010).

**Table 3.7: REALISTIC USE OF COLOR: AGE AND NUMBER OF COLORS**

*M*, (sd), df, F and p Values

| | Unrealistic (1) n = 10 | Mixed (2) n = 54 | Realistic (3) n = 18 | df | F | p | Post Hoc Comparison |
|---|---|---|---|---|---|---|---|
| Age | 92.6 (5.3) | 99.7 (10.3) | 105.9 (9.9) | 2,79 | 6.18 | .033 | 1<3; 1=2; 2 =3 |
| Total Number of Colors | 7.9 (5.1) | 9.2 (5.4) | 13.3 (3.4) | 2,79 | 5.56 | .005 | 1&2<3; 1 = 2 |

***Hypothesis Three: The Association of Realistic Use of Color With Cognitive Variables***

It was hypothesized that the use of unrealistic color would be indicative of cognitive delays rather than being associated with psychopathology.

A MANOVA was performed in order to determine whether the "*Unrealistic*", "*Mixed*" and "*Realistic*" groups would differ in their cognitive, language and graphomotor ability. Since age and number of colors were significantly related to realistic use of color they were entered as covariates with missing data replaced by *M* values (Table 3. 8). The three groups were comparable for their performance on all cognitive measures examined when age and number of colors were controlled. The groups significantly differed for graphomotor ability as with both the "*Mixed*" and "*Realistic*" groups receiving higher scores compared to the "*Unrealistic*" group.

In order to examine the claim that idiosyncratic colors in drawings was a marker for psychopathology an additional MANOVA was performed, comparing the groups ratings for CBCL: Internalizing and Externalizing Indices and Attention Problems, Social Problems and Thought Problems subscales with covariates of age, number of colors and VMI scores since performance on this measure was found to differ significantly between groups (Table 3.8).

None of the behavioral measures examined were found to differ significantly between the three groups.

**Table 3.8: REALISTIC USE OF COLOR: COGNITIVE AND BEHAVIORAL MEASURES COVARYING FOR AGE AND TOTAL NUMBER OF COLORS**

*M*, (sd), df, F and p Values

| | Unrealistic n = 10 | Mixed n = 54 | Realistic n = 18 | df | F | p[a] |
|---|---|---|---|---|---|---|
| WASI | | | | | | |
| *VIQ* | 93.9 (16.7) | 96.9 (12.5) | 101.7 (15.8) | 2,77 | 1.31 | n.s. |
| *PIQ* | 90.3 (11.0) | 99.2 (13.5) | 95.4 (14.7) | 2,77 | 1.89 | n.s. |
| CELF | | | | | | |
| *Receptive Index* | 86.9 (20.7) | 92.0 (15.4) | 89.4 (13.2) | 2,77 | .555 | n.s. |
| *Expressive Index* | 83.0 (20.2) | 88.4 (14.3) | 86.1 (12.1) | 2,77 | .501 | n.s. |
| VMI | 84.9 (10.4) | 91.6 (8.9) | 90.8 (11.8) | 2,77 | 3.38 | .039 |
| **ADDITIONAL COVARIATE OF VMI** | | | | | | |
| CBCL | | | | | | |
| *Internalizing Index* | 56.4 (12.4) | 54.3 (10.9) | 57.4 (9.4) | 2,76 | 1.47 | n.s. |
| *Externalizing Index* | 57.7 (6.9) | 55.3 (9.1) | 57.7 (8.9) | 2,76 | .939 | n.s. |
| CBCL Subscales | | | | | | |
| *Attention Problems* | 63.1 (6.4) | 61.7 (8.9) | 61.8 (7.4) | 2,76 | .266 | n.s. |
| *Social Problems* | 56.4 (6.7) | 58.3 (7.1) | 59.7 (6.2) | 2,76 | .078 | n.s. |
| *Thought Problems* | 56.8 (8.4) | 56.1 (7.2) | 55.0 (5.9) | 2,76 | .286 | n.s. |

a = n.s. is p > .10

To further explore the association of color realism and behavior, 41 children identified as ADHD and 41 children who did not meet criteria for this diagnosis were compared for their use of realistic color using a Pearson Chi Square. No differences between groups was observed suggesting that at least for this group of prepubescent children idiosyncratic color was not associated with poor affect regulation (Table 3.9).

**Table 3.9: REALISITIC USE OF COLOR AND ADHD**

Number and (%)

| | Unrealistic | Mixed | Realistic |
|---|---|---|---|
| No ADHD | 5 (12.2) | 27 (65.8) | 9 (22.0) |
| ADHD | 5 (12.2) | 27 (65.8) | 9 (22.0) |

*In summary*, idiosyncratic use of color was not associated with behavioral problems in this sample of children. Unrealistic use of color was more readily explained as a function of maturation and depressed graphomotor skills. However, it should be noted that these findings might only apply to the children in this age-restricted sample (i.e. 7 years to 9 years 3 months). Cognitive and/or behavioral issues may become more apparent in older children who continue to use color in their drawings in an unrealistic fashion.

### *Additional Analyses: Sex Differences in the Use of Specific Colors*

Since boys and girls differed on the number of colors they used to complete their drawings and in the association of color use and behavior, additional analyses were undertaken to examine if other fundamental sex differences emerged for color.

Boys' and girls' use of the eleven different colors for both the Family and Peer drawings were compared using a Chi Square statistic (Table 3.10).

**Table 3.10: USE OF SPECIFIC COLORS**

Data reported as percentage of children using specified color

| | FAMILY DRAWING | | | PEER DRAWING | | |
|---|---|---|---|---|---|---|
| | All | Boys | Girls | All | Boys | Girls |
| Black | 66.7 | 60.3 | 79.3 | 75.6 | 71.2 | 85.2 |
| Red | 62.1 | 51.7 | 82.8** | 66.3 | 61.0 | 77.8 |
| Yellow | 52.9 | 43.1 | 72.4* | 58.1 | 47.4 | 81.5** |
| Blue | 51.7 | 44.8 | 65.5 | 56.9 | 54.2 | 62.9 |
| Sky Blue | 50.6 | 41.4 | 68.9* | 37.2 | 28.8 | 55.6* |
| Brown | 47.1 | 39.6 | 62.1 | 47.7 | 38.9 | 66.7* |
| Orange | 37.9 | 32.8 | 48.3 | 45.3 | 35.6 | 66.7** |
| Yellow Green | 37.9 | 32.8 | 48.3 | 34.9 | 25.4 | 55.6** |
| Violet | 33.3 | 25.9 | 48.3* | 20.9 | 20.3 | 22.2 |
| Light Brown | 32.2 | 25.8 | 44.8 | 24.4 | 22.0 | 29.6 |
| Green | 24.1 | 13.8 | 44.8** | 31.4 | 30.5 | 33.3 |

* Pearson $X^2$ = p $\leq$ .05 ** Pearson $X^2$ = p $\leq$ .01

A greater percentage of girls compared with boys used the following colors in the Family drawings: green ($X^2$ = 10.46, p = .001); red ($X^2$ = 7.57, p = .006); yellow ($X^2$ = 6.28, p = .012); sky blue ($X^2$ = 6.22, p = .013); and violet ($X^2$ = 4.59, p = .032). In the Peer drawings a greater percentage of girls used yellow ($X^2$ = 8.81, p = .003); orange ($X^2$ = 7.22, p = .007); yellow-green ($X^2$ = 7.40, p = .007); brown ($X^2$ = 5.69, p = .017); and sky blue ($X^2$ = 5.67, p = .017).

These findings were not unexpected given the fact that if girls' total color use was greater than that of boys, they will, by necessity, have used specific colors with greater frequency. However, when the frequency of specific color use was rank ordered differences in the patterns of how specific colors were used were found for boys compared to girls (Table 3.11).

Boys' were found to use black most frequently followed by the three primary colors, red, then blue, followed by yellow for both types of drawings. Girls' exhibited a

different pattern from boys both within and across drawing types. The rank order of color used in girls' Family drawings was red, followed by black, yellow and then sky blue. In girls' Peer drawings the use of black occurred most frequently, followed by yellow, red; with orange and brown sharing a fourth rank order position.

**Table 3.11: RANK ORDER OF COLORS BY BOYS AND GIRLS**
Colors with same number share rank

| FAMILY DRAWING | | PEER DRAWING | |
|---|---|---|---|
| Boys | Girls | Boys | Girls |
| 1- Black | 1-Red | 1-Black | 1-Black |
| 2 -Red | 2-Black | 2-Red | 2-Yellow |
| 3 -Blue | 3-Yellow | 3-Blue | 3-Red |
| 4 -Yellow | 4-Sky Blue | 4-Yellow | 4-Brown |
| 5 -Sky Blue | 5- Blue | 5-Brown | 4-Orange |
| 5 -Brown | 6- Brown | 6-Orange | 5-Blue |
| 6 -Orange | 7-Orange | 7-Green | 6-Sky Blue |
| 6 -Y. Green | 7-Y. Green | 8-Sky Blue | 6-Y. Green |
| 7 –Violet | 7-Violet | 9-Y. Green | 7-Lt. Brown |
| 7 - Lt. Brown | 8-Lt. Brown | 10- Violet | 8-Green |
| 8 - Green | 8-Green | 11-Lt. Brown | 9-Violet |

*In summary*, in this sample of prepubescent children, several sex differences in the use of color in drawings emerged. In addition to using a greater number of colors and tending to use them more realistically, girls' used specific colors at different frequencies and exhibited a different pattern of use when compared with boys.

As hypothesized, limited use of color was related to internalizing behaviors but only for boys. No association was found for increased use of color and externalizing behaviors for either boys or girls. These findings taken in total begin to suggest that there are some fundamental and perhaps important differences in girls' and boys' relationship to color.

## Figure Depiction in Children's Drawings

### *Number of Friends Depicted in the Peer Drawing*

The number of "*friends*" a child depicted in his or her Peer drawings was proposed as a child-centered measure of social functioning with those having a large social network expected to incorporate a greater number of figures.

#### *Preliminary Analyses*

Two raters calculated the total number of figures in each Peer drawing with a high degree of reliability (Coder A: *M* = 3.54, sd = 1.80; Coder B: *M* = 3.38, sd = 1.81; r = .939, p <.0001). Scoring disagreements were resolved by consensus.

During scoring it was noted that 13 (14.9%) of the drawings contained extraneous figures, including "*self"* drawn more than once, parents or the examiner. Due to these observations the number of friends was recalculated with "*self*" and extraneous figures removed from the total score. Questionable figures, such as siblings, cousins and unnamed figures were not deducted. Two girls, who refused to complete a Peer drawing, were scored as drawing 0 friends. One boy was removed from further analysis because his drawing consisted of scribbling and although he identified a general area as "*me and my friends*," none could be individually identified[10]. All further analyses were based on these corrected scores for a total sample size of 87 (boys = 58) with a *M* number of friends = 2.15, a sd = 1.62 with a range of 9.

[10] Although this boy's Peer drawing data was not entered into the analysis it is relevant to this discussion that he received a SSRS: Social Skills Rating score of 75 (5%ile) and a SSRS: Problem Behavior score of 118 (88%ile). In addition, his CBCL: Social Problems T score was 69 (97 %ile). These scores were highly indicative of deficient social skills.

***Examination of Extraneous Variables***

As was true for color, it was important to determine which extraneous variables might influence the number of friends a child depicted in his or her drawing. Using independent samples t-tests no effects were found for order of administration (Peer drawing administered Day 1: n = 40, *M* = 1.98, sd = 1.53; Day 2: n = 47, *M* = 2.30, sd = 1.71; $t_{(85)} < 1$) or sex (Boys: *M* = 2.07, sd = 1.67; Girls: *M* = 2.31, 1.54; $t_{(85)} < 1$).

Age was positively correlated with older children depicting more friends (Pearson r = .277, p = .010). This finding was not unexpected considering it has been well recognized that as children mature, they become increasing focused on peer relationships.

To determine if the number of friends depicted was associated with general cognitive, language or graphomotor abilities partial correlations were performed controlling for age (Table 3.12). None of the measures of general cognitive, language or graphomotor skills correlated significantly with the number of friends depicted in the Peer drawing. This lack of association was somewhat unexpected considering impaired verbal and nonverbal cognitive functioning has been recognized as having a negative impact on a child's ability to form and maintain friendships.

**Table 3.12: ASSOCIATION OF NUMBER OF FRIENDS DEPICTED WITH COGNITIVE MEASURES CONTROLLING FOR AGE**

| | r | p |
|---|---|---|
| WASI (n = 87) | | |
| *VIQ* | -.127 | n.s. |
| *PIQ* | -.155 | n.s. |
| CELF (n = 86) | | |
| *Receptive Language* | .020 | n.s. |
| *Expressive Language* | .004 | n.s. |
| VMI (n = 84) | -.035 | n.s. |

***Hypothesis One: Number of Friends and Social Skills Functioning***

It was hypothesized that a reduced number of friends in the Peer drawing would be correlated with social functioning as measured by the SSRS: Social Skills Rating and the CBCL: Withdrawn/Depressed, Social Problems and Aggression subscales. Partial correlations were performance controlling for age (Table 3.13).

**Table 3.13: ASSOCIATION OF NUMBER OF FRIENDS DEPICTED WITH SOCIAL AND BEHAVIORAL MEASURES CONTROLLING FOR AGE**

| | R and p Values | |
|---|---|---|
| | r | p[a] |
| SSRS [b] (n = 81) [c] | | |
| *Social Skills Rating* | .226 | .044 |
| CBCL Subscales [d] (n = 85) | | |
| *Withdrawn/Depressed* | -.039 | n.s. |
| *Social Problem* | -.207 | .059 |
| *Aggression* | .198 | .071 |
| SSRS Subscales (n = 81) | | |
| *Cooperation* | .203 | n.s. |
| *Assertion* | .097 | n.s |
| *Responsibility* | .199 | .077 |
| *Self-Control* | .252 | .024 |

a = n.s. is p > .10
b = Higher scores associated with better adaptive functioning.
c = Six parents were not administered the SSRS.
d = Higher scores associated with poorer adaptive functioning

None of the examined CBCL subscales were significantly correlated with number of friends depicted in the Peer drawing, although both Social Problems and Aggression approach significance with increases in problematic behaviors associated with a decrease in the number of friends depicted. As predicted the Social Skills Rating was positively correlated with number of friends depicted. Children with better overall social skills incorporated more friends in their Peer drawings. However, the association was modest

and accounted for little of the variance ($r^2$ = .051).

Since the Social Skills Rating is a composite score derived from four subscales (Cooperation, Assertion, Responsibility and Self-Control[11]) it was of some interest as to whether specific domains would be differentially associated with the number of friends depicted in a drawing. It was predicted that Assertion, the primary measure of a child's ability to make and maintain friendships, would be most highly correlated with number of friends drawn. However, only the Self-Control subscale was significantly and positively correlated, with children exhibiting increased levels of self-control drawing more friends. The Cooperation and Responsibility subscales approached significance in the expected direction with increased levels of adaptive functioning associated with more friends depicted. Only Assertion, the primary measure of peer relationships, lacked any association with the number of friends depicted.

*In summary*, older children depicted more friends in their Peer drawings. After controlling for age, children who drew fewer friends displayed impaired social functioning as well as evidenced increased levels of aggression and poorer self-control. However, it must be acknowledged that, overall, these associations were weak and therefore the number of friends depicted in Peer drawings has limited potential as a child-centered measure of social functioning.

### *Additional Analyses of Number of Figures in Peer Drawing*

Observations made while scoring the Peer drawings led to the formulation of some additional questions regarding children's depiction of friends. While some of these observations generated specific hypotheses others led to analyses that were exploratory in

[11] Refer to Appendix B for samples of the questions that make up these various subscales.

nature.

***No Friends Depicted***

A small subset of five children (boys n = 3) either refused to complete the Peer drawing (n = 2; boys n = 0) or failed to depict any friends (n = 3; boys n = 3). This sample was considered too small for a quantitative analysis. However, a comparison of group *M* performance on cognitive and behavioral variables for children grouped as having "*No Friends*" and those depicting "*Friends*" defined as the depiction of any additional figures besides a self-figure was revealing (Table 3.14). Children drawing friends appeared to be somewhat older and consistently displayed better language functioning as well as receiving higher scores on all parent rated social skills measures compared to the "*No Friends*" group.

Children were then grouped as having "*No Friends*" or having "*One Friend*" defined as the depiction of one additional figure besides the self-figure. It appeared drawing at least one friend was indicative of better verbal functioning as well as superior social skills compared to children depicting no friends (Table 3.14).

**Table 3.14: COMPARISION OF "*FRIENDS*" WITH "*NO FRIENDS*" AND "*NO FRIENDS*" WITH "*ONE FRIEND*"** [a]

*M* and (sd)

| | Friends n = 82 | No Friends n = 5 | One Friend [b] n = 30 |
|---|---|---|---|
| Age | 100.1 (10.1) | 94.0 (5.9) | 96.8 (10.0) |
| WASI | n = 82 | n = 5 | n = 30 |
| *VIQ* | 98.7 (14.6) | 95.4 (8.7) | 101.9 (15.2) |
| *PIQ* | 97.3 (14.2) | 97.0 (11.9) | 99.2 (14.6) |
| CELF | n = 81 | n = 5 | n = 30 |
| *Receptive Language* | 91.9 (15.5) | 77.8 (23.1) | 93.6 (16.9) |
| *Expressive Language* | 87.8 (14.6) | 75.8 (19.8) | 88.1 (14.8) |
| VMI | n = 80 | n = 4 | n = 30 |
| | 90.7 (9.9) | 91.2 (9.5) | 90.8 (11.2) |
| CBCL Subscales | n = 80 | n = 5 | n = 30 |
| *Withdrawn/Depressed* | 56.7 (6.7) | 57.0 (11.7) | 55.3 (5.3) |
| *Social Problems* | 57.9 (6.6) | 62.8 (8.9) | 58.9 (7.6) |
| *Aggression* | 56.2 (6.8) | 56.8 (8.3) | 58.4 (8.6) |
| Social Skills Rating Subscales | n = 76 | n = 5 | n = 28 |
| *Cooperation* | -.141 (1.3) | -1.05 (.98) | -.253 (1.6) |
| *Assertion* | -.392 (1.0) | -1.43 (1.3) | -.294 (1.1) |
| *Responsibility* | .002 (1.1) | -1.64 (.87) | -.004 (1.1) |
| *Self-Control* | -.006 (1.0) | -.560 (1.6) | -.239 (1.3) |

a = Scores denoting a higher levels of cognitive or behavioral functioning are underlined with the caveat that most of these differences would likely be statistically meaningless.
b = "*One Friend*" is a subset of "*Friends*".

*In summary,* although these findings must be viewed cautiously, children who refused to draw a Peer picture or fail to depict any friends appeared to be cognitively and behaviorally distinct from those depicting friends. Even the inclusion of one friend in the Peer drawing was indicative of superior language abilities and social skills when compared to children failing to complete a Peer drawing or producing a picture devoid of peers.

***Extraneous Figures in the Peer Drawing***

As mentioned, 13 children drew extraneous figures in their Peer drawings. This would qualify as a "marker" for psychopathology by either the Koppitz's system or the DAP:SPED method of scoring since it occurred in less than 15% of the total sample. No a priori hypotheses had been proposed regarding this feature since it was an unanticipated finding. However, an attempt was made to determine the demographic, cognitive and/or behavioral variables that might account for this unusual behavior.

Children were grouped as follows: "*No Extra Figures*" or "*Extra Figures*". Two girls who refused to complete a Peer drawing and one boy, who scribbled his drawing, were dropped from this analysis for a total sample of 85 ("*No Extra Figures*": n = 72; "*Extra Figures*": n = 13).

Chi Square analyses found no order of administration effects (Peer drawing administered Day 1: "*No Extra Figures*": n = 33, 45.8%; "*Extra Figures*": n = 7, 53.8%; $X^2 = < 1$). Children in the "*Extra Figure*" group were significantly more likely to be female ("*Extra Figures*" boys: n = 5, 8.6%; "*Extra Figure*s" girls: n = 8, 29.6%; $X^2 = 5.28$, p = .012). An independent samples t-test found the groups were similar in age, suggesting that maturation was not a relevant factor in whether or not children included extraneous figures into their Peer drawings in this age-restricted sample ("*No Extra Figures*": *M* = 99.5, sd = 10.3; "*Extra Figures*": *M* = 101.5, sd = 9.82; $t_{(83)} = < 1$).

A MANOVA was used to compare the groups on cognitive, language and graphomotor performance with missing data replaced with group *M* scores (Table 3.15). No significant differences between the groups were found for WASI: PIQ scores or graphomotor ability. Significant group differences were found for performance on the

WASI: VIQ and the CELF: Receptive Index while the CELF: Expressive Index tended towards significance. On all threes of these verbal measures children drawing extraneous figures evidenced lowered performance compared to those drawing no extra figures.

The WASI: VIQ and the CELF: Receptive Language Index was further investigated by comparing group performance on the subtests that comprise these indices in an attempt to isolate the nature of the underlying language problem. A MANOVA comparing group performance on Vocabulary and Similarities subtests of the WASI and the CELF: Concepts & Directions and Word Classes were performed[12] (Table 3.15). No significant differences were found between groups for performance on the Concept & Directions subtest. Highly significant group differences were found for WASI: Similarities with children including extraneous figures performing poorly on this subtest compared to the *"No Extra Figures*" group. Both the WASI: Vocabulary and CELF: Word Classes approached significance with those in the "*No Extra Figures"*" group receiving higher subtest scores when compared to the "*Extra Figures*" group.

[12] Sentence Structure was not entered into the analysis. Since children above the age of 9 years are not administered this subtest there would have been too large a reduction in sample size and procedures for the replacement of missing data would have been compromised.

**Table 3.15: "*EXTRA FIGURES*" VS "*NO EXTRA FIGURES*": COGNITIVE MEASURES**

*M*, (sd), F and p Values

| | No Extra Figures n = 72 | Extra Figures n = 13 | df | F | p[a] |
|---|---|---|---|---|---|
| WASI | | | | | |
| *VIQ* | 100.1 (14.7) | 89.6 (9.6) | 1,83 | 6.22 | .016 |
| *PIQ* | 97.8 (14.3) | 94.9 (12.7) | 1,83 | .425 | n.s. |
| CELF | | | | | |
| *Receptive Language* | 93.1 (14.6) | 81.7 (18.4) | 1,83 | 5.55 | .015 |
| *Expressive Language* | 88.5 (14.6) | 80.5 (15.1) | 1,83 | 3.07 | .073 |
| VMI | 91.1 (10.2) | 90.0 (6.4) | 1,83 | .091 | n.s. |
| WASI: VIQ Subscales[a] | | | | | |
| *Vocabulary* | 46.9 (11.1) | 40.7 (6.4) | 1,83 | 3.91 | .055 |
| *Similarities* | 52.5 (9.4) | 44.1 (9.2) | 1,83 | 9.21 | .004 |
| CELF Receptive Subscales [b] | | | | | |
| *Concepts & Directions* | 7.8 (3.2) | 6.3 (2.9) | 1,83 | 2.46 | n.s. |
| *Word Classes* | 9.7 (2.5) | 8.2 (2.6) | 1,83 | 3.33 | .059 |

a = n.s. is p > .10
b = Scores reported are T scores
c = Scores reported are scaled scores

The finding of language differences between these two groups should be considered cautiously due to grossly unequal group sizes and the increased risk of Type I errors due to multiple comparisons. However, it does suggest that children including additional figures in their Peer drawings may be cognitively distinct from those who do not incorporate extraneous figures. Given that verbal performance was relatively depressed compared to nonverbal ability, children who included extraneous figures were not simply of lower cognitive aptitude but specifically limited in their receptive and to a lesser extent their expressive language ability. Most notably, their problems appear to be centered on the ability to understand and express semantic relationships. In terms of their

performance on the Peer drawing, this may represent a lack of appreciation as to what constitutes the correct subordinates of the class "*friends*" causing them to be overly inclusive.

Since the inclusion of additional figures could easily be interpreted as noncompliance, group ratings on the Social Skills Rating subscales of Cooperation, Self-Control and the CBCL subscale of Rule-Breaking were compared using a MANOVA analysis (Table 3.16). Children who included extra figures received comparable rating on the SSRS: Cooperation and Self-Control subscales as well as for the CBCL: Rule-Breaking to those in the "*No Extra Figures*" group. This suggests that noncompliance, as operationalized by these three subscales, was an unlikely factor as to why some children incorporate extraneous figures into their Peer drawings. Rather than being noncompliant, these children simply may not have fully understood the task instructions. In fact, children with a diagnosis of SLI were significantly more likely to draw extraneous figures compared to those with more typically developing language ("*No Extra Figures*" and SLI: n = 18, 25.0%; "*Extra Figures*" and SLI: n = 8, 61.5%; $X^2 = 6.924$, p = .009).

**Table 3.16: "*EXTRA FIGURES*" VS. "*NO EXTRA FIGURES*": BEHAVIORAL MEASURES**

*M*, (sd), F and p Values

| | No Extra Figures (n = 72) | Extra Figures (n = 13) | df | F | p[a] |
|---|---|---|---|---|---|
| Social Skills Rating Subscales [a] | | | | | |
| *Cooperation* | -.219 (1.25) | .038 (1.07) | 1,83 | .559 | n.s. |
| *Self-Control* | .005 (1.00) | -.356 (1.17) | 1,83 | 1.43 | n.s. |
| CBCL Subscales | | | | | |
| *Rule-Breaking* | 58.0 (6.9) | 56.5 (6.1) | 1,83 | .533 | n.s. |

a = n.s. is p > .10

*In summary*, in this sample, there existed a small subset of children who when

asked to draw a picture of themselves and friends included extraneous figures. Overall, these children did not appear to be oppositional or noncompliant but rather were of lower verbal intelligence and demonstrated reduced receptive language functioning mostly centered in their ability to understand semantic relationships. This subset of children was also significantly more likely to be identified as having SLI.

### *Additional Analyses - Family Drawings*

No a priori hypotheses had been generated regarding the number of figures depicted in the Family drawing. Observations made while scoring these drawings led to additional hypotheses and analyses.

#### *No Maternal Figure*

One might assume that when a child is asked to draw a picture of his or her family the failure to draw a maternal figure would be meaningful and likely related to attachment issues. In this sample of 87 children (1 boy not administered Family drawing), no maternal figure was depicted in 10 (11.5%) of the Family drawings despite the fact that these children had a biological mother present in the household. This observation led to the formulation of the hypothesis that children failing to include a maternal figure would evidence increased levels of behavioral disturbance as measured by the CBCL.

***Preliminary Analyses*** - Children were grouped as "*Maternal Figure Present*" or "*Maternal Figure Omitted*". Chi Square analyses found no order of administration (Family drawing administered on Day 1: "*Maternal Figure Present*" n = 77, 88.5%; "*Maternal Figure Omitted*" n = 10, 11.5%; $X^2 = 2.895$, p = .089) or sex differences

("*Maternal Figure Present*": Boys n = 51, 87.9%; Girls n = 26, 89.6%; "*Maternal Figure Omitted*" Boys n = 7, 12.1%; Girls n = 3, 10.3%; $X^2 = < 1$) between groups. An independent sample t-test found age to be a non significant factor ("*Maternal Figure Present*": *M* age = 99.8 months, sd = 10.0; "*Maternal Figure Omitted*": *M* age = 100.8 months, sd = 11.8; $t_{(85)} = < 1$).

The two groups cognitive, language and graphomotor performances were compared using a MANOVA with missing data replaced by group *M* scores. Although the "*Maternal Figure Present*" and the "*Maternal Figure Omitted*" groups received comparable WAIS PIQ and VMI scores, group differences were found for several verbal measures. The two groups differed significantly on both the CELF: Receptive and Expressive Indices scores as well as showing a trend towards significance on the WAIS VIQ. In all cases better verbal functioning was associated with the omission of a maternal figure.

Group differences in language measures were unexpected findings. The nature of the relatively lower language performance in the "*Maternal Figure Present*" group was further examined with a MANOVA comparing the two groups' ability on the subscales comprising the WASI: VIQ and the CELF: Receptive and Expressive Language Indices[13] (Table 3.17). The WASI: Vocabulary and the CELF: Concepts and Directions, Recalling Sentences and Understanding Paragraphs subtests were comparable between groups while the CELF: Formulated Sentences showed a trend towards significance with children excluding a maternal figure evidencing higher functioning. Children excluding a maternal figure received significantly higher scores on the WASI: Similarities subtest as

[13] Sentence Structure and Word Structure were not entered into the analysis. Since children above the age of 9 years are not administered these subtests there would have been too large a reduction in the sample size.

well as the CELF: Word Classes – Receptive and Word Classes – Expressive subtests compared to those drawing a maternal figure. All three of these subtests assess a child ability to use language in an abstract fashion.

**Table 3.17: "*PRESENT*" OR "*OMITTED*" MATERNAL FIGURE: COGNITIVE MEASURES**

*M*, (sd), df, F and p Values

| | Maternal Figure Present n = 77 | Maternal Figure Omitted n = 10 | df | F | p[a] |
|---|---|---|---|---|---|
| WASI | | | | | |
| *VIQ* | 97.1 (13.8) | 106.1 (13.9) | 1,85 | 3.78 | .055 |
| *PIQ* | 96.2 (14.1) | 102.6 (8.9) | 1,85 | 1.96 | n.s. |
| CELF | | | | | |
| *Receptive Language* | 89.5 (16.3) | 101.8 (8.7) | 1,85 | 5.44 | .022 |
| *Expressive Language* | 86.1 (15.4) | 96.3 (7.2) | 1,85 | 4.24 | .043 |
| VMI | 90.0 (9.9) | 94.1 (8.2) | 1,85 | 1.53 | n.s. |
| WASI VIQ Subscales | | | | | |
| *Vocabulary* | 45.1 (10.4) | 50.6 (9.9) | 1,85 | 2.51 | n.s. |
| *Similarities* | 50.4 (9.4) | 56.7 (9.5) | 1,85 | 4.03 | .048 |
| CELF Receptive Subscales[b] | | | | | |
| *Concepts & Directions* | 7.4 (3.3) | 8.7 (2.7) | 1,85 | 1.42 | n.s. |
| *Word Classes – Receptive* | 9.2 (2.6) | 11.6 (1.9) | 1,85 | 8.20 | .005 |
| *Understanding Paragraphs* | 8.3 (3.3) | 10.0 (1.8) | 1,85 | 2.61 | n.s. |
| CELF Expressive Subscales[b] | | | | | |
| *Formulated Sentences* | 7.5 (2.8) | 9.3 (2.4) | 1,85 | 3.63 | .060 |
| *Recalling Sentences* | 7.6 (2.8) | 8.8 (1.7) | 1,85 | 1.67 | n.s. |
| *Word Classes – Expressive* | 8.9 (2.8) | 12.4 (2.0) | 1,85 | 14.4 | <.001 |

a = n.s. is p > .10
b = Scores are reported as scaled scores

Perhaps the underlying difference between children who include or exclude a maternal figure is that the latter do not take the instruction "*Draw everyone in your family…*" literally. An alternative explanation could be that children with weaker

language skills rely more on a maternal figure. In contrast, those who have stronger verbal abilities have greater self-reliance and have begun to explore the world with greater independence.

***Hypothesis: The Association of No Maternal Figure with Behavioral Disturbance*** - It was hypothesized that children omitting a maternal figure in their Family Drawing would evidence increased levels of behavioral disturbance compared to children including a maternal figure.

Using a MANOVA analysis the two groups of children were compared on a wide range of behavioral measures including the CBCL: Internalizing and Externalizing Indices and Attention, Social and Thought Problems subscales; the Social Skills Rating and Behavior Problems and parent and teacher ADHD IV ratings with group *M* scores replacing missing data. No significant differences between groups were found on any of the behavioral ratings examined (Table 3.18). Although there was reduced power due to unequal group membership these findings began to suggest that the exclusion of a maternal figure from the Family drawing lacks value as a marker of psychopathology in this sample.

**Table 3.18: "*PRESENT*" OR "*OMITTED*" MATERNAL FIGURE: BEHAVIORAL MEASURES**

*M*, (sd), df, F and p Values

| | Maternal Figure Present n = 77 | Maternal Figure Omitted n = 10 | df | F | p[a] |
|---|---|---|---|---|---|
| CBCL | | | | | |
| *Internalizing Index* | 54.4 (10.5) | 59.7 (11.9) | 1,85 | 2.24 | n.s. |
| *Externalizing Index* | 55.8 (8.9) | 54.3 (10.3) | 1,85 | .231 | n.s. |
| CBCL Subscales | | | | | |
| *Attention Problems* | 61.9 (8.2) | 60.4 (9.6) | 1,85 | .311 | n.s. |
| *Social Problems* | 58.0 (6.9) | 60.3 (5.2) | 1,85 | .959 | n.s. |
| *Thought Problems* | 56.0 (7.2) | 56.5 (8.2) | 1,85 | .033 | n.s. |
| SSRS | | | | | |
| *Social Skills Rating* | 95.8 (16.6) | 98.7 (16.9) | 1,85 | -.516 | n.s. |
| *Problem Behaviors* | 103.3 (14.4) | 102.0 (16.6) | 1,85 | .255 | n.s. |

a = n.s. is p > .10

*In summary*, the hypothesis that including no maternal figure in a Family drawing was indicative of behavioral disturbance was not supported. Unexpectedly, children who omitted a maternal figure evidenced significantly stronger language functioning compared to those who included this figure. This finding may be related to children with relatively weaker language have a greater need for "*mother*" to help them to negotiate interactions with the outside world. However, conclusions regarding omission of a maternal figure should be considered extremely tentative due to the fact that this was a referred clinical sample, with relatively few children qualifying as free from some degree of cognitive and/or behavioral limitations. Additional methodological concerns included the limited sample size, unequal groups and multiple comparisons.

***Number of Figures in Family Drawings***

No specific hypotheses regarding the number of figures a child included in their Family drawing was originally proposed. However, since the examination of number of figures incorporated into the Peer drawing and the inclusion of extraneous figures proved to be of some value, additional analyses of the Family drawings were undertaken.

***Number of Family Members Depicted*** - The number of figures in the Family drawing calculated by two raters resulted in a high degree of agreement (Coder A: $M$ = 4.66, sd = 1.99; Coder B: $M$ = 4.62, sd = 1.94; r = .975, p < .0001). All scoring disagreements were resolved by consensus.

As was true of the Peer drawings, a subset of children (n = 6, 6.9%) included extraneous figures such the examiner, cab drivers, doormen or television figures. Due to this observation, the number of figures was recalculated with extraneous figures removed from the total. Due to examiner error, one child was not administered the Family drawing. All further analyses were based on these corrected scores for a total sample of 87 drawings (boys n = 58) with the $M$ number of figures = 4.53, a sd = 1.90 with a range of 9.

An independent sample t-test found no order of administration effects (Family drawing administrated on Day 1: $M$ = 4.67, sd = 2.21; Day 2: $M$ = 4.36, sd = 1.46; $t_{(85)}$ = < 1) and age did not correlate with total number of family members depicted (Pearson r = -.120, p = .267). Despite boys and girls having an comparable number of actual family members (Boys n = 57, $M$ = 3.74, sd = 1.2; Girls n = 28, $M$ = 4.29, sd = 1.6, $t_{(83)}$ = -1.73, p = .087) an independent sample t-test found sex to be a significant factor with girls drawing more family members compared to boys (boys: $M$ = 4.14, sd = 1.69; girls:

*M* = 5.31, sd = 2.09; $t_{(85)}$ = -2.815, p = .006).

The association of cognitive and behavioral variables with total number of figures depicted in the Family drawings was examined using Pearson r correlations for the entire sample and then individually for boys and girls since sex differences were observed (Table 3.19). General cognitive ability, language and graphomotor ability was not significantly correlated with the number of figures depicted in the Family drawing for either the entire sample or for the sub samples of boys or girls.

The association of number of family members depicted and internalizing and externalizing behaviors was examined using Pearson r correlations (Table 3.20). The Externalizing Index was not significantly correlated with the number of family members depicted for the total sample or for the sub samples of boys or girls. The Internalizing Index, although not significantly correlated with number of family members depicted did evidence a trend with fewer figures depicted associated with elevated behavioral ratings. The analysis of the sub samples of boys and girls revealed sex differences. Girls who drew fewer family members were rated as evidencing increased Internalizing behaviors while the same was not true for boys.

The association of the number of family members depicted by girls and Internalizing behavior was further investigated. Of the CBCL subscales comprising the Internalizing Index, only Somatic Complaints was found to be negatively and significantly correlated with the number of figures included in girls' Family drawings. Girls drawing fewer family members were rated with higher levels of somatic concerns. The subscales of Anxious/Depressed and Withdrawn/Depressed failed to reach significance although a trend was found with girls' drawing fewer family members rated

with somewhat higher levels of anxiety and withdrawal.

**Table 3.19: ASSOCIATION OF NUMBER OF FIGURES IN FAMILY DRAWING WITH COGNITIVE MEASURES**

*M*, (sd), r and p Values [a]

| | Total Sample | Boys | Girls |
|---|---|---|---|
| WAIS | n = 87 | n = 59 | n = 29 |
| *VIQ* | *M* = 98.4 (14.3)<br>r = .046, p = n.s. | *M* = 99.6 (15.6)<br>r = .225, p = .090 | *M* = 96.1 (11.0)<br>r = -244, p = n.s. |
| *PIQ* | *M* = 97.3 (13.9)<br>r = -.073, p = n.s. | *M* = 97.9 (14.8)<br>r = -.044, p = n.s. | *M* = 95.9 (12.3)<br>r = -.093, p = n.s. |
| CELF | n = 86 | n = 59` | n = 28 |
| *Receptive Index* | *M* = 91.0, (16.1)<br>r = .096, p = n.s. | *M* = 91.2 (16.0)<br>r = .163, p = n.s. | *M* = 90.5 (16.6)<br>r = .016, p = n.s. |
| *Expressive Index* | *M* = 87.3 (15.0)<br>r = -.046, p = n.s. | *M* = 88.6 (15.9)<br>r = .063, p = n.s. | *M* = 84.5 (12.8)<br>r = -.158, p = n.s. |
| VMI | n = 84<br>*M* = 90.6 (9.9)<br>r = .070, p = n.s. | n = 56<br>*M* = 90.5 (10.4)<br>r = .172, p = n.s. | n = 29<br>*M* = 90.8 (9.0)<br>r = -.124, p = n.s. |

a = n.s. is p > .10

**Table 3.20: ASSOCIATION OF NUMBER OF FIGURES IN FAMILY DRAWING WITH BEHAVIORAL MEASURES**

*M* , (sd), r and p Values [a]

| | Total Sample<br>n = 86 | Boys<br>n = 57 | Girls<br>n = 29 |
|---|---|---|---|
| CBCL | | | |
| *Internalizing Index* | *M* = 55.1 (10.8)<br>r = -.203, p = .062 | *M* = 55.5 (11.2)<br>r = - .009, p = n.s. | *M* = 54.3 (10.3)<br>r = -.531, p = .003 |
| *Externalizing Index* | *M* = 55.6 (9.1)<br>r = -.109, p =n.s. | *M* = 56.5 (9.1)<br>r = .012, p = n.s. | *M* = 53.8 (8.8)<br>r = -.216, p = n.s. |
| Internalizing Subscales | | | |
| *Anxious/Depressed* | | | *M* = 56.1 (6.5)<br>r = -.331, p = .079 |
| *Withdrawn/Depressed* | | | *M* = 56.4 (6.9)<br>r = -.347, p = .065 |
| *Somatic Complaints* | | | *M* = 56.1 (7.2)<br>r = -.465, p = .010 |

a = n.s. is p > .10

These findings could be interpreted in two possible ways. The number of family members depicted was an accurate recording of a girl's family make-up. Smaller families, which have been associated with increased levels of depression, offered these girls less social support. An alternative interpretation was that the actual family size was unrelated to the number of family members depicted in a child's Family drawing but rather was a "*projection*" of her disconnection and isolation.

In an attempt to understand the relationship between the number of family members included in a Family drawing and internalizing behaviors several additional correlations were performed. First, for girls there was no significant correlation between actual number of household members reported by the parent and CBCL Anxious/ Depressed (Pearson r = .208, p = .289), Withdrawn/Depressed (Pearson r = .078, p = .693) or Somatic Complaints (Pearson r = -.083, p = .673). Secondly, for girls there was also no significant correlation between the actual household size and number of family members depicted in the Family drawing (Pearson r = .234, p = .231). These findings began to suggest that the number of family members a girl depicted in her Family drawing was not reality driven but rather indicative of her internal state.

*In summary*, girls' displaying elevated levels of internalizing behaviors, especially those rated higher on Somatic Complaints included significantly fewer family members in their drawing. The girls' depiction of the number of family members in these drawings was unrelated to actual family size as reported by the parent.

## Use of Space, Figure Size and Scaling

### *Use of Space - Overall Organization*

On the Bender – Gestalt Test, a person is asked to reproduce a series of geometric forms with the failure to use space efficiently considered indicative of pathology. In contrast, the organization of figure drawings has not received much attention. Yet when disorganization occurs, it is striking. Figures appear to float across the page with little regard for the principles of gravity or conversely are crammed together in a haphazard manner.

It was hypothesized that only the most cognitively impaired children would have difficulty drawing a coherently organized picture and consequently, organization would only weakly or indirectly be associated with problematic behaviors.

#### *Preliminary Analysis*

The sample size for this analysis was 86 with two children who refused to complete both drawings removed from the analysis. The Family and Peer drawings of the remaining children were each scored for organization, as described in the Methods section, and then collapsed across drawing with children grouped as "*Organized*" or "*Disorganized*" if one or both drawings met criteria. Two raters scored all drawings and interrater reliabilities were calculated (Coder A: Organized n = 60, 69.8%; Coder B: Organized n = 53, 61.6%; $X^{2} = 45.84$, p = .0001) with raters disagreeing on the classification of 14 (16.3%) of the children. Final scores and classification, therefore, were derived by consensus with a bias towards placing children into the "*Organized*" group. Final grouping was: "*Organized*" n = 56 (65.1%) and "*Disorganized*" n = 30 (34.9%).

A Chi square found the groups comparable for sex ("*Organized*" boys": n = 37, 63.8%; "*Organized*" girls: n = 19, 67.8%; $X^2$ = .137, p >.1) and an independent sample t test found no difference for age ("*Organized*": *M* age in months = 100.2, sd = 10.22; "*Disorganized*": *M* age in months = 99.4, sd = 10.4; $t_{84} < 1$).

***Hypothesis One: The Association of Disorganized Drawings and Cognitive Ability***

It was hypothesized that children with lower intellectual functioning would have the greatest difficulty with organizing their drawings. A MANOVA of group differences on cognitive and graphomotor ability was performed with missing values replaced by group *M* scores (Table 3.21). None of the measures examined differ significantly between groups.

**Table 3.21: "*ORGANIZED*" VS "*DISORGANIZED*": COGNITIVE AND GRAPHOMOTOR MEASURES**

*M*, (sd), df, F and p Values

| | Organized n = 56 | Disorganized n = 30 | df | F | p[a] |
|---|---|---|---|---|---|
| WASI | | | | | |
| *VIQ* | 97.0 (11.9) | 100.1 (17.5) | 1,84 | .886 | n.s. |
| *PIQ* | 97.3 (13.5) | 96.8 (14.1) | 1,84 | .020 | n.s |
| VMI | 89.7 (9.3) | 92.6 (10.3) | 1,84 | 1.78 | n.s |

a = n.s. is p > .10

***Additional Analysis of Disorganization***

Disorganization was so striking when it occurred in a child's drawings that an additional exploratory analysis was conducted to examine if it was associated with behavior problems.

A MANOVA was conducted comparing group rating on behavioral measures.

Since no a priori hypothesis was proposed regarding organization and specific behavioral pathology a broad range of behavioral measures were entered into the analysis (Table 3.22). All behavioral measures were found to differ between groups with "*Disorganized*" children receiving significantly higher parental ratings for internalizing and externalizing behaviors as well as Social and Thought Problems. Attention Problems approached significance with "*Disorganized*" children found to have increased levels of problematic behavior on this subscale.

**Table 3.22: "*ORGANIZED*" VS "*DISORGANIZED*": BEHAVIORAL MEASURES**

*M*, (sd), df, F and p Value

| | Organized n = 56 | Disorganized n = 30 | df | F | p |
|---|---|---|---|---|---|
| CBCL | | | | | |
| *Internalizing Index* | 53.1 (9.1) | 58.3 (12.8) | 1,84 | 4.76 | .032 |
| *Externalizing Index* | 54.1 (8.3) | 58.4 (9.8) | 1,84 | 4.46 | .038 |
| CBCL Subscales | | | | | |
| *Attention Problems* | 60.4 (7.4) | 63.9 (9.5) | 1,84 | 3.49 | .065 |
| *Social Problems* | 56.7 (5.5) | 58.4 (9.8) | 1,84 | 10.0 | .002 |
| *Thought Problems* | 54.1 (5.7) | 59.6 (8.7) | 1,84 | 12.6 | .001 |
| CBCL Internalizing Subscales | | | | | |
| *Anxious/Depressed* | 55.2 (6.1) | 59.7 (8.1) | 1,84 | 8.38 | .005 |
| *Withdrawn/Depressed* | 55.8 (6.1) | 58.6 (7.9) | 1,84 | 3.22 | .076 |
| *Somatic Complaints* | 55.0 (5.9) | 59.6 (8.2) | 1,84 | 8.94 | .004 |
| CBCL Externalizing Subscales | | | | | |
| *Aggressive* | 55.1 (5.8) | 58.6 (8.0) | 1,84 | 5.02 | .028 |
| *Rule-Breaking* | 56.6 (6.0) | 60.0 (7.7) | 1,84 | 5.55 | .021 |

An additional MANOVA was performed to determine if the various subscales, which comprise both the Internalizing and Externalizing Indices, would be differentially associated with "*Disorganization*" (Table 3.22). Once again, with the exception of Withdrawn/Depressed that tended towards significance, all subscales were found to differ

significantly between groups with "*Disorganized*" children rated as more problematic in the areas of Anxiety/Depression, Somatic Complaints, Aggression and Rule Breaking behaviors.

Although disorganization, defined as a failure to organize figures on the page, was extremely sensitive for the presence of psychopathology it was rather nonspecific. Since disorganization is one of the primary behavioral characteristics of children with ADHD[14] a Chi Square analysis was performed to determine if this diagnosis was associated with "*Disorganization*". This, however, was not the case with approximately equal numbers of children with and without ADHD found to produce disorganized drawings ("*Disorganized*" + ADHD: n = 12, 28.6%; "*Disorganized*" + No ADHD: n = 14, 31.8%; $X^2 = < 1$).

*In summary*, disorganization of figures on the page was not, as hypothesized, associated with cognitive or graphomotor limitations. However, disorganization was highly indicative of widespread parent rated problematic behaviors.

### *Use of Space - Shifts to the Left of Midline*

Drawings shifted off the midline have long been considered indicative of psychopathology and continue to be included in the more recently developed scoring systems as a graphic indicator of problematic behavior. Others, however, have offered alternative explanations as to why children may neglect one side of the page with maturation of attention processes being one such explanation.

#### *Preliminary Analysis*

In order to explore the relationship of midline shifting and psychopathology, both

[14] One of DSM IV criteria for ADHD is "has difficulty organizing tasks and activities".

drawings were examined for the presence of this feature. Drawings were scored by two raters with acceptable interrater reliability (Family Drawing - Central Placement Coder A: n = 69, 81.2%; Coder B: n = 71, 83.5%; $X^2 = 72.28$, p = .0001 and Peer Drawing – Central Placement Coder A: n = 67, 77.9%; Coder B n = 64, 74.4%; $X^2 = 61.27$, p < .0001). Disagreements were resolved by consensus.

Children where grouped as follows: "*No Shift*" if figures were placed centrally in both drawings (n = 56), or "*Shift*" if all figures in either drawing were placed to the left of the midline (n = 30). Three children, all of whom were female, shifted their figures to the right and were removed from further analysis. In addition, two girls who refused to complete the Peer drawing were removed from the analysis. One boy, who did not produce a Family drawing, evidenced shifting in his Peer drawing and was therefore included in the "*Shift*" group for a total sample size of 86 ("*No Shift*" n = 55, 64% and "*Shift*" n = 31, 36%).

Of particular interest was the association of age and the presence of midline shifts. An independent sample t test comparing the two groups was not significant for age ("*Shift*": *M* age: 97.7, sd = 9.2; "*No Shift*": *M* age = 101.4, sd = 10.4; $t_{84} = 1.60$, p = .113) and a Chi Square analysis found no sex differences between groups ("*Shift*": boys n = 22, 37.3%; girls n = 8, 29.6%; $X^2 < 1$).

The possibility that cognitive and/or graphomotor ability might have been a factor in midline shifting was examined using a MANOVA (Table 3.23). The two groups received comparable scores on all cognitive, language and graphomotor tasks.

***Hypothesis Two: The Association of Figure Placement to the Left of Midline and Problematic Behavior***

Although from a psychoanalytic viewpoint leftward shifts have been most consistently associated with impulsive behavior this proposition has received limited empirical validation.

Specific hypotheses regarding left-sided shifting was that it would most likely be associated with attention and impulsivity. A MANOVA comparing group performance for behavioral variables which included the CBCL Subscales of Attention Problems, Aggression and Rule-Breaking; Social Skills Rating subscales of Cooperation and Self-Control; and parent and teacher ratings on the ADHD IV: Inattention and Hyperactivity/ Impulsivity was performed. Group *M* values replaced missing data (Table 3.23). The two groups were found to be indistinguishable on the majority of the behavioral measures with the exception of ratings most highly associated with a diagnosis of ADHD, the CBCL subscale of Attention Problems and the ADHD IV parent and teacher ratings. Attention Problems was found to be highly significant with children shifting their figures to the left of center receiving higher rating on this subscale. In addition, Rule-Breaking tended towards significance, once again with children shifting their figures to the left of center receiving higher scores. Parent rated Inattention as well as teacher rated Inattention and Hyperactivity/Impulsivity also approached significance with the "*Left Shift*" group receiving higher ADHD IV ratings.

**Table 3.23: "*CENTRAL*" vs "*LEFT*" FIGURE PLACEMENT: COGNITIVE, GRAPHOMOTOR, AND BEHAVIORAL MEASURES**

*M*, (sd), F and p Values

| | No Shift (n = 55) | Left Shift (n = 28) | df | F | p[a] |
|---|---|---|---|---|---|
| WASI | | | | | |
| *VIQ* | 97.3 (14.0) | 99.9 (15.3) | 1,81 | .590 | n.s. |
| *PIQ* | 96.8 (13.0) | 98.4 (15.8) | 1,81 | .245 | n.s. |
| CELF | | | | | |
| *Receptive Language* | 90.7 (16.1) | 93.0 (13.4) | 1,81 | .446 | n.s. |
| *Expressive Language* | 86.2 (15.2) | 90.5 (13.2) | 1,81 | 1.67 | n.s. |
| VMI | 90.2 (10.2) | 92.2 (8.3) | 1,81 | .856 | n.s. |
| CBCL Subscales | | | | | |
| *Aggression* | 56.3 (6.9) | 56.5 (6.6) | 1,81 | .014 | n.s. |
| *Rule-Breaking* | 56.9 (6.2) | 59.6 (7.8) | 1,81 | 2.81 | .098 |
| *Attention Problems* | 59.6 (7.6) | 65.4 (8.7) | 1,81 | 9.69 | .003 |
| Social Skills Rating Subscales | | | | | |
| *Cooperation* | -.108 (1.2) | -.319 (1.2) | 1,81 | .574 | n.s. |
| *Self-Control* | -.037 (1.1) | -.131 (.83) | 1,81 | .156 | n.s. |
| ADHD IV Rating Scales | | | | | |
| *Parent*: | | | | | |
| Inattentive | .914 (1.2) | 1.45 (1.3) | 1,81 | 3.49 | .065 |
| Hyperactive/Impulsive | .454 (1.1) | .848 (1.4) | 1,81 | 1.93 | n.s. |
| *Teacher*: | | | | | |
| Inattentive | .661 (.94) | 1.04 (.68) | 1,81 | 3.70 | .058 |
| Hyperactive/Impulsive | .435 (1.1) | .864 (.96) | 1,81 | 3.19 | .078 |

a = n.s. is p > .10

To test whether shifting was specific to ADHD, a Chi Square analysis was performed comparing children who meet criteria with those who did not meet criteria for this disorder. Of the 41 children with ADHD, 18 (43.9%) shifted their drawing to the left side of the page while 10 (23.8%) of the 42 children who did not meet criteria shifted their figures ($X^2 = 3.747$, p = .053). These findings partially support the hypothesis that shifting figures off of the midline was indicative of children with ADHD. However, it

must be noted more than half of those with ADHD do not shift their figures while many children who do not meet criteria for a diagnosis of ADHD shifted their figures. Shifting off of midline, therefore, should not be considered diagnostic for ADHD.

*In summary*, no differences in cognitive or graphomotor performance were found between children who shift their figures to the left of the midline and those who place their figures more centrally. Behaviorally, children who shift their figures away from the midline evidenced more problems with attention on the CBCL and tended to receive higher ADHD IV Inattention ratings by parents. Teacher ratings for Inattention and Hyperactivity/Impulsive on the ADHD IV also tended to be somewhat elevated for children who shifted their figures. However, although children meeting criteria for ADHD tended to shift their figures off of the midline when compared to children without this disorder, this graphic feature cannot be considered diagnostic. Many with ADHD did not shift their figures while a significant subset of "typically" developing children's drawing contained shifted figures.

## *Figure Height*

Extremes in figure size have consistently been associated with behavioral variables including self-esteem, anxiety, and depression. Compared to many other graphic variables, figure size has the potential of being relatively immune to the effects of general cognitive ability, although small figure size has been associated with aphasia in adults.

### *Height of Self-Figure in the Family Drawing*

It was hypothesized that extremes in the height of the self-figure would be a

projective feature indicative of behavioral problems and not be associated with a child's cognitive or graphomotor performance.

***Preliminary Analysis*** - The height of the self- figure in the Family drawing was calculated as described in the methods section. Scoring by one rater was deemed appropriate because it was believed that this variable would be relatively immune to bias since physical measurements were made and both extremes, shorter or taller figures, have been linked to behavioral problems. One boy was not administered a Family drawing due to examiner error, one boy said "*I forgot to draw myself*" and one girl drew a figure in which height could not be calculated for a total sample size of 85 (boys n = 57) with a *M* height of the self-figure = 8.79 units of ¼ inch squares and a sd of 4.56 and a range = 23.

Since the total number of figures included in a drawing could influence the overall height of individual figures a Pearson correlation of self-figure height and the total number of people and animals depicted in the Family drawing was performed and was found to be non significant ($r = -.090$, $p > .1$).

The association of sex and age with self-figure height was assessed. Using an independent sample t test, the height of the self-figure did not differ between boys and girls (Boys: *M* height = 8.40, sd = 4.24; girls: *M* height = 9.57, sd = 5.14; $t_{(83)} = -1.112$, $p = .270$). A Pearson r correlation found no association of self-figure height and age ($r = .021$, $p > .1$). There was considerable variability between children in the height of the self-figure and this may have obscured relevant findings. However, within a given child's drawings the self-figure height remained fairly consistent. A Pearson r correlation of the height of the self-figure in the Family and Peer drawing was found to be highly

significant (r = .605, p = .0001).

As previously discussed, research on figure height has been mixed regarding interpretation. While some have claimed that an enlarged figure denotes psychopathology, others have proposed that it is the depiction of smaller figures that is of concern. In fact, both figure size extremes appear as markers for psychopathology in Koppitz's EI and the DAP:SPED scoring methods. Therefore, the children were divided into three groups based on their self-figure height: "*Short"* (> 1 sd below the *M*; 4 or less units, n = 17), "*Average*" (within +/-1 sd of the *M* = 8.79, 5 to 13 units, n = 60) or "*Tall*" (>1 sd above the *M*; 14 or more units; n = 8).

Although it was unlikely that general cognitive ability or language functioning would have a direct relationship with the height of the self-figure it was important to rule out any indirect effects such as poor language performance leading to impaired self esteem which in turn led the child to depict a smaller image of self. It was also conceivable that graphomotor difficulties could directly impact on figure size. A MANOVA was performed to determine if group differences existed for cognitive, language or VMI graphomotor ability. Missing data points were replaced by group *M*s (Table 3. 24). No significant group differences were observed for any of the cognitive or graphomotor variables examined.

***Hypothesis Three: Association of Figure Height and Behavior Problems*** - It was hypothesized that extremes in the height of the self-figure would be associated with problematic behaviors.

A MANOVA examining a wide range of behavioral variables across the three height groups was examined (Table 3.25). No significant differences were found

between groups for ratings on the CBCL: Internalizing and Eternalizing Indices or Thought Problems subscales while Social Problems showed a trend towards significance with children drawing shorter figures tending to have increased social difficulties compared to those grouped as "*Average*" or "*Tall*". These findings do not support previous claims that short figure size was associated with withdrawal and depression while tall figures were the product of children with externalizing behaviors. However, it was in agreement with Rabinowitz, (1992) who found that peer accepted girls drew the mother taller than peer-rejected girls.

**Table 3.24: HEIGHT OF SELF-FIGURE IN FAMILY DRAWING: COGNITVE AND GRAPHOMOTOR MEASURES**

*M*, (sd), df, F and p Value

| | Short<br>n = 17 | Average<br>n = 60 | Tall<br>n = 8 | df | F | p[a] |
|---|---|---|---|---|---|---|
| WASI | | | | | | |
| *VIQ* | 101.4 (13.9) | 96.6 (14.6) | 102.5 (9.9) | 2,82 | .957 | n.s. |
| *PIQ* | 101.0 (17.7) | 95.1 (12.5) | 99.0 (12.2) | 2,82 | 1.37 | n.s. |
| CELF | | | | | | |
| *Receptive Language* | 90.8 (20.5) | 89.9 (15.4) | 96.8 (10.6) | 2,82 | .616 | n.s. |
| *Expressive Language* | 86.4 (15.6) | 86.7 (15.4) | 94.4 (12.1) | 2,82 | .950 | n.s. |
| VMI | 92.2 (12.6) | 90.0 (8.9) | 89.5 (6.8) | 2,82 | .400 | n.s. |

a = n.s. is p > .10

**Table 3.25: HEIGHT OF SELF-FIGURE IN FAMILY DRAWING: BEHAVIORAL MEASURES**

*M*, (sd), df, F and p Values

| | Short (1) n = 17 | Average (2) n = 60 | Tall (3) n = 8 | df | F | p[a] | Post Hoc Comparison |
|---|---|---|---|---|---|---|---|
| CBCL | | | | | | | |
| *Internalizing Index* | 57.8 (11.1) | 54.0 (10.9) | 55.2 (8.7) | 2,82 | .791 | n.s. | |
| *Externalizing Index* | 57.5 (6.5) | 55.2 (9.1) | 54.4 (13.5) | 2,82 | .496 | n.s. | |
| CBCL Subscales | | | | | | | |
| S*ocial Problems* | 61.3 (7.7) | 57.8 (6.4) | 55.6 (6.3) | 2,82 | 2.53 | .086 | |
| *Thought /Depressed* | 59.1 (8.4) | 55.3 (6.3) | 56.5 (11.0) | 2,82 | 1.85 | n.s. | |
| *Attention Problems* | 66.0 (6.8) | 60.8 (8.4) | 58.0 (6.3) | 2,82 | 3.75 | .028 | 1>2; 1&2=3 |
| ADHD IV Rating Scale | | | | | | | |
| *Parent* | | | | | | | |
| Inattentive | 1.72 (1.5) | 1.06 (1.3) | .964 (1.0) | 2,82 | 1.73 | n.s. | |
| Hyperactive/Impulsive | 1.21 (1.2) | .495 (1.2) | .637 (1.3) | 2,82 | 2.24 | n.s. | |
| *Teacher* | | | | | | | |
| Inattentive | .903 (.90) | .810 (.88) | .334 (.85) | 2,82 | 1.23 | n.s. | |
| Hyperactive/Impulsive | .691 (1.3) | .565 (1.0) | .491 (.81) | 2,82 | .120 | n.s. | |

a = n.s. is p > .10

Scores on the Attention Problems subscale were found to be significantly different between groups. A post hoc Tukey revealed significant differences between the "*Short*" and "*Average*" groups with those drawing shorter figures rated as having increased attention problems (p = .49). However, no significant group differences were found between the "*Short*" and "*Tall*" groups and the "*Average*" and "*Tall*" groups.

Since the height of the self-figure appeared to be weakly related to difficulties with attention, an additional MANOVA was performed to examine if the three groups differed on parent and teacher rated ADHD behaviors. Overall, parent and teacher observations for inattention and hyperactive/impulsive behaviors were found to be comparable across the three groups. Additionally, a Chi Square comparing children with and without ADHD and self-figure height groupings was found to be non significant (No ADHD "*Short*" n = 8, 19.0% and ADHD "*Short*": n = 9, 20.9%; No ADHD "*Average*": n = 29, 69.0% and ADHD "*Average*": n = 31, 72.1%; No ADHD "*Tall*": n = 5, 11.9%; ADHD "*Tall*" n = 3, 6.9%; $X^2$ = .614).

These findings suggested that the height of the self-figure in the Family drawing was not a powerful predictor of cognitive, graphomotor and more importantly behavior difficulties for this group of children.

***Relative Height of Self and Maternal Figures***

It was hypothesized that children with improper scaling (self $\geq$ maternal figure) would evidence higher levels of externalizing behavior most notably in aggression and rule-breaking, and would more likely be viewed by their parent as uncooperative and lacking in self-control. Diagnostically it was proposed that children who failed to draw the maternal figure larger than the self-figure would more likely be identified as having

ADHD.

***Preliminary Analysis*** - The height of each child's self-figure drawing and the height of his or her maternal figure were calculated as previously described. Children who omitted a maternal figure in their family drawing (n = 10) were removed from this analysis as was 1 child who "forgot" to draw himself, 1 child in which figure heights could not be calculated and 1 child who was not administered the Family drawing for a total sample size of 75.

The children where grouped as follows: "*Mother>Self*": Maternal figure taller than self-figure by a least 1 measurement units, with each unit equal to approximately ¼ inch (n = 48, 64.0%) and "*Self≥Mother*": self-figure was of greater or equal height to maternal figure (n = 27, 36.0%). Self-figures were considered to be of equal height to maternal figure if maternal figures was not depicted at least 1 measurement units taller than self-figure.

The association of the demographic variables of sex and age with scaling of the self-figure with the maternal figure was examined. A Chi Square analysis found no difference between the two groups for sex ("*Mother>Self*": Boys n = 31, 62% and Girls n = 17, 68%; $X^2 < 1$) and an independent samples t-test found no group differences for age ("*Mother>Self*" *M* = 100.71, sd = 11.63; "*Self≥Mother*" *M* = 98.26, sd = 7.69; $t_{(73)} = 1$).

As in previous analyses, it was important to evaluate whether cognitive and/or graphomotor ability influenced the relative heights of the self- and maternal figures. A MANOVA comparing groups was performance with missing data replaced by group *M* scores (Table 3.26). No significant differences between groups for cognitive, language or graphomotor ability were found.

***Hypothesis Four: Relative Height of Self-Figure and Maternal Figure*** - It was hypothesized that children who drew the self-figure taller than the maternal figure would evidence externalizing behavioral problems.

A MANOVA was performed comparing the two groups, "*Self* $\geq$ *Mother*" and "*Mother* > *Self*" on the CBCL subscales associated with externalizing behaviors and the Social Skills Rating sub domain of Cooperation and Self-Control. Group M scores replaced missing data (Table: 3.26).

As predicted, children who depicted themselves as equal to or greater in height than the maternal figure were rated with significantly higher levels of aggression and poorer self-control compared to those who depicted the maternal figure taller than the self-figure. No significant differences between groups were found for behavioral rating on the CBCL subscale of Rule-breaking or the Social Skills Rating sub domain of Cooperation.

**Table 3.26: RELATIVE HEIGHT OF SELF AND MATERNAL FIGURES: COGNITVE AND BEHAVIORAL MEASURES**

Means and (sd) and t Scores

| | Mother > Self (n = 48) | Self ≥ Mother (n = 27) | df | F | p[a] |
|---|---|---|---|---|---|
| WASI | | | | | |
| *VIQ* | 98.1 (14.9) | 95.4 (11.9) | 1,73 | .633 | n.s. |
| *PIQ* | 96.9 (15.1) | 94.3 (12.4) | 1,73 | .587 | n.s. |
| CELF | | | | | |
| *Receptive Index* | 90.4 (16.1) | 88.2 (17.5) | 1,73 | .278 | n.s. |
| *Expressive Index* | 87.4 (15.6) | 84.3 (15.5) | 1,73 | .677 | n.s. |
| VMI | 91.2 (9.5) | 88.6 (10.7) | 1,73 | 1.19 | n.s. |
| CBCL Subscales [b] | | | | | |
| *Aggression* | 55.1 (6.1) | 58.6 (7.9) | 1,73 | 4.72 | .033 |
| *Rule-Breaking* | 57.7 (6.8) | 57.9 (6.2) | 1,73 | .020 | n.s |
| Social Skills Rating Scale Subscales [c] | | | | | |
| *Cooperation* | -.106 (1.19) | -.497 (1.37) | 1,73 | 1.66 | n.s. |
| *Self-Control* | .206 (.912) | -.537 (1.08) | 1,73 | 10.0 | .002 |

a = n.s. is p > .10
b = Reported as T scores with higher scores indicative of poorer functioning.
c = Reported as z-scores with lower (negative) scores indicative of poorer adaptive functioning.

In order to examine if ADHD was associated with scaling difficulties a Pearson Chi-Square analysis was performed comparing "*Mother>Self*" and "*Self≥Mother*" groups with ADHD status. Scaling difficulties were not associated with a diagnosis of ADHD ("*Mother>Self*" and No ADHD: n = 24, 50.0%; "*Mother>Self*" and ADHD: n = 24, 50.0%; $X^2 < 1$).

*In summary*, children were relatively consistent across their Family and Peer drawings in the sizing of their self-figures. Despite this inter-drawing consistency, the size of the self-figure was not found to be associated with any of the cognitive or

graphomotor variables examined. This lack of association of self-figure size was also true for a large number of behavioral variables with the sole exception of CBCL: Attention Problems with children grouped for drawing "*Short*" self-figures having significantly higher ratings for inattention when compared to those grouped with "*Average*" and "*Tall*" self-figures. This finding, however, was not validated by parent and teacher ratings on the ADHD IV scale nor was a diagnosis of ADHD associated with self-figure height extremes.

In contrast, to these limited findings, relative height of mother and self-figures was more predictive of behavioral problems. Child who drew the self-figure equal or greater in size to the maternal figure displayed higher levels of aggressive behavior and were rated as having poor self-control when compared to those who drew their maternal figures taller than the self-figure.

# CHAPTER 4

# DISCUSSION

## Methodological Concerns

Any discussion of the studies comprising this dissertation must be done cautiously due to several important methodical concerns. First, many of the statistical analyses were conducted on relatively small samples of children. For example, all analyses related to sex differences resulted in tenuous findings since fewer girls were enrolled in the study compared to boys. This enrollment pattern, however, was not surprising since in the general population many more boys are identified with developmental and behavioral disorders compared to girls. Despite this weakness, some sex differences emerged most notably for the use of color. Limitations in sample size also prevented a full examination of ethnic differences in the use of color.

However, an adequate sample would have necessitated at least a twofold increase in the number of enrolled children and would not have solved all of the statistical concerns related to power. In particular, graphic features generally considered to be pathognomonic, by definition, occur infrequently. In order to obtain an adequate number of children including these rarely occurring features a considerable increase in the overall sample would have been required. This fact did not only compromise the studies contained in this dissertation but has historically plagued research on children's drawing.

Secondly, the restricted age range of the children participating in this study prevented a full examination of how maturational factors influence graphic representations. However, even within this restricted sample, age appeared to be an important mediating variable since it was found to influence both the realistic use of color

as well as the number of friends depicted in the Peer drawing. The inclusion of both younger and older aged participants would have allowed for a more definitive analysis of how maturation influenced both of these variables.

In particular, the limited age range of the children prevented a full analysis of realistic color use. For children under 9 years of age, idiosyncratic use of color appeared to be related to maturational factors and did not, as some have proposed, appear to be a marker for psychopathology. However, this may not be true for older children and it is quite possible that continued use of unrealistic color into early adolescence maybe indicative of cognitive and/or behavioral issues.

Thirdly, perhaps even more problematic than limitations in sample size and restricted age range was the lack of an objective measure of children's emotional and behavioral functioning. Both the CBCL and the SSRS rely primarily on parental observations. One of the central reasons for conducting these studies was to attempt to refine children's drawings as a child-centered measure of social and emotional functioning. The use of primarily parental observations to assess emotional and social functioning made it impossible to fully gauge to value of children's drawing independent of these inherently biased measures.

Despite the fact that the CBCL and the SSRS were less than ideal measures for determining the validity of children's drawings some important findings emerged including the association of color with internalizing behaviors in boys and the rather strong correlation of disorganized use of space with emotional and behavioral problems.

## Discussion of Broader Issues

### *Complexity of Drawings*

Despite these methodological concerns there are several findings that emerged which began to address the overall objectives of this dissertation. First, this series of analyses underscored the complexity of drawing tasks and highlighted a multitude of factors that are associated with a child's drawing performance. Significant associations between graphic representation and sex, age, graphomotor skills and cognitive ability and behavioral measures were found.

What was perhaps most notable was that different graphic dimensions of a drawing appeared to be differentially affected by these mediating variables. For example, the number of colors used to complete the drawings was linked to emotional factors with sex a strong modifying factor while the number of friends depicted in the Peer drawing was associated with social functioning as well as the age of the child.

In general, cognitive ability as measured by the WASI and the CELF and graphomotor skills did not appear to be very important factors for the set of graphic variables examined. This was an unexpected finding since it was assumed that cognitive factors and drawing ability would be more closely associated to each other as would graphomotor skills and drawing. The strongest of these associations were found for children including extraneous figures to have depressed verbal skills and for increased graphomotor ability to be associated with an increased use of realistic color.

The apparent disconnect between cognitive and graphomotor abilities and drawings were likely due to the graphic features chosen for analysis. One can easily imagine that different graphic variables, such as number of facial or body features,

drawing complexity, use of transparencies and perspective, would have yielded a different pattern of associations with cognitive and graphomotor abilities playing a more central role.

### *Graphic Markers as Indicative of Psychopathology*

Graphic variables that occur in less than 15% of drawings have traditionally been identified as pathognomonic and considered "markers" for behavior problems. In this sample of children, the exclusion of a maternal figure was found to occur in 11.5% of the Family drawings. This was an unexpected finding but given its low rate of occurrence and potentially ominous meaning (Kaplan & Main, 1986) it was anticipated that omission of the mother would be associated with elevated ratings for emotional and behavioral problems.

In this sample, however, the failure to include a maternal figure was not associated with elevated scores on any of a broad range of behavioral measures examined. Rather than being a marker for psychopathology it was found to be associated with relatively higher verbal ability. Although this specific finding must be considered cautiously it does highlight a broader issue. There is no reason to assume that graphic variables having a low rate of occurrence are only indicative of deficit cognitive ability or behavior problems but may just as readily imply superior cognitive or behavioral functioning.

Others have noted an association of graphic markers, considered to be pathognomonic, with superior performance. Most notably, McPhee and Wegner (1976) found many stylistic features identified by Burns and Kaufman (1970) to be related to projected anxiety was more frequently found in the drawing of well adjusted children.

These findings begin to suggest that a low rate of occurrence, in and of itself, does not necessarily denote pathology.

### *Projective Nature of Drawings*

Research directly examining the projective nature of adults' drawings is limited and almost non-existent for children. Several of the analyses contained in this dissertation directly examined the association of a particular graphic feature with a specific behavior while taking into account both extraneous and mediating variables.

Girls drawing fewer figures in their Family drawings were rated as exhibiting increased levels of internalizing behaviors by parents. The number of figures in the Family drawing did not correlated with the actual number of household members identified in the parent completed History Form nor was the actual number of household members associated with any behavioral measures. Decreased figure depiction, therefore, might be interpreted as projection of anxiety.

The number of colors used to complete the drawings appears to have a degree of projective significance. The use of fewer colors was found to be especially sensitive to increased parental ratings of internalizing behaviors in boys. Although previous research has shown that clinically depressed adults use less color in their drawings, in this study, the boys' ratings for Anxious/Depressed were well below what would be considered clinical levels[15] and few if any would have met DSM criteria for depression. This finding begins to suggest that the number of colors used in drawings may be a particularly sensitive projective marker for internalizing behaviors in boys.

A purely physiologic basis for a color – emotional relationship cannot be ruled

[15] Boys grouped as "Below Average" in their use of color received a mean T score of 66.7 on the CBCL Anxious/Depressed subscale. A clinically significant T score on the CBCL is $\geq$ 80.

out. Anecdotally, it is common for adults suffering from depression to describe their world as gray or lacking color. Additionally, it has been observed that although several graphic markers for adults with severe depression returned to normal levels following ECT their use of color remained restricted (Hoshino, Silbert, Knapp, & Weaver, 1998).

### *Drawings as Child Centered Measure of Behavioral and Social Functioning*

The Peer drawing was developed as a tool to evaluate children social functioning. In its current format it was found to be a rather poor measure of overall social functioning when parental ratings were used as the dependant measure as evidenced by the rather weak correlation of number of friends depicted and SSRS ratings. However, the Peer drawing does appear to have some potential for identifying the most severely socially impaired children.

A qualitative analysis comparing children who refused to complete a Peer drawing, drew only themselves, or draw questionable or unidentifiable figures with those including one or more friends demonstrated that those without friends received lower social skills ratings for all sub domains including Cooperation, Assertion, Responsibility and Self-Control than those including friends. In addition the "No Friends" group received higher CBCL: Social Problems scores as well have evidencing scores for receptive and expressive language that were more than 1 sd below those of children depicting one or more friends. What remains unclear is how depressed language functioning is related to poor social skills.

In contrast to the rather weak correlation of number of friends depicted with social functioning, disorganized drawings were found to be a potentially powerful indicator of psychopathology. It was originally hypothesized that a disorganized

placement of figures would be linked to cognitive limitations. This was not found to be the case. Disorganization, however, proved to have the potential to be a successful marker for psychopathology although it was rather non specific in that it correlated equally well with the CBCL: Internalizing and Externalizing Indices. By comparison, the most recently developed drawing instrument for the screening of psychopathology in children is the DAP:SPED, which although fairly reliable for identifying child with internalizing disorders is rather poor in detecting children with externalizing problems. Disorganization does not appear to have this limitation.

The association of disorganized drawings with impaired emotional and behavioral functioning is in need of further examination and replication. Additionally, refinements in rating this feature are necessary since there was an unacceptable level of interrater agreement. The restricted sample used in this study would also need to be extended to include younger and older children in order to evaluate when in the maturational process disorganization becomes indicative of impaired emotional functioning.

## Discussion of Specific Findings

### *Use of Color*

One of the more interesting findings to emerge from the analysis of color use was the consistent pattern of sex differences in the use of color between girls and boys. Girls were found to use significantly more colors to complete their drawing as well as using a different palette when compared to boys of similar age with a trend for girls to use color in a more realistic fashion. Additionally, the association of color and affect appeared to differ with internalizing problems in boys associated with restricted use of color while the same was not true for the girls in this sample. These differences begin to suggest a

fundamental difference in how girls and boys related to color.

In general, findings of robust sex differences for motor and/or cognitive ability have remained elusive and therefore controversial. Sex differences in relation to color, however, have been fairly consistent and include female infants increased responsiveness to color compared to males (Staples, 1932), differences in color preference (Ellis & Ficek, 2001) and larger color lexicons (Nowaczyk, 1982). These observed sex differences have been explained from both a physiological/biological perspective as well as being the result of gender socialization. Clearly, much more research is still needed in this area. Additionally, a further examination of the association of color and affect is warranted given the current lack of unbiased measures for the assessment of internalizing behavior problems available for use with children.

### *Assessment of Peer Relationships*

The Peer drawing, as developed for this dissertation, was found to be a rather poor index of social skills functioning. The weak correlations between the number of friends depicted and measures of social skills functioning were likely due to several factors. When asked to draw themselves and friends, a number of children were overly inclusive drawing siblings, cousins, and/or parents even though these relationships did not meet a standard definition of "*friend*". Although some of these children likely had true friendships with sibling and cousins it seemed unlikely that this was the case for all of those including these types of extraneous figures. It remains unclear if this over inclusiveness was a compensation for a lack of peer relationships, a failure to comply with the task demands, or a lack of understanding in what constitutes the subordinates of

the super ordinate "*friends*". Given the way the Peer drawing task was constructed it was impossible to determine with any degree of certainty if the inclusion of siblings and/or other relatives was a violation since the exact nature of these relationships was not determined during inquiry.

However, when children who depicted figures that were clear violations to the administration instructions (e.g. parents or the examiner) were compared to those who did not draw extraneous figures significant differences between groups emerged. Although the two groups were comparable in age, those depicting figures clearly outside the super ordinate category of "*friends*" were found to have significantly lower VIQ scores as well as decreased receptive and expressive language functioning. These children might have included extraneous figures due to a lack of understanding in what constitutes the class "*friends*". These findings also suggest that verbal skills may play an important mediating role in children's successful completion of tasks that are routinely considered to be nonverbal. Additionally, over inclusive children were found to have obtained comparable parental ratings on the CBCL: Rule Breaking subscale and the Social Skills Rating domains of Cooperation and Self-Control compared to children not including extraneous figures suggesting that noncompliance was not an important mediating factor.

### *Use of Space*

As discussed, overall organization of figures on the page may have the potential for being a powerful marker for psychopathology. Shifting of figures off the midline, an additional graphic variable associated with use of space, was also examined as a more specific indicator of impulsivity and/or ADHD.

The current literature suggests that some children and adults with ADHD fail to

attend to the left half of visually presented stimuli. The finding in this dissertation was inconclusive with shifting to the right (and therefore neglecting the left half of space) observed in only three girls, two of who met criteria for ADHD. Obviously, this extremely small sub sample of girls does little to confirm or refute the existing literature on the subject.

A more common graphic feature for the drawings collected was the placement of figures on the left half of the page, which may reflect an inattention to the right half of space. Anecdotally, many have observed that impulsive children tend to shift their figures to the left half of space. The findings of this dissertation lend some support for this observation. However, although many children with ADHD shifted their figures, a substantial number did not and conversely many children who did not meet criteria for a diagnosis of ADHD were also found to shift their figures. Clearly, inattention and/or impulsivity although associated with shifting did not provide an adequate explanation for the occurrence of this phenomenon. Additionally, the restricted age of the participants in this study prevented a full exploration of how maturational factors might interact with attention and impulsivity in causing children to place their figures off center.

### *Height*

Previous research has suggested that the height of the self-figure is a relatively poor indicator of a child's emotional and/or behavioral well-being. The studies included in this dissertation lend further support to this conclusion. Although the height of the self-figure remained relatively stable across the set of two drawings it was generally found to be a poor indicator of cognitive and/or emotional functioning.

In contrast, the relative height of the self-figure to the maternal figure, although

not associated with cognitive or graphomotor functioning, was correlated with some of the behavioral measures examined. Children drawing the self-figure taller than the maternal figure were rated as having significantly poorer self-control and higher levels of aggression when compared to those drawing the self-figure relatively smaller than the maternal figure. These findings suggest that, much like the use of color and anxious girls depicting fewer figures in their Family drawing, relative height may be a pure projective feature of children's drawings.

## Concluding Remarks

Time and sample size limitations allowed for the examination of only several graphic variables. However, even this very restricted analysis clearly demonstrates that children's drawings have the potential for providing a wealth of information regarding motor, language and cognitive development and ability as well as being a window into the child's social and emotional functioning.

Some have suggested that the use of children's drawing for the evaluation of cognitive and behavioral abilities should be abandoned, while others have taken the extreme position that the continued use of drawings in the context of assessment is unethical. The studies included in this dissertation suggest an alternative position. The very complexity of children's drawings makes them an intriguing area of study. More importantly, drawings represent a potentially rich source of information regarding the inner world of the child.

# APPENDIX A

## Comparison of Koppitz EIs and DAP:SPED Items

***Common details indicated in italics***

| **KOPPITZ** (30 Items) | **DAP:SPED** (55 Items) |
|---|---|
| | top placement |
| | bottom placement |
| | left placement |
| | right placement |
| | baseline drawing |
| | rotated page |
| | restart |
| ***poor integration*** | ***failed integration*** |
| ***slanting figure*** | ***slanting figure*** |
| | inconsistent position |
| | left-/right-facing figure |
| ***tiny figure*** (*height*) | ***short figure*** (*height*) |
| | tiny figure |
| ***big figure*** (*height*) | ***tall figure*** (*height*) |
| no body | |
| | big figure (area) |
| | figure facing away |
| ***transparencies*** | ***transparencies*** |
| tiny head | |
| | no head |
| | hair omitted |
| ***no eyes*** | ***eyes omitted*** |
| ***crossed eyes*** | ***crossed eyes*** |
| | gazing left/right |
| | vacant eyes |
| | closed eyes |
| ***no nose*** | ***nose omitted*** |
| ***no mouth*** | ***mouth omitted*** |
| ***teeth*** | ***teeth*** |
| | frowning mouth |
| | slash mouth |
| | object in mouth |
| no neck | |
| ***no arms*** | ***arms omitted*** |
| ***arms clinging to body*** | ***arms pressed to torso*** |
| short arms | reaching arms |
| long arms | |
| ***hands cut-off*** | ***hands cut-off*** |
| big hands | hidden hands |
| | fingers omitted |
| asymmetry of limbs | talons for fingers |
| | hands held in fists |
| ***legs together*** | ***legs together*** |

| | |
|---|---|
| ***no legs*** | ***legs omitted*** |
| ***no feet*** | ***feet omitted*** |
| ***genitals*** | ***nude figure*** |
| | torso omitted |
| shading of face | |
| shading of body, ***limbs*** | ***feet shading*** |
| ***shading of hands***, neck | ***hand shading*** |
| | crotch shading |
| | crotch erasure |
| | outside shading |
| ***monster***, grotesque figure | ***monster*** |
| ***three figures*** | ***multiple figures*** |
| clouds | uniforms |
| | background filled in |
| | object attached |
| | aggressive symbols |
| | numbering, lettering |

Adapted from: Koppitz (1968) and Naglieri, McNeish, & Bardos (1991)

# APPENDIX B

## Parent Rating Scales: Sample Questions

### *ADHD IV*
(DuPaul Rating Scale)

Inattention
- Is easily distracted
- Does not seem to listen when spoken to.
- Fails to give close attention to details or makes careless mistakes in schoolwork

Hyperactive/Impulsive
- Fidgets with hands or feet or squirms in seat
- Has difficulty waiting turn
- Is "on the go" or acts as if driven by a motor

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### *Child's Behavior Checklist*
(CBCL)

INTERNALIZING

Anxious/Depressed
- Cries a lot
- Fears
- Worries

Withdrawn/Depressed
- Enjoys little
- Rather be alone
- Lacks energy

Somatic Complaints
- Nightmares
- Overtired
- Aches

EXTERNALIZING

Rule-Breaking Behavior
- Lacks guilt
- Runs away
- Lies, cheats

Aggressive Behavior
- Argues a lot
- Destroys own things
- Gets into fights

ADDITIONAL SUBSCALES

Attention Problems
- Can't sit still
- Confused
- Daydreams

Social Problems
- Doesn't get along
- Not liked
- Not liked

Thought Problems
- See things
- Picks skin
- Strange ideas

---

***Social Skills Rating Scale***
(SSRS)

Cooperation
- Helps you with household tasks without being asked.
- Gives compliments to friends or other children in the family.
- Uses time appropriately while waiting for your help with homework or some other task.

Assertion
- Is liked by others.
- Is self-confident in social situations such as parties or group outings.
- Accepts friend's ideas for playing.

Responsibility
- Answers the phone appropriately.
- Introduces herself or himself to new people without being told.
- Acknowledges compliments or praise from friends

Self-Control
- Receives criticism well.
- Avoids situations that are likely to result in trouble.
- Controls temper when arguing with other children.

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