CHILDREN'S INFORMANT ACCURACY: A SOCIAL INFORMATION PROCESSING APPROACH TO UNDERSTANDING FACTORS AFFECTING ACCURATE SOCIAL NETWORK RECALL

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ABSTRACT

PHIL ICARD: Children's informant accuracy: A social information processing approach to understanding factors affecting accurate social network recall
(Under the direction of Jill Hamm, PhD)

Objective: The purpose of this study was to examine how accurate students are at recalling their classroom social networks or their informant accuracy. An additional goal of this study was to examine the impact of aggression and popularity on informant accuracy at both the individual and group level. It was hypothesized that aggression and popularity would have differential relationships with informant accuracy across gender.

Participants: A cohort of fifth grade students (n = 511) were recruited from two school districts in eastern North Carolina during the Spring of the 2002-2003 academic year. The sample was 55% female and 51% Caucasian.

Methods: Participants in this study were asked to report from free recall the peer groups in their classrooms. Students and teachers were also given questionnaires assessing the social-behavioral characteristics of peers/students within their classrooms. Individual student reports of peer groups were compared to an overall aggregate socio-cognitive map to determine level of informant accuracy.

Results: Informant accuracy was found to be negatively correlated with aggression in males and a positively correlated with aggression in females. Females were found to be more accurate at reporting classroom social networks than males ($p < .01$). Multivariate analysis of teacher ratings found significant interaction effects for aggression x gender ($p < .001$) and

aggression x popularity ($p < .01$). Analysis of peer ratings found significant multivariate effects for aggression x gender ($p < .01$) and aggression x popularity x gender ($p < .05$). Females rated as aggressive by their peers had increased informant accuracy compared to non-aggressive girls. No group-level differences were found in relation to informant accuracy. Descriptive statistics were reported for an exploratory analysis of special education status.

Conclusions: The results of this study suggested that being an aggressive girl may be beneficial in terms of accurate recall of social networks in late childhood. For males aggression appears to have a negative relationship with informant accuracy although this finding was supported only by correlational analysis. Limitations of the current study and directions for future research are discussed.

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CHAPTER I

INTRODUCTION

The importance of belonging to a social group increases as children approach adolescence and peer networks become a central influence on their behavior. Social groups are abundant in school settings where children spend the majority of their early lives, yet not all children easily join or interact with these groups. Difficulty in joining social groups is concerning given that most school age children are exposed to the same social network for similar amounts of time. These discrepancies in gaining social group membership may be linked to how children process social information. Social information processing models have been studied extensively in relation to maladaptive behavior (Crick & Dodge, 1994), but research has up till now not used these models to understand how children process their classroom social networks. One way social network processing has been studied is by looking at how accurate people are at recalling groups within a social network or their informant accuracy.

Informant accuracy in social settings has been of interest to social researchers since the 1950s. Kenny and Albright (1987) attribute this interest to the emergence of intelligence testing as researchers felt that if cognitive abilities vary, then so should social abilities. Contemporary social network researchers describe informant accuracy as the ability to recognize friendship dyads or groups within a social network (Bondonio, 1998; Casciaro, 1998; Casciaro, Carley, & Krackhardt, 1999; Krackhardt, 1987). Unfortunately, the existing

literature on informant accuracy has focused solely on adult populations and has yet to measure how accurate children are at perceiving their social networks.

The implication for looking at children's informant accuracy centers on helping children increase the number of peer group options available to them. Children are constantly warned by teachers, parents, and other influential people in their lives to avoid the "bad crowd". The problem with this sound advice is that a child may only have success in interacting with the "bad crowd" because his/her social-cognitive deficits impede accurate social network processing and thus appropriate interaction with other peer groups. Children with limited numbers of peer group options are at the mercy of their peers, putting them at risk for participation in maladaptive behaviors or social isolation. The current study looks at children's informant accuracy and seeks to understand what individual or possibly group characteristics disrupt a child's peer group perception.

Social Information Processing Theory and Children's Informant Accuracy

Research on the informant accuracy of adults has found that adults accurately recall 40% to 50% of their social networks (Brewer, 2000; Casciaro, 1998; Casciaro, Carley, & Krackhardt, 1999). For children, two questions must precede the exploration of network accuracy: 1) How does social accuracy develop? and 2) When should we expect children to be accurate perceivers? How accuracy develops can be conceptualized through socio-ecological models of learning suggesting that children develop social competencies through interaction with more competent peers and adults (Vygotsky, 1978). The frequency and availability of these interactions varies for each child. Hence, the development of social-cognitive accuracy must be seen as a reciprocal function that involves continuous transaction

between individual characteristics and social-environmental variables. Children with more socially competent peers and adults in their social milieu may be more proficient in developing the skills necessary to process the social environment.

The onset of interpersonal accuracy can be described through the work of developmental theorists such as Jean Piaget. A central premise of Piaget's theory is the existence of domain general mental stages, which guide children from undifferentiated conceptions of self/other to differentiated perceptions that allow for perspective-taking and social reasoning (Piaget & Inhelder, 1969). From a Piagetian perspective, accuracy may be pinpointed to the development of concrete operations around the ages of seven to eleven as children begin to decenter and focus on multiple interpersonal characteristics (Barenboim, 1981; Rordkin & Moan, 1971). Although useful as a general framework, social accuracy is best seen as a process that develops on a gradient and is influenced heavily by individual, social, and environmental factors (Bronfenbrenner, Harding, & Gallowey, 1958).

Another method of determining when children accurately report social groups and characteristics is to compare student ratings or reports to those of their peers or teachers. Malloy, Yarlas, Montvilo, and Sugarman (1996) followed students in first through sixth grade for three years to determine levels of consistency between self-peer, self-teacher, and peer-teacher ratings of student behavioral characteristics. The majority of their behavioral indexes were stable by sixth grade meaning that at this age-level individual students tended to report the same behavioral characteristics for other students as their peers and teachers. Gest, Farmer, Cairns, and Xie (2003) also found positive and statistically significant correlations between children's reported social clusters and observational ratings of peer

interaction in seventy-two children in the fourth through seventh grades. Therefore, it appears that accurate perception of social networks is largely developed in late childhood.

Social Cognition and Informant Accuracy

The establishment of informant accuracy as a socio-cognitive process has been important to the continued study of this phenomenon. Leary (2005, p. 85) defined social cognition as "the process by which people perceive, draw inferences about, and think about other individuals and social groups". An essential component of social cognition is the ability to process social information. Kenny (1991) explained that when external factors are controlled, informant accuracy is solely a measure of how an individual processes his/her social environment. Thus, accurate recall of social networks (or informant accuracy) requires informants to process and store social information to determine relational bonds and the strength of these bonds. Once established as a socio-cognitive process, informant accuracy's relationship with maladaptive behavior or other social-behavioral characteristics can be examined. Social information processing models provide a prototypical channel for linking socio-cognitive processes to behavioral patterns and have been studied extensively in children (Crick & Dodge, 1994).

Inherent in social information processing models (SIPM) are sequences of steps requiring the perception, encoding, categorization, and long-term memory storage of social stimuli (Crick & Dodge, 1994; Bless, Fiedler, & Strack, 2004). Progression through these steps influence what decisions or judgments are made in regard to social situations. The similar underlying mechanisms inherent in informant accuracy and social information processing allow for examination of accuracy scores in relation to informant characteristics shown in SIPM literature to cause deficient or advanced social processing (e.g., gender,

aggression, popularity). Figure 1 illustrates the relationship between the social information processing model and informant accuracy.

Gender and SIPM

Eisenburg and colleagues (1996) have found few gender differences in the ability to understand what others think and feel. However, females appear to have more complex reasoning capacity for social situations and are better at noticing social cues (Porath, 2001). Furthermore, females tend to value friendship quality more than males and use different techniques for maintaining these friendships (Laird, Petit, Dodge, & Bates, 1999; Richard & Schneider, 2005). Given these findings it is not surprising that Crain and colleagues (2005) found the social information processing model (Crick & Dodge, 1994) worked differently for males and females. Specifically, aggressive girls did not display the same social processing deficits as aggressive boys (i.e., hostile attribution biases). One possible reason may be the relational strategies used by females to facilitate and manipulate their social surroundings give them an a priori advantage over males in processing social information. Therefore, it is also important to consider whether or not females will have an advantage in regards to informant accuracy. To date, no studies have investigated how informant accuracy is moderated by gender.

Aggression, Popularity, and SIPM

Research on social information processing has shown that aggression influences social processing (Asarow & Callan, 1985; Dodge, 1980; Dodge, 1993; Dodge & Frame, 1982; Dodge & Somberg, 1987). In particular, aggressive boys are more likely to make hostile attributions to non-hostile social stimuli and use prior social information instead of incorporating new information in novel social situations (Dodge, 1980; Dodge & Tomlin,

1987). The social goals developed by aggressive children during social interactions are also more maladaptive than non-aggressive children (Salmivalli et al., 2005). Although no previous studies have looked at how aggressive behavior influences informant accuracy, aggression's effect on the encoding of social cues suggests that some association may exist.

Much like aggression, the effect of popularity on informant accuracy has not been studied. However, recent sociological studies have shown that accurate processing of social networks is related to network centrality and prosocial behavioral characteristics (Casciaro, Carley, & Krackhardt, 1999). Network centrality refers to group members who receive high numbers of nominations to a peer group or network. Popular students have been characterized in prior research as being central members of their social networks as well as possessing prosocial characteristics (Cassidy, Werner, Rourke, & Zubernis, 2003; Farmer & Rodkin, 1996; Rodkin, Farmer, Pearl, & Van Acker, 2000). These findings suggest being popular may increase a child's overall accuracy for their social network.

It is important to note that aggression and popularity are not entirely unrelated as aggressive students may be simultaneously labeled as popular (Farmer, Leung, Pearl, Rodkin, Cadwallader, & Van Acker, 2002). However, by late childhood popular children are no longer reinforced for physically aggressive behaviors although relational aggression may be promoted during this time period (Cairns, Cairns, Neckerman, Ferguson, & Gariepy, 1989; Cairns, Cairns, Neckerman, Gest, & Gariepy, 1988). Relationally aggressive tactics (e.g., gossip, alienation, splitting) may require advanced skill in processing boundaries and characteristics of social networks. It is unclear if being aggressive-popular leads to increased informant accuracy compared to aggressive non-popular students and non-aggressive students.

Group Characteristics

Aggression and popularity have implications for informant accuracy at both the individual and group level. Research has shown that peer groups have strong socialization influences on members even when group norms are maladaptive (Farmer, Estell, Leung, Trott, Bishop, & Cairns, 2003). Although aggressive students are just as likely to hang out with non-aggressive students, aggressive-popular and aggressive-unpopular students have different bases of peer support (Farmer et al., 2002; Rodkin, Farmer, Pearl, & Van Acker, 2006). Membership in an aggressive, or conversely, a popular group may affect how individuals view their social environment consequently mediating accurate perception of the social network. No previous work has considered how membership in aggressive or popular groups affects informant accuracy.

Determination of Informant Accuracy

An understanding of previous methodological problems for determining informant accuracy is necessary for the conceptualization of accuracy as a social information process. The examination of previous work reveals three conditions necessary for studying accuracy in the recall of social networks, which are: 1) consistent and equal exposure to a social environment by all members of the social network, 2) an adequate criterion by which to judge an informant's accuracy, and 3) appropriate aggregation techniques for cognitive data.

A review of pre-1950s investigations of accuracy in interpersonal perception found that the data aggregation methods used in these studies were unreliable and produced ambiguous social structures (Cronbach 1955). Later research comparing cognitive and behavioral data for accuracy calculation found only 50% overlap between the two social structures formed from these methods (Bernard & Killworth, 1977; Bernard, Killworth, & Sailer, 1979;

Bernard, Killworth, & Sailer, 1982; Bernard, Killworth, Kronenfeld, & Sailer, 1984). A major problem with informant accuracy in the late 1970s was the use of unstable, open social networks. Many of the networks used had no face-to-face contact between members and many of these individuals spent little time in the actual network being analyzed. Other studies of informant accuracy varied in conceptual design and statistical methodology requiring calculation of accuracy scores not only for the perceiver but the object of perception (Kenny & Albright, 1987; Kenny, 1991). These initial studies highlighted the importance of calculating informant accuracy in stable networks where individuals have equal and consistent exposure to social groups. By utilizing stable, long-term networks, researchers found that cognitive data more closely approximated behavioral data (Freeman, Romney, and Freeman, 1987). In addition, better cognitive aggregation techniques and stable networks allowed accuracy calculation to consider only perceiver variance (Kenny, 1991; Krackhardt, 1987).

Definition of Terms

The study of informant accuracy (or social accuracy) requires the comparison of a child's individual report of peer groups within his/her classroom to an aggregated socio-cognitive map of the entire classroom social network. Social networks are best described as a cluster of social groups (e.g., cliques, peer groups, friendship groups) within a social setting (e.g, classroom, office). Socio-cognitive maps are formed by taking the individual reports of classroom social groups and forming an overall aggregate map for a classroom. Once the overall map or social structure for the classroom is formed, individual student maps can be compared to the aggregate for accuracy calculation.

Another concept discussed in the informant accuracy literature is network centrality or being a central or peripheral member of a social group. As previously mentioned, central (also called nuclear) members receive many nominations as belonging to a social group and therefore are considered key members of the group social structure. Peripheral members are individuals who show up in reports of friendship or social groups, but receive significantly fewer nominations than central members. The assumption is that students are more likely to leave out peripheral members when reporting classroom social groups. The use of weighted informant accuracy models gives a student more credit for reporting nuclear members as opposed to peripheral members. Similarly, social groups that are reported more frequently within a social network are regarded as nuclear groups.

Lastly, the current study looks at both a student's accuracy for reporting social groups and the number of groups he/she reports to determine the types of errors the student may be making. There are two types of errors that are possible within the study of informant accuracy, which are omission and commission. Omission errors are evident when students fail to report important groups or group members and as a result have lower informant accuracy scores. Commission errors are seen in situations where a student reports a similar number of groups as other students but has a lower informant accuracy score. The assumption with commission errors is that students are reporting group members that do not actually belong in the group.

Statement of Purpose

The following study seeks to understand how accurately children recall classroom social groups (or their informant accuracy) by examining a cohort of fifth grade students during the spring of 2003-2004 academic year. The socio-cognitive mechanism required for

network perception appears to be functional in late childhood suggesting that children's level of recall may be similar to informant accuracy averages found in the adult literature. By examining both the number of groups recalled by each participant and their accuracy for this recall, researchers can begin to understand the types of errors (e.g., omission, commission) made by children when reporting social groupings.

An additional goal of this study is to explore whether certain perceiver characteristics such as gender, aggression, or popularity disrupt the social perceptual processes necessary to see social networks. Teacher- and peer-ratings of social-behavioral characteristics are utilized in order to gain a comprehensive understanding of the relationship between aggression/popularity and informant accuracy. Research into behavior classification systems for children suggests that students and teachers are sensitive to different aspects of aggression and popularity (Bruyn & Boom, 2005; Pelligrini & Bartini, 2000). Teachers tend to be most sensitive to physical aggression and the prosocial aspects of popularity. Alternatively, students have the opportunity to observe relationally aggressive tactics and are more likely to nominate students who have high social self-esteem or are considered "trend setters" as popular (Bruyn & Boom, 2005). The use of a two-dimensional rating system (teacher vs. peers) allows for a broader assessment of social-behavioral characteristics that may be related to informant accuracy.

The influence of aggression and popularity are examined at both the individual and group level as it is unclear whether membership in aggressive or popular groups also affects network perception. An increased understanding of how children process their surrounding social network is essential to developing future social skill interventions and helping children increase their social competencies in school settings. By learning what impedes network

recall, researchers will be able to explore methods for increasing social network accuracy. Increasing children's ability to comprehend their social surroundings will ease social transitions and hopefully cultivate new, pro-social group options.

Research Questions

The present study seeks to answer six questions in regard to children's informant accuracy:

- **Question 1**: *Is informant accuracy for classroom social networks moderated by gender?*
- **Question 2**: *Is individual aggression related to informant accuracy for classroom social networks?*
- **Question 3**: *Is individual popularity related to informant accuracy for classroom social networks?*
- **Question 4:** How *does being both popular and aggressive relate to informant accuracy?*
- **Question 5***: Is aggressive group membership associated with informant accuracy?*
- **Question 6**: *Is popular group membership associated with informant accuracy?*

CHAPTER II

LITERATURE REVIEW

Informant Accuracy

Informant accuracy is a phenomenon that has been studied for over half a century in sociology and social psychology with researchers seeking to understand interpersonal processes and intrapersonal perception. Early studies of accuracy were often plagued by sampling error, poor aggregation techniques, and inconsistencies in how accuracy was operationally defined. Findings from initial investigations were disheartening to the study of informant accuracy as researchers were unable to find stable relationships between cognitive and behavioral reports of social interaction. By the late 1980s, researchers began to develop new techniques for estimating accuracy, which allowed them to begin to use accuracy estimations to describe groups of individuals and also look at intra-individual characteristics of accurate perceivers. The subsequent literature review will begin with early investigations of accuracy and move toward contemporary methods of analysis. The purpose of this review of the informant accuracy literature is twofold: 1) To examine historical and modern approaches to accuracy calculation and 2) To explore what individual characteristics researchers have associated with informant accuracy. This will allow movement beyond methodology and set the stage for the current investigation of children's informant accuracy as a social information process.

Interpersonal Accuracy

One of the first studies of accurate social perception in interpersonal perception was completed by Gage (1953) in an attempt to see how well judges estimated the personality characteristics of four fifth-grade children. Using a 223-item personality inventory, Gage obtained (a) stereotype responses (the percentage of judges who predicted without any input, how a typical fifth grade girl or boy would answer an item); (b) the percentage of judges who after seeing a series of films of the child doing some sort of expressive behavior, predicted that the child would endorse an item as yes; and (c) the child's actual response. Three types of item sets were derived from this information: (a) accurately shifted items, (b) inaccurately shifted items, and (c) unshifted items. Accurately shifted items were those in which the judges' responses after seeing the film were 15% greater than the stereotyped response in the same direction as the child's response. Inaccurately shifted items were those in which the judges' responses after seeing the film were 15% lower than the stereotyped response and in the opposite direction of the child's response. Unshifted items were items that differed by less that 15 percent from the stereotyped response. Results indicated moderate reliability coefficients for accurately shifted items (median KR20 = .58) and inaccurately shifted items (median KR20 = .48), which suggested that judges were consistent in judging similar items. Although this study indicated that accuracy could be reliably measured, it failed to define accuracy as a unitary construct. For example, judges high on accurately shifted items could be considered accurate in perceiving manifest or observable stimuli, whereas judges high on inaccurately shifted items were more accurate at taking the role of another. The problem inherent in this methodology that is social accuracy requires both attention to manifest value and perspective-taking. A truly accurate perceiver would be high on both, yet in this study

these variables were negatively correlated. Gage concluded that a great deal of measurement error was inherent in these calculations and to determine accurate perception input stimuli must be constant for all observers.

This study and several other early investigations of interpersonal perception prompted Cronbach and Gage (Gage, 1955; Gage and Cronbach, 1955) to review early methods of accuracy measurement. They concluded that the differential conceptualizations and operational definitions of accuracy were too great to make generalizations from accuracy scores. They critiqued earlier work (e.g., Gage, 1953) as measuring empathy and not accuracy, which until this point in time were seen as one and the same. Interpersonal perception was described as the interaction between a Judge (j) and an Other (O) that required acquisition of previous knowledge about the Other and extrapolation from available knowledge. From this Cronbach (1955) argued that four different models or algorithms existed for calculating accuracy, which were elevation, differential elevation, stereotype accuracy, and differential accuracy. Elevation concerns the level of correspondence between a judge's average score across targets and traits and the average score of the Other across targets and traits. Differential elevation is a judge's ability to perceive deviations from the average response of the Other. Stereotype accuracy is a measure of acquired knowledge suggesting that every accuracy decision is in part affected by a judge's prior knowledge of the stereotypical Other. Lastly, differential accuracy is the degree to which a judge consistently responds across items. Cronbach cautioned researchers that meaningful accuracy calculation was impossible without the consideration of all these potential sources of error. Gage and Cronbach speculated that many of these error sources could be controlled if experiments were designed to keep acquaintance constant and extrapolation low. Most

early investigations did not consider differences in the judges' experiences. For instance, in the 1953 study by Gage, judges were tested individually with no mention of controlling for past experience or acquaintance with the target child. Methodological issues kept the study of accuracy stagnate for over twenty years.

Early Informant Accuracy

In the late 1970s several sociological researchers began to address the issues of defining accuracy by looking at the discrepancies between cognitive and behavioral data. Bernard, Killworth, and colleagues (Bernard & Killworth, 1977; Bernard et al., 1980; Bernard, Killworth, & Sailer, 1982; Killworth & Bernard, 1976; and Killworth & Bernard, 1979) examined accuracy in series of five studies using four different communication networks. These groups were as follows: (a) individuals from a deaf community who used TTY phone communication, (b) 54 individuals in a ham radio network, (c) 40 persons from a social science research office, and (d) 34 persons from a technology institute in West Virginia. The fourth study in this series (Bernard et al., 1980) also obtained data from 58 members of a college fraternity. These five studies are discussed sequentially.

Bernard and Killworth's (1976; hereafter referred to as Accuracy I) initial study involved twenty-five members from the deaf community who were asked to rank the members of the network with whom they most frequently communicated. The results showed that the persons participants mostly communicated with were within the top four rankings only 50% of the time. It was concluded from this experiment that pre-cognitive recall of communication networks (Who will you talk to?) is not strongly related to actual behavior (Who did you actually talk to?). However, the experiment did not utilize a stable criterion to determine accuracy as the communication networks varied significantly by individual (e.g.,

some communicating with much larger networks). It should also be noted that this study involved a group of individuals who had no face-to-face contact, which keeps the measure of accuracy limited only to recall of verbal communication via TTY lines. Variations in network size and consistency made conclusions drawn about individual accuracy inconclusive.

The second experiment in this series (Bernard & Killworth, 1977; hereafter referred to as Accuracy II) addressed the use of pre-cognitive data in Accuracy I. For this experiment all four previously mentioned groups were used. Pre- and post-cognitive data ("who will you talk to" and "who did you talk to") were collected on individuals in the deaf community. Post-cognitive data was collected on the ham radio group, office, and fraternity participants. The results of the Accuracy II study were similar to Accuracy I in that that each group at best was only accurately recalling 50% of their previous communications. These results were comparable for both pre- and post-cognitive reports, ranked and scaled data, and those keeping communication logs (ham and deaf community). Although the investigators once again concluded that pre- and post-cognitive recall data were highly inaccurate, they still did not address the issues of social input equality or individual perceiver differences. For groups that did have social input equality (office and tech group) the criterion by which they were judged (periodic observations) may have skewed the behavioral data.

The third study (Killworth & Bernard, 1979; hereafter referred to as Accuracy III) looked at the differences in dyadic and triadic structures in the behavioral and cognitive data. Triadic structure implies a relationship between three individuals, in this case a perceiver (k) and two other people (i and j). An example of a triadic structure would be transitivity in which three people (A, B, and C) report relational ties as follows: A reports a tie to B, B

reports a tie to C, and A also reports a tie to C. There are 16 possible triadic ties in social networks (Holland & Leinhardt, 1975) with certain triads occurring at greater frequencies than others. The authors of this study found that when examined at the triadic level, many similar structures occurred between cognitive and behavioral data, if examined as an aggregate across all informants. However, if these structures were examined individually, triad by triad, the correspondence between these two structures decreased significantly. This study implied that aggregating cognitive data may be necessary to produce adequate criterion for comparison. The issue the authors had with this technique was that unitary samples of cognitive data were unstable. More specifically, they argued that error had a greater impact on cognitive networks than behavioral networks, which are relatively stable. Ironically, instability later factored into informant accuracy once adequate measurement criteria were established and researchers began controlling for error in accuracy derivations.

The fourth study (Bernard, Killworth, & Sailer, 1980; hereafter referred to as Accuracy IV) looked at the correspondence between cognitive and behavioral data at the clique level. Thus, instead of relying on a dyadic or triadic model, the investigators examined the cliques reported in these groups using factor analysis, an iterative block modeling technique, and a graph-theoretic approach. Results were analogous to Accuracy II and III in that the agreement between the two indices across all three models was relatively low.

The fifth and final study (Bernard et al., 1982; hereafter referred to as Accuracy V) looked at the time windows in which informants were asked to report their behavior. They described windows as having two properties: lag and width. Lag is the amount of time elapsed between the end of the window, and width is the amount of time over which informants are asked to recall their behavior. Fifty-seven scientists were interviewed and

their responses recorded over varying time windows. Although the lag and width of window failed to explain much of the variance in inaccuracy, one finding emerged that was promising, the effect of network centrality. Both the recall and behavior data were able to reproduce the most prominent members in the network. In other words, individuals were accurate in recalling communications with popular members of the network.

Bernard and colleagues (1984) later reviewed these five studies and came to the following conclusions: (a) recall of networks decays over time, (b) actual behavior may not be best accounted for by observation and (c) inconsistencies in data collection affect recall data. Therefore, in order to measure informant accuracy, experimental designs must consider: (a) the appropriate window for obtaining cognitive data, (b) inconsistent stimulus characteristics that would influence informant perception, (c) and the type of network that can be expected to have accurate cognitive recall. This last point warrants further discussion because it has strong implications for how accuracy is studied in the current investigation.

If we are to define accuracy as a socio-cognitive process then the social network in question must meet three criteria: (1) interaction must exist, (2) interaction must be consistent across informants, and (3) an adequate criterion by which to judge an informant's accuracy must be available. For example, Accuracy II-IV used individuals from the deaf community and ham radio users. These participants had no social contact and their networks were assumed to exist solely through verbal or type-written communication. In addition, these individuals were not exposed to similar amounts of social stimuli, meaning some ham radio users may have talked monthly to ten people while others may have talked to one hundred. Even though the authors of these five studies concluded that cognitive data were poor

predictors of actual behavior, the above mentioned methodological flaws permitted the re-opening of the investigation into informant accuracy in the late 1980s.

Freeman, Romney, and Freeman (1987) were one of the first to address issues found in the Accuracy (I-V) studies by arguing that cognitive data or informant reports of social interaction approximated long-term behavioral patterns. For this study the investigators recorded the attendance patterns of an ongoing mathematical seminar attended by faculty and graduate students from the hosting university as well as individuals from other universities. The last seminar session was designated the "target" session. Seventeen individuals who attended the target session were asked to recall who else attended five days after the session had ended. Preliminary results supported the Accuracy studies in that of the 272 possible listings, 115 were left out, and 26 individuals who did not attend were recalled. However, when informant reports were compared to the average attendance across all seminars, high correlations were found suggesting that cognitive data approximates long-term behavior patterns.

The authors also postulated that the omission and commission errors present in the data set were the result of the differences in how people perceive, process, and retrieve information about their experiences. Cognitive recall of social structures was described as function of memory by which individuals draw from previous experiences and organized mental structures. Freeman and colleagues tested this hypothesis by partitioning the informants into two groups: the in-group and the out-group. The in-group consisted of 8 informants who were housed in an office space that allowed for frequent social interaction; the out-group included the 9 informants housed in non-socially interactive settings. The hypothesis was that in-group membership would lead to more developed internal mental

structures of the network, which would aid in the recall of data. A second hypothesis was that in-group members would tend to make more errors of commission and fewer errors of omission than out-group members. Results supported these hypotheses with in-group members having more errors of commission (2.8 false recalls per informant for in-group vs. 0.4 false recalls per informant for out-group) and out-group members having more errors of omission (8.1 omissions per informant vs. 4.7 omissions per informant). The implications of this study were two-fold: 1) aggregated cognitive data (social structures) tend to approximate long-term patterns of social events and 2) errors in recall of social events are associated with memory and information processing.

Cognitive Social Structures

Building on research showing the relevance of cognitive recall data, Krackhardt (1987) discussed three methods of forming cognitive social structures from informant reports. These structures were described as the set of all possible relational statements between pairs of actors in a system, producing a set of *R* matrices. Each *R* matrices has a "perceiver" *k*, a "sender" *i*, and "receiver" *j*, which produces a three-dimensional $R_{i,j,k}$ matrix. Krackhardt posited that to compare these structures the matrices must be reduced to two-dimensional form. The aggregation methods for reducing *R* matrices were as follows: (a) slices, (b) locally aggregated structures (LAS), and (c) consensus structures (CS). The first technique is termed slicing and involves holding *k* constant and looking solely at the matrix produced by *k*. This allows for comparison with another person's *k* matrix for structural similarity. The second method, (LAS), involves a binary reduction of data as follows: $R = 1$ if $R_{i,j,i} = R_{i,j,j}$ and $R = 0$ if $R_{i,j,i} \neq R_{i,j,j}$. Thus, a relational matrix is considered to exist only if both the "sender" and "receiver" believe it to exist. If only one member of the dyad acknowledges the relation,

the LAS technique codes this as a zero or no relation. The last approach, (CS), looks at the entire vector of perceivers in determining the (i, j) relationship. Consensus structures consider a relationship to exist only if the majority of members in the network perceive it to exist. Therefore, thresholds, or cutoffs, are determined a priori to aggregation and true relationships are found according to algorithms such as Equation 1 below.

$$Ri, j \begin{cases} 1 \\ 0 \end{cases} if \frac{1}{N} \sum_k Ri, j, k \geq Threshold \qquad (1)$$

Consensus methods are similar to techniques later used by Cairns and Cairns (1994) to study social structures in classrooms using .40 as the threshold for inclusion into a social cluster. Krackhardt (1987) found that accuracy varied considerably depending of the type of aggregation performed on raw data. The most reliable structures were LAS and CS.

Social Relations and Weighted Models

By the early 1990s the use of aggregated cognitive social structures as criteria for accuracy research was an accepted practice (Krackhardt, 1990; Casciaro, 1998). However, one issue still remained: the issue of individual differences and environmental consistency when measuring informant accuracy. Kenny and Albright (1987) reviewed the early critiques by Cronbach (1955) and suggested that accuracy in perception could be best accounted for by a social relations model (Kenny & La Voie, 1984). Described as the second wave of accuracy research (Accuracy I-V being the first), the social relations model characterized a perceiver's judgment as a componential process comprised of a constant, an actor effect, a partner effect, and a relationship effect. The constant measures the relationship between a judge's average response and the average response on what is being

measured. The actor effect is the extent to which some individuals are better judges of the criterion. The partner effect is the extent to which some targets are more easily judged than others. Finally, the relationship effect is the degree to which a judge is particularly accurate for a certain target.

This componential model uses principles of generalizability theory (Cronbach, Gleser, Nanda, & Rajaratnam, 1972) to obtain variance components for each effect. The components represent the judge's and target's individual and joint contribution to overall accuracy or inaccuracy. Although the calculation of accuracy scores via the social relations model is quite complicated, it raises the issue that accuracy measurement is confounded by experience and environmental variables. For instance, the Accuracy I-V studies were ineffective because the networks measured were inconsistent, open, and at times void of face-to-face social interaction. Kenny (1990) suggested using a weighted model to account for differences in acquaintance, overlap, shared meaning systems, consistency, extraneous information, and communication. In other words, if the persons being examined in a social network are not equally and consistently exposed to the network, then a weighted model or generalizability estimate is needed to account for perceiver and target variation in network accuracy. For example, the accuracy of children just entering fifth grade would be obviously lower than children leaving fifth grade because those leaving have been exposed to the social network longer and more consistently.

The social relations model and weighted average model account for factors that have plagued earlier research and suggest that multiple factors contribute to the perception of a social network. On the other hand, if the target is consistently and equally available to all perceivers, then a two-facet generalizability model is possible. This model allows

researchers to look at accuracy in two different ways: 1) perceiver contribution and 2) target contribution. Particularly, if one were interested in which individuals were accurate, then perceiver variance would be a measure of individual accuracy because it is a measure of how each individual interacts across all targets. If one were interested in which groups are more easily seen, then only measuring the target variance would tell us how targets influence different ratings by judges. Each of these facets involve measurement error (usually captured by the interaction effect), but contemporary accuracy research tends to assume target consistency in which only the calculation of perceiver variance is necessary.

Contemporary Informant Accuracy

The current conceptualization of accuracy is how accurate an individual is at recalling a social network given face-to-face communication, prolonged acquaintance, and consistency in the network (Kenny, 1991). This operational definition permitted social investigators to take the next step in accuracy research, which was identifying individual characteristics associated with accurate network perception. Casciaro (1998) was the first to look at the structural characteristics of individuals who accurately perceive the network.

In this study Casciaro examined the relationship between network centrality, need for achievement, need for affiliation, hierarchical level, and informant accuracy. Twenty-four members of an Italian University research center were asked to report friendship ("Who does Bob consider a friend?") and advice networks ("Who does Bob go to for advice?") within the department. Data were aggregated using the LAS technique described by Krackhardt (1987) and the following means and standard deviations were obtained: advice accuracy, $M = 0.450$, $SD = 0.120$; friendship accuracy, $M = 0.420$, $SD = 0.118$. Network centrality, defined as the number of advice or friendship ties converging on an actor, predicted both friendship

and advice accuracy. Need for affiliation was positively associated with friendship accuracy and need for achievement was moderately positively correlated with advice accuracy.

An additional component of this study examined the relationship between five hierarchical levels in the network and recall accuracy (the director of the center being the highest and two center secretaries being the lowest). Surprisingly, hierarchical level had a negative relationship with accuracy in the advice and the friendship network. Hierarchical level (or power status) is differentiated from network centrality in that central members do not necessarily have high power or influence over others. In this study central members were those relied on most often by friends and colleagues in everyday communication. The author argued that in certain networks high status removes individuals from the social group in such as way that their perception of the network is skewed.

The effect of centrality on accuracy is unclear, however, as Krackhardt (1990) found no significant correlations between centrality and accuracy in 28 employees of an entrepreneurial information systems company. This study postulated that accuracy would predict power in a network over and above the structural factors of centrality and formal position. Stepwise regression analysis found that only advice accuracy added significant explained variance to power reputation, but this contribution was secondary to formal position in the network. Although friendship accuracy was positively correlated with advice accuracy, friendship accuracy was a relatively weak predictor in this study. One possible explanation for the small contribution of friendship accuracy was that the social network being measured was a work environment where friendship was weakly defined. The fact that friendship accuracy correlated only with advice accuracy suggested that most of the variance explained by friendship accuracy was already explained by advice accuracy. Means (and

standard deviations) for friendship and advice accuracy were .326 (.070) and .406 (.062), respectively. These means are lower than those found by Casciaro (1998) and thereby reiterate the point that accuracy is mediated by the type of network being measured. An academic department may foster the development of friendship ties more so than an office environment.

Most available studies of accuracy have focused primarily on social structural variables (e.g., centrality, power) that relate to accuracy. A study by Casciaro, Carley, & Krackhardt (1999) used the academic department recall data from Casciaro (1998) to study the relationship of positive affectivity and network perception. The authors differentiated between two types of accuracy: local and global. Local accuracy is how well an individual recalls his/her direct personal contacts or social network. Global accuracy refers to "the perception of the complete set of social relationships linking all members of a social network" (Casciaro et al., 1999, p. 287). Affectivity was measured with an 11-item positive emotionality scale. The results showed a significant negative correlation between positive affect and local advice network accuracy. A positive correlation was also found between positive affect and global friendship accuracy. The authors explained these results in terms of the depressive realism hypothesis (Lewinsohn, Mischel, Chaplin, & Barton, 1980), which states that the negative self-evaluation and low self-esteem associated with depression leads to accurate self-perceptions. Individuals with high self-esteem and positive self evaluations actually have distorted views of self relations but are more accurate at judging others in the network. The results of this study have major implications for the study of behavioral, social, or temperamental characteristics related to accuracy. First of all, it appears that global accuracy provides a better estimate of social perception as local accuracy is focused more on

self-perception. Secondly, social-behavioral characteristics that influence self-esteem, affect, or the amount of time spent in social interaction may have an impact on informant accuracy.

Children's Informant Accuracy

Research on informant accuracy has until this point disregarded the study of children's accuracy for classroom social networks. Children spend much of their day in a school classroom, which provides them with consistent exposure to the social network that encompasses them. Bondonio (1998) found that accuracy tends to increase when individuals in a network are closer in age and have similar tenures in a group. This finding was supported by Brewer (2000) who found that small social networks that frequently communicate were less likely to "forget" social interactions when prompted for cognitive recall. Therefore, it appears that children in elementary school classrooms would have ample opportunity to observe and encode the social groups surrounding them. Much like the study of children's informant accuracy, children's socio-cognitive capacities for accurately recalling social groups in elementary school classrooms have also not been clearly established in the literature.

Malloy and colleagues (Malloy, Sugarman, & Montvilo, 1995; Malloy et al., 1996) have found that by fifth and sixth grade there is consistent agreement between self-, peer-, and teacher judgments of students' behaviors and popularity. Similarly, Pearl and colleagues (manuscript submitted for publication) found a high level of agreement between teachers' and students' reports of the most salient social groups in fourth and fifth grade classrooms. Thus it seems that children do have the socio-cognitive skill necessary for accurately recalling classroom social groups by late elementary school.

Building on these recent investigations of informant accuracy, the goal of the current investigation is to utilize a social information processing approach to determine how certain social-behavioral characteristics (i.e., aggression, popularity) relate to accurate reporting of social networks for children. The following sections of this literature review provide a conceptualization of children's informant accuracy as a social information process. Conversely, social behavioral characteristics that have been shown to affect social information processing are discussed in relation to informant accuracy.

Social Information Processing Models (SIPM)

In order to estimate the accuracy of cognitive data in a given social context, individual differences in information processing as well as previously acquired knowledge must be considered (Freeman et al., 1987; Kenny, 1990). Social information processing models provide a foundation for the examination and conceptualization of these differences. Bless, Fiedler, and Stack (2004) distinguish three elements inherent in social information processing: (1) input from a social situation, (2) retrieval of prior knowledge regarding the situation, and (3) the performance of mental operations on a social stimulus. Decades of research into social cognition has produced several models of social information processing (Huesmann, 1988; Yeates & Selman, 1989); however, few models have contributed to the understanding of how children process social information more than the two models proposed by Crick and Dodge (Crick & Dodge, 1994; Dodge 1986). The relationship and alignment of these models with informant accuracy will be described next.

The first SIP model, developed by Dodge (1986), proposed four mental steps that children go through when faced with novel social situations or cues. These stages are as

follows: (1) encoding of situational cues, (2) representation and interpretation of cues, (3) mental search for situation response, and (4) response selection. A second model, a reformulation of the first model, was developed by Crick and Dodge (1994) to address the limitations of the first model. In particular, the authors posited that SIP was not a linear process completed in sequential steps. Instead, they concluded that SIP was best seen as a cyclical model that involves feedback loops to earlier levels. The reformulated model consisted of the following steps: (1) encoding of cues, (2) interpretation of cues, (3) clarification of goals, (4) response access or construction, (5) response decision, and (6) behavioral enactment. Each of the levels has a bi-directional relationship with an internal cognitive database, which is made up of memories, acquired rules, social schemas, and social knowledge. A person's accurate recall of social networks can affect or be affected by difficulties at any one of these stages. Similarly, just as the SIP model serves as a bi-directional feedback mechanism, so too does accuracy. In order to better understand the relationship between the SIP model and accuracy, each stage in the model will be examined individually.

The first and second stage in the SIP model, encoding and interpretation, require a person to sense, perceive, attend to, focus on, and make inferences regarding social stimuli. In this stage children call upon previous experiences (e.g., schema or scripts) to deal with new situations and in doing so try to infer causality or intent to the situation. Children with limited social experience, poor working models, or social schemas have trouble extrapolating beyond their "database" of knowledge, which leads to wrongful attributions of causality and intent. An example of how this influences accuracy is as follows: An aggressive child who is struggling with academics is put into a group with high academically achieving students.

The child is unable to read at the pace of the group and when the other children try to assist him/her with a passage, he/she infers that the other children are making fun of him/her. Thus, the low achieving child does not attend to other characteristics of the group, such as their pro-social interactions, relational ties, or what a group with this type of behavior accomplishes in the classroom. Processing deficits or inaccuracy at these two levels prevents social osmosis or entering social groups with positive social and behavioral characteristics. Research has shown that rejected children generate ineffective, irrelevant, or vague strategies for initiating and maintaining friendships (Asher, Renshaw, & Geraci, 1980). Conversely, socially competent children, who have accurate perception and knowledge of available groups within a network, can form and maintain friendships more readily.

In stages 3 and 4, children set goals or select desired outcomes for new social situations and attempt to access or retrieve responses from long-term memory storage. Crick and Dodge (1994) described goals as "focused arousal states that function as orientations toward producing a particular outcome" (p.87). Although not all social situations change a child's existing goals, whatever goal exists, or is formed, can serve an internal or external purpose. An internal goal may be feeling happy or less anxious, whereas an external goal may be leaving an uncomfortable situation (e.g., classroom) or having someone talk to you. Research has shown that both socially adjusted and maladjusted children have similar social expectations for behaviors (Crick & Ladd, 1990), but socially maladjusted children are more likely to construct social goals that impede social relationships (Crick & Dodge, 1989; Renshaw & Asher, 1983). The formulation of appropriate social goals requires children to have accurate perceptions of network characteristics in order to select behaviors that would facilitate entry into a group. For example, a child who has an inaccurate perception of a local

network, approaches a group of quite, reserved girls and begins to pick on them hoping to gain their interest. Instead of allowing the child to join the group, they ignore the child and walk away. This makes the child be even more verbally or relationally aggressive to the girls in later encounters. Thus, being inaccurate affects not only a child's perception of the network, but the goals or strategies generated to interact with the network. After goals are constructed, stage 4 of the SIP model suggests a response search in which children access behavioral options from long-term memory. Petit, Dodge, and Brown (1988) found that less socially competent and aggressive children access more aggressive and less prosocial responses than normal peers for group entry and friendship initiation. Studies have also shown that aggressive children retrieve fewer strategies than non-aggressive peers (Asarnow & Callan, 1985). To conclude, at stages 3 and 4 accurate perception of social groups allows a child to form goals for interacting with groups and aides them in selecting responses appropriate to group norms.

In stages 5 and 6, children decide on a response and perform the chosen behavior. A child must also evaluate the response and the outcome that is expected from the response. Crick and Ladd (1990) found that socially maladjusted children evaluate aggressive responses more favorably than prosocial responses. Other work has shown that maladjusted children have positive outcome expectations for aggressive behavior (Feldman & Dodge, 1987). In these later stages, behavior reinforces inaccuracy. As a child continuously tries and fails to join groups using poorly selected strategies, the social information obtained from the situation and stored in the child's "database" can be as equally inaccurate as what was initially perceived. At these later stages the effect of social maladaption on accuracy can be more readily identified and linked to social-behavioral characteristics.

In order to truly align the SIP model formulated by Crick and Dodge (1994) with informant accuracy several assumptions must be made. They include the following: 1) the perception of the social network is a socio-cognitive process, 2) individual perceiver characteristics account for much of the variation in accuracy, and 3) accuracy has an effect on the performance of socially competent behavior. The first assumption is addressed by Crick and Dodge as they describe social perception as a developmental process that becomes more efficient and accurate with age. Specifically, the authors explain that social information processing is related to social accuracy because both constructs follow a similar course of development that requires precise detection of subtle social cues. In addition, both processes require storage, organization, and retrieval of stored cues.

The second assumption is addressed by Kenny (1991; Kenny & Albright, 1987) with the partitioning of actor, target, and relationship effects inherent in the calculation of an accuracy score. As previously suggested, accuracy becomes a measure of individual actor differences when social stimuli are consistent and held constant across perceivers. The last assumption is necessary since Crick and Dodge stress that their model of social information processing is a mechanism for explaining social adjustment. In particular, this model has traditionally sought to examine processing deficits in socially maladjusted children who are physically or verbally aggressive. The sparse literature on informant accuracy has yet to study behavioral characteristics such as aggression, but research has linked informant accuracy with positive affectivity and network centrality (Bondonio, 1998;Casciaro et al., 1999). Research on children's networks has linked network centrality with both popular and aggressive behavioral configurations (Rodkin et al., 2000; Rodkin et al., 2006). Thus, further

investigation is needed to understand how aggression and popularity are related to social accuracy.

The remaining literature review focuses on the relationship of gender, aggression, and popularity to informant accuracy as conceptualized through the SIP model. Research has suggested that social information processing may be moderated by gender differences as girls are more aware of how to use social networks to influence relationships (Cairns et al., 1989; Crick & Gropeter, 1995). These gender differences extend to the study of aggression as girls have been found to use more relationally aggressive strategies as opposed to overtly physical strategies used by boys (Crain, et al., 2005; Crick, 1997). The conceptualization of aggression as resulting from deficits in social information processing is the most studied type of maladjustment in the social information processing literature (Crick & Dodge, 1994) and will be briefly reviewed. The relationship of popularity, informant accuracy, and the SIP model has not been well studied. What is known is that children who are popular are more likely to be central members of their social networks (Rodkin, Farmer, Pearl, & Van Acker, 2000), and network centrality is associated with greater accuracy in adults (Bondonio, 1998; Casciaro, 1998). Therefore this study will also explore what type of relationship exists between popular group members and accurate recall of the social network.

Gender

Research has found few gender differences in the ability to understand what others think and feel (Eisenberg, Martin, & Fabes 1996). However, studies of children as young as preschool have found that girls have a more complex reasoning capacity for interpersonal situations and are better at noticing subtle cues in interpersonal situations than boys (Porath, 2001). Females have also been found to be more perceptive of nonverbal interpersonal cues

(Field & Walden, 1982). In addition to better interpersonal perceptions, girls report higher dyadic and group friendship qualities such as intimacy and closeness (Laird, Pettit, Dodge, & Bates, 1999; Lansford, & Parker, 1999; Rose & Asher, 1999). Richard & Schneider (2005) found that girls have more friendship motivation than boys, which supports other work showing that girls are more likely to compromise in social conflict situations and report high levels of desire to maintain friendship quality (Rose & Asher, 1999). These findings are also reflected by the Cairns and colleagues' (1989) use of social cognitive interviews to longitudinally study aggressive patterns in a cohort of fourth grade children. The authors found that by seventh grade conflict among same-sex female dyads involved high degrees of relational manipulation (e.g., alienation, ostracism), which were almost non-existent in male same-sex dyads. In a study social information processing skills, girls were found to be more skillful than boys at encoding, formulating social goals, and making prosocial decisions in response to hypothetical vignettes (Fraser et al., 2005). Thus, knowledge of existing social networks and network boundaries may be seen as vital to female relationships.

Explanations for the emergence of greater cognitive accuracy in females can be conceptualized from a social cognitive theory of gender development (Bussey & Bandura, 1999). This theory posits that from an early age, boys and girls are exposed to and reinforced for different models of behavior. Relational models for girls tend to be more caring and nurturing, whereas models for boys are more likely to be tough or competitive (Maccoby, 1998). Theories of how children morally develop have also been divided on the basis of gender in that moral development in females is linked more to caring than following rules, which is a general strategy that has been used to describe moral reasoning in males (Gilligan

& Attanucci, 1988; Kohlberg, 1976). Therefore, the study of accuracy must take into account gender-related effects when studying constructs such as aggression or popularity.

Aggression

The link between aggression and social information processing was first examined by Dodge (1980) in cohorts of second, fourth, and sixth grade boys. For this experiment, boys were asked to complete a puzzle and then exposed to a pre-recorded audiotape of another child commenting on the puzzle in either a hostile, pro-social, or ambiguous manner. Aggressive boys were found to attribute hostile intent more often than non-aggressive children in ambiguous situations. No differences were found when the intent of the recording was actually meant to be hostile. This initial study suggested that aggression may affect social competence and interpersonal accuracy in non-hostile situations.

Dodge and Frame (1982) followed up this preliminary investigation with two studies examining attribution biases in three cohorts of boys in kindergarten through fifth grade. Again aggressive boys were found to attribute a hostile intent more often to ambiguous stimuli than non-aggressive peers, but only when the stimulus was actually directed at the student. When the ambiguous stimulus was directed toward another student, no differences were found in attribution. In addition, the authors found that aggressive boys had more intrusions in their recall of a peer's behavior. More specifically, when asked to recall particular aspects of non-hostile peer behavior, aggressive students had a propensity to report behaviors that never happened. The recall of hostile responses was similar to non-aggressive peers. Lochman and Dodge (1994) also found severely aggressive boys to have poor social memory when asked to recall relevant cues from video vignettes. Similarly, Sancilio,

Plumert, and Hartup (1989) found that aggressive boys were only more likely to have hostile attribution biases when the stimulus was directed at themselves.

Hostile attribution biases in aggressive children have been linked to Stage 1 and Stage 2 of the SIP model (Crick & Dodge, 1994). In particular, these children are thought to have trouble interpreting and processing the normal social interaction with which they are involved. Dodge and Tomlin (1987) described this deficit as "top down" processing, or using only information from past experiences without incorporating new available information from the social context. They described normal children as using "bottom up" processing, which implies the use of available social information to reach social judgments. Hymel, Bowker, and Woody (1993) found that aggressive-unpopular and aggressive-withdrawn students were on average one-half standard deviation below the mean on measures of social competence. The fact that aggressive children are not always able to process social information correctly and have higher frequencies of false recalls validates the current study of the impact of aggression on informant accuracy.

Aggression and Gender. An important question that has been raised in the literature is whether or not the SIP model works the same way for girls as it does boys. Reviews of the literature on hostile attribution biases in boys have found large effect sizes, especially when the stimulus used was an actual social interaction and the child was severely aggressive (Orobio de Castro, Veerman, Koops, Bosch, & Monshouwer, 2002). However, when applied to cohorts of fourth and fifth grade girls, peer-nominated aggression was not positively correlated with hostile attributions (Crain, Finch, & Foster, 2005). In fact, in a second study, Crain and colleagues found that aggression was negatively correlated with hostile attribution biases. These findings suggest that aggression affects the interpersonal accuracy of males

and females differently. The differences may be attributed to the developmental course of aggression in males and females (Cairns et al, 1989).

Recently studies have begun to investigate the disparity in aggression across gender and how these differences affect social competence (Crick, 1997; Grotpeter & Crick, 1996; Salmivalli, Ojanen, Haanpaä, & Peets, 2005). Two longitudinal studies have found that by middle school girls are significantly more relationally aggressive than boys (Cairns et al., 1989; Zimmer-Gembeck, et al., 2005). Relational aggression involves tactics such as the alienation, ostracism, and gossiping about other peers. Grotpeter and Crick (1996) found that the friendships of relationally aggressive children contained more intimacy, jealousy, and exclusivity than the friendships of overtly aggressive students. This suggests that relational aggression may require acute social perception for internal and external manipulation of group members, which supports the findings of Crain and colleagues (2005) that social information processing is not affected by being an aggressive girl.

In addition to encoding and processing social stimuli, aggression has also been shown to affect the development of social goals. Salmivalli et al. (2005) found that social goals mediate the relationship between peer perception and aggression. In particular, peer perception was influenced by whether an aggressive child had communal or agentic goals. An example of an agentic goal is striving for interpersonal power or domination, whereas communal goals seek to maintain interpersonal interactions. Girls were found to have more communal goals while boys were found to have more agentic goals. The clarification of goals is a Stage 3 process in the SIP model, and as evidenced by Salmivalli et al. continues to affect accuracy in interpersonal situations. As children choose behavioral goals and make decisions stemming from these goals, accuracy or inaccuracy is continuously reinforced.

Thus, reiterating the notion that aggression and accuracy have a bidirectional relationship throughout the stages of the SIP model. In summary, aggression appears to have a negative effect on the social information processing of boys but not girls. Although the informant accuracy of aggressive children has not been studied, research suggests that social processing deficits found in aggressive males may prevent accurate recall of social networks.

Aggressive Groups

While individual aggression has been linked to social-cognitive deficits, the effect of aggressive peer groups on social cognition is less clear. What is known is that aggressive children are just as likely to hang out with non-aggressive peers as aggressive peers (Farmer et al., 2002). Farmer and colleagues used peer nominations and teacher ratings to assess the peer group affiliations of three cohorts of aggressive children in elementary and middle school. Groups were identified as aggressive (one half of members are aggressive), non-aggressive (1 or 2 aggressive members), mixed (at least 3 aggressive members and 3 non-aggressive members), or zero aggressive (no aggressive members). Popular-aggressive youth were found to associate with each other and non-aggressive students who had similar behavioral characteristics as themselves. Unpopular-aggressive youth were more likely to hang out with non-aggressive peers.

Other studies have found different behavioral configurations for aggressive boys (i.e., Tough, Bright Antisocial, Troubled), which may indicate that aggressive children who interact with more socially-skilled peer groups reach a level of social competence commensurate with the group (Rodkin, Farmer, Pearl, & Van Acker, 2000). In other words, the influence of aggression on children's social perception may be moderated by peer group membership. Rodkin et al. (2006) demonstrated that aggressive groups most often nominate

"Tough" peers (children who are rated as being both highly popular and aggressive) as being cool, whereas non-aggressive groups most often nominate "Model" peers (children who are highly popular but not aggressive). DeRosier, Cillessen, Coie, and Dodge (1994) observed the group interactions of aggressive students and found that continued aggression was mediated by the response of the aggressive students' peer groups. If a peer group joined in on the aggressive act, then children were more likely to continue the aggressive behavior. If the peer group ignored the aggressive act, then the child's aggression was attenuated. Thus, peer group support for aggressive acts may enhance the effect of aggression of social accuracy. The influence of membership in aggressive peer groups on informant accuracy is tested in the current study.

Popularity

Recent studies of informant accuracy have found significant positive correlations with network centrality (Bondonio, 1998; Casciaro, 1998). More specifically, persons with high centrality are better at recalling their social networks than individuals with lower centrality. Only one study has investigated behavioral characteristics of central members that may increase or decrease accuracy. Casciaro and colleagues (1999) found that improved social accuracy is associated with informants who possess prosocial behavioral characteristics. Prosocial behaviors and network centrality have also been linked to popularity.

Farmer and Rodkin (1996) found that boys and girls who were rated by their peers as being popular were more likely to be nuclear members of their network as opposed to secondary or peripheral members. Although research has also shown that both aggressive and popular children can be central members, the centrality of overtly aggressive children declines in adolescence (Hawley, 1999). Hawley attributes this decline to the fact that

children must constantly compete for social cognitive stimulation in their environment. As children approach late childhood, prosocial behaviors as opposed to aggressive behaviors become more reinforced within children's networks. Prosocial behaviors are associated with popularity at this stage of development.

Popular children have been shown to have more prosocial skills than non-popular children (Pakaslahti et al., 2002) and greater recall of social events (Normandeau & Kardash, 1999). This was supported by Gottman, Gonso, and Rasmussen (1975) in a study of third and fourth grade students who were asked to complete a battery of social skills assessments. The authors found that sociometrically popular children were more socially skilled and more likely to be positively reinforced in the classroom for socially interactive tasks. Thus, a logical next question to ask is whether or not popularity improves social information processing and thus, improves social-perceptual accuracy. However, before the relationship between popularity and social accuracy is discussed, popularity must be operationally defined.

Popular children have traditionally been identified in one of three ways in the literature: (a) sociometrics, (b) peer nominations, and (c) teacher ratings (Coie, Dodge, & Coppotelli, 1982; Farmer, et al., 2003; Rodkin et al., 2006). Sociometrically popular children are those who are well-liked by many classmates and disliked by few. Peer nominated or peer-perceived popular students are found by asking children to list students who exhibit various popular behaviors such as "Who is popular with boys/girls" or "Who is a trend setter". Finally, teacher rated popular students are similar to peer-perceived popular students in that a classroom teacher rates the children in his/ her classroom on popular behavioral characteristics. Cairns and Cairns (1994) found teacher ratings to be sensitive to the

developmental changes in popularity in children and are conversely utilized along with peer nominations in the current study.

Although research has validated the use of both peer nominations and sociometrics for popularity determination, different behavioral qualities have been associated with each (Bruyn & Boom, 2005). Peer nominations have been shown to select popular children who are trend setters, have high social self-esteem, and use relational manipulation strategies such as gossiping. Sociometrically popular children are more likely to receive popular status based on cooperation and empathy (Bruyn & Boom) [1].

Popular Preschoolers. Studies looking at the relationship between popularity and social cognitive skill have found moderately positive correlations between the two. Brochin and Wasik (1992) had popular kindergartners complete a series of social problem solving tasks, which involved group entry/initiation, maintenance of social interactions, and conflict management. Popular children were found to be significantly better than unpopular children at conflict management. No differences were found for group entry/initiation and maintenance social interactions. Cassidy and colleagues (2003) investigated the psychological understanding of sociometrically popular pre-school children on a series of social competence tasks involving Theory of Mind (TOM) and perspective-taking. The authors found that social competence and popularity were positively associated, although much of the explained variance in this study was attributed to language development.

Popular School-Age Children. Studies of older children have also linked popularity to perceptual skill and increased social competence. Lease, Musgrove, and Axelrod (2002) identified three different popular groups in a group of fourth, fifth, and sixth graders, which

[1] There has been much debate over which technique is most appropriate for identifying popular students; however methodological issues in the determination of popularity are beyond the depths of the current study.

were: High Status, Well-liked/Dominant, and Perceived-Popular/Dominant. High Status students had elevated scores on measures of likability, perceived popularity, and social dominance. Well-liked/Dominant students had elevated scores on likability and social dominance, and Perceived-popular/Dominant students had elevated scores on perceived popularity and social dominance. Interestingly, all three groups were seen as socially dominant and had higher levels of self esteem and self-concept. Similarly, Boivin and Bégin (1989) found that sociometrically popular elementary school students rated themselves as more socially skilled than rejected, neglected, controversial, or average students. The results were supported by Patterson, Kupersmidt, and Griesler (1990) who also found higher perceived social competence in popular children. Although not entirely conclusive, it appears that popular children rate themselves as better social perceivers than non-popular children.

Gender and Popularity. Like aggression, the influence of popularity on social accuracy most likely varies across gender and is mediated by an individual's aggregate social-behavioral temperament. Several studies have looked at the different communication and behavioral patterns of popular boys and girls. Murphy and Faulkner (2006) in study of sociometrically popular 5- to 7- year-olds found that popular girls were more likely to use collaborative forms of speech than non-popular girls while trying to describe toys to peers in an interactive task. No differences in collaborative speech were found between popular and unpopular boys. Studies of older adolescents have also found different characteristics to be associated with popularity in boys and girls. LaFontana and Cillessen (2002) found that relational aggression and dominance were related to being a popular girl, whereas athletic ability was positively correlated with popular boys. Lease and colleagues (2002) found that

High Status, Well-liked/Dominant, and Perceived-popular/Dominant girls, but not boys, were rated highly on items assessing prosocial skills such as "helping others." High Status girls received the highest prosocial ratings. Chambliss et al. (1978) looked at how accurate middle school children were at naming other students who liked them. Using a sociometric procedure, Chambliss and colleagues found that low-popular boys were more accurate than popular boys and low-popular girls were less accurate than popular girls. In addition, girls that are relationally aggressive are less likely to have conflictual friendships and more likely to have central status in the network if they are perceived as popular among their peers (Cillessen & Mayeux, 2004; Rose, Swenson & Carlson, 2004). These findings support those of LaFontana & Cillessen highlighting the importance of social awareness and prosocial skill in the interpersonal interactions of popular girls.

Furthermore, a pilot study by Mirny (2001) found that peer group membership in eighth grade meant different things for boys and girls. For girls, being in a group meant being popular or well liked, whereas for boys it meant hanging out with people who have similar interests. Girls were found to be more dependent on groups. Thus, for girls achieving popular status may indicate a high degree of social competence or "fitting in". Popular boys on the other hand may achieve popularity without being highly socially competent, but by being aggressive and athletic (Rodkin et al., 2000). It appears that being a popular girl may increase social perception and social competence as inclusion and success in female peer groups depends more on interpersonal perception. This is corroborated by Crain et al. (2005) who found that social information processing was affected by gender differences in behavioral characteristics.

Popular Groups

Individual popularity seems to have a gender-moderated relationship with social competence in that being popular seems to improve interpersonal skills, especially for girls. However, another important facet of popularity that needs to be considered is whether or not being a part of a popular group influences social competence. There is evidence that popular peer groups have strong socialization influences on peers (Allen, Porter, McFarland, Marsh, & McElhaney, 2005). Allen and colleagues found that although popularity was associated with high levels of ego development, attachment security, and close friendship competence, popularity was also heavily influenced by social norms. Their longitudinal analysis of popular groups indicated increases in substance and alcohol use over time. In addition, Farmer and colleagues (2003) linked school dropout to membership in both popular and aggressive groups. Thus, even though popular children seem to have perceptual advantages within networks, they are still subject to the forces of group norms. If these norms are socially maladjusted, then social processing and informant accuracy may be affected.

Rodkin and colleagues (2006) found that aggressive-popular and unaggressive-popular students have different bases of peer support. More specifically, the authors discovered that aggressive groups nominate popular-aggressive children as cool, whereas non-aggressive groups nominate popular-nonaggressive children. Popular groups with advanced socio-cognitive skill may increase the overall skill of the group leading to greater informant accuracy. Adler and Adler (1995) describe peer groups, especially popular peer groups, as dynamic entities that must continuously maintain boundaries, evaluate members, and sustain position and influence within a network. The magnitude of social-perceptual skill required to

support this process is uncertain as no prior research has tested the effects of popular group membership on social processing and informant accuracy.

Current Study

In summary, research has yet to examine children's informant accuracy for their classroom social networks. Despite limited investigation on this topic, children appear to have the ability to recall classroom networks in late elementary school. Given this assumption and the alignment of informant accuracy with a social information processing model, the current study examines how aggression and popularity impact children's informant accuracy at both the individual and group level. The preceding review of social information processing research suggested a gender moderated effect for both aggression and popularity.

Based on the available literature, six research questions regarding the informant accuracy of the current sample are presented below with subsequent hypotheses.

Question 1: *Is informant accuracy for classroom social networks moderated by gender?* Porath (2001) found that girls were more perceptive of social cues than boys. In addition, girls have been shown to have more efficient social information processing skills (Fraser et al., 2005) and be more concerned about friendship maintenance (Rose & Asher, 1999).

***Hypothesis 1*: Girls will be more accurate perceivers of classroom social networks than boys.**

Question 2: *Is individual aggression related to informant accuracy for classroom social networks?* Dodge and colleagues have studied aggressive boys extensively and found this group to possess several social information processing deficits (Dodge 1980; Dodge & Somberg, 1987). The relationship between aggression and social information processing

skills of girls is less clear (Crick, 1996). In fact relationally aggressive girls may show more accurate network recall than nonaggressive girls as relational aggression requires acute perception of social interactions for manipulations and exclusion (Crain et al., 2005).

***Hypothesis 2a**: Aggressive boys will be less accurate in recalling classroom social networks than non-aggressive boys. Hypothesis 2b: Aggressive girls will be more accurate in recalling classroom social networks than non-aggressive girls.*

Question 3: *Is individual popularity related to informant accuracy for classroom social networks?* Popular students have shown increased social competence, higher levels of social recall, and more prosocial skills than non-popular students (Brochin & Wasik, 1992; Murphy & Faulkner, 2006; Pakaslahti et al., 2002; Patterson et al., 1999). However, popular and unpopular girls appear to have more varied social skills than popular and unpopular boys (Chamblis et al., 1978). The socio-perceptual advantages inherent in popularity may increase informant accuracy for social networks.

Hypothesis 3a: Popular girls will have higher levels of informant accuracy for classroom social networks than unpopular girls. Hypothesis 3b: Popular boys will not vary significantly from unpopular boys in regards to informant accuracy.

Question 4: How *does being both popular and aggressive relate to informant accuracy?* Aggressive children affiliate with both popular and aggressive groups, although the support received by these students differs (Farmer et al., 2002; Rodkin et al., 2006). What is not known is the outcome of being both popular and aggressive relative to informant accuracy. As being a popular-aggressive student is characterized by different social behaviors for boys and girls (e.g., fighting vs. gossip), it is expected that popular-aggressive girls may have

better processing skills for social networks when compared to aggressive-unpopular girls (Crain et al., 2005; Crick, 1997).

Hypothesis 4a: Popular-aggressive girls will have greater informant accuracy than aggressive-unpopular girls, popular-nonaggressive, and unpopular-nonaggressive girls. Hypothesis 4b: Aggressive-popular and aggressive-unpopular boys will show lower levels of informant accuracy compared to popular-nonaggressive and unpopular-nonaggressive boys.

Question 5: *Is aggressive group membership associated with informant accuracy?* Farmer et al. (2002) found that aggressive boys are members of both aggressive and popular groups. Similarly, peer groups have been shown to have a mediating effect on both male and female aggressive responding and social interactions (DeRosier et al., 1994; Werner & Crick, 2004). For males, aggressive peer groups that support aggressive social acts may impede accurate network processing (Rodkin et al., 2006). However, the relationally-aggressive techniques used by aggressive female groups to maintain group boundaries may increase informant accuracy of these groups (Adler & Adler, 1995).

Hypothesis 5a: Males in aggressive groups will have lower informant accuracy compared to males in nonaggressive groups. Hypothesis 5b: Females in aggressive groups will have higher informant accuracy than females in nonaggressive groups.

Question 6: *Is popular group membership associated with informant accuracy?* Although popular students appear to have certain social advantages over unpopular peers, both popular and unpopular groups have been shown to be influenced by maladaptive group norms (Farmer et al., 2003) Inclusion or exclusion from popular peer groups varies by gender with girls being more concerned with relational issues and group maintenance (Richard &

Schneider, 2005; Rose & Asher, 1999; Rose, et al., 2004). Thus, popular group membership for girls may require more social network knowledge and accuracy to maintain status within the popular group than for boys. Popular boys, on the other hand, may just need to be athletic or a considered a leader to maintain status (Lafontana & Cillessen, 2002).

Hypothesis 6a: Girls who are members of popular groups will have higher informant accuracy than girls in unpopular groups. Hypothesis 6b: Boys in popular groups and unpopular groups will have similar levels of informant accuracy.

CHAPTER III

METHODS

The current study is part of a five-year longitudinal investigation of a model program for training teachers and related service personnel in a systematic intervention to prevent and treat disruptive behavior disorders in youth transitioning to middle school. Project BEST (Behavioral and Emotional Support Training) follows two cohorts of fifth grade children receiving coordinated interventions from fifth grade through eighth grade. There are approximately 500 students per cohort. In-service trainings and consultation are provided to teachers in order to enhance the performance of students across academic, behavioral, and social domains. Project BEST began on December 1st 2002 and runs through November 30th 2007 under the direction of Thomas Farmer, PhD (Principal Investigator).

In addition to systematic interventions, a multi-method survey is given in the fall and spring of each academic year. These surveys require teachers to report the social groupings and academic, behavioral, and social characteristics of children in their classrooms. Students are asked to report the social groupings and academic, behavioral, and social characteristics of their peers and themselves.

Participants

The current study examines the informant accuracy of the fifth grade cohort of Project BEST tested in the spring of 2003 (WAVE 1, COHORT 1). Participants were recruited from two school districts in North Carolina for a total of 27 elementary schools and 56 classrooms.

Of the 1,144 students attending these schools, 713 (62.3%) consented to participate and 431 (37.7%) did not. The gender demographic across all students in participating schools consisted of 583 boys (51.0%) and 561 girls (49.0%).

The sample used in the present study consisted of 511 students; 281 (54.9%) females and 230 (45.0%) males. Fourteen schools and 33 classrooms were included and 23 classrooms were excluded because of less than 50% participation rate or withdrawal from the study. Fifty percent participation was required to ensure representative aggregation of the classroom social network (Cairns et al., 1995). Special education status was known for 382 of the students with 353 not in special education, 26 in special education, and 3 utilizing a 504 plan. Ethnicity was known for 453 of the participants: 260 Caucasian (57.4 %), 179 African American (39.5 %), 5 Hispanic (1.1 %), and 9 (2.0 %) were of another ethnicity.

Measures

Social Networks. The Social Cognitive Mapping (SCM) procedure was used to identify the classroom social networks of each participant and his/her peers (Cairns, Perrin, and Cairns, 1985). For this measure, participants were given a probe that asked "Are there some kids in your classroom who hang around together a lot? Who are they?" (SEE APPENDIX I) Students were asked to list as many groups as they could think of including groups to which they had no personal affiliation. The SCM procedure has shown adequate psychometric properties when used to determine school social networks (Cairns et al., 1988; Kinderman, 1993; Leung, 1996; Xie, Cairns, & Cairns, 1999). Research has also found high short-term reliability of peers groups identified by the SCM procedure with as much as 90% of members remaining in groups over a three week period (Cairns, Leung, Gest, & Cairns, 1995). The validity of the SCM measure has been assessed using observational procedures and analysis

of group behavioral characteristics. Research has shown that students interact more often with their SCM reported group members and that the groups reported by the SCM procedure have similar behavioral characteristics (Cairns et al., 1995; Cairns et al., 1985; Farmer & Hollowell, 1994; Gest, et al., 2003; Leung, 1996).

The SCM groups are identified using the SCM 4.0 computer program (Leung, 1996) using procedures described by Cairns et al. (1996). The SCM 4.0 program uses consensus structure methodology (Krackhardt, 1987) with a correlational threshold of .40 to aggregate and identify peer groups. The program generates three matrices, which are: (a) a recall matrix, (b) a co-occurrence matrix, and (c) a correlation matrix. The recall matrix lists all groups named by each respondent. The co-occurrence matrix lists the number of times each student is named to a peer group with other students. For example, Johnny may co-occur 15 times with Thomas, 13 times with Edward, and only 1 time with Stephen. It is expected that students in the same peer group will have similar profiles or associate with the same people. The last matrix, the correlation matrix, correlates the affiliative profiles of each student with the profiles of every other student. Students are considered to be a member of a peer group if their profiles correlate with 50% of the group members.

In order to ensure the reliability and validity of the SCM procedure a classroom participation rate of 50% was utilized and has been established by prior research (Cairns et al., 1995). The average participation rate across classrooms was 69.6% (range = 52%-100%). Given the strong psychometric properties of the SCM method, it was felt that the groups produced by the program provided an optimum criterion for the determination of informant accuracy. In addition, the aggregation techniques used in this study were similar to

methods used in other accuracy research (Bondonio, 1998; Casciaro, 1998; Casciaro et al., 1999; Krackhardt, 1997).

Aggression and Popularity. The popularity and aggressiveness of each student was determined using the *Interpersonal Competence Scale-Teacher* form and peer nomination procedures.

Interpersonal Competence Scale – Teacher (ICST). The ICS-T is an 18-item questionnaire consisting of seven-point Likert scales. The ICS-T yields composite scores on six primary subscales: aggression (AGG, composed of "always argues," "gets in trouble," and "always fights"), popularity (POP, composed of "popular with boys," "popular with girls," and "lots of friends"), academic (ACA, composed of "good at math") and "good at spelling"), affiliative (AFF, composed of "always smiles" and "always friendly"), olympian (composed of "good at sports," "good-looking," and "wins a lot"), and internalizing (INT, composed of "worries a lot," and "cries a lot," and "always sad"). The aggression and popularity composites were used in the present study.

Composite scores were standardized in two ways: (a) within gender and (b) within gender and rater. A student was considered to be popular or aggressive if their gender Z-score was greater than or equal to +.50, and their gender/rater Z-score was greater than or equal to zero. This procedure was utilized to retain between rater differences in reporting aggression and popularity, while accounting for any reporting bias that may occur because some raters have tendencies toward the ends of the scales. Based on composite standard scores, students were dichotomously labeled "aggressive (1)/non-aggressive (0)" or "popular (1) /non-popular (0)". Additionally, students were placed into one of four categories based

on the presence or absence of aggressive/popular traits: a) Popular-Aggressive, b) Popular-Nonaggressive, c) Nonpopular-Aggressive, d)Nonpopular-Nonaggressive.

The psychometric properties of the ICS-T have been examined in previous studies (Cairns & Cairns, 1994; Cairns et al., 1995; Leung, 1996; Rodkin et al., 2000). Three week test retest reliability coefficients are moderately high (i.e., .80-.92) (Cairns et al., 1995), and median test-retest reliabilities across factors are .81 for girls and .87 for boys. One year coefficients were found to be moderately strong (i.e., .40-.50). The validity of the ICS-T has been examined through convergence with observations, student records (i.e., grades, discipline reports), and peer nomination measures (Cairns & Cairns, 1994; Cairns et al., 1995; Leung, 1996; Rodkin et al., 2000). Reliability coefficients for the current sample were $\alpha = .86$ for the aggression composite and $\alpha = .81$ for the popularity composite.

Peer Nomination. Students' levels of aggression and popularity were also determined using peer nomination procedures that require children to rate their peers on social-behavioral characteristics. Research has shown that peer nomination procedures are sensitive to indirect or relationally aggressive techniques used by females (Archer, 2004). Students were asked to nominate peers from free recall that best fit 16 social-behavioral descriptions. They were told that they could nominate themselves and the same person for more than one item. The peer nomination measure is presented as APPENDIX II along with item descriptions. Items on the peer nomination measure are similar or identical to peers assessments used by other investigators (e.g., Coie, Dodge, & Coppotelli, 1982; Masten, Morison, & Pellegrini, 1985). Peer nominations have been shown to identify aggressive characteristics of students that teachers have little opportunity to observe such as relational manipulation using non-physical techniques (Pellegrini & Bartini, 2000). Similarly, items

included the in peer nominations such as “starts rumors” and “bully” have been used to study relational aggression by other researchers (Crick, 1996; Crick, 1997; Rose, Swenson, & Waller, 2004)

Composite scores for the peer nominations were calculated by summing the total number of nominations each student received for each peer nomination item and dividing by the total number of possible nominators (i.e., all students in classroom). Factor analysis of the 16-items yielded a four-factor solution consisting of Aggression, Prosocial Skills, Social Prominence (Popularity), and Internalizing. The current investigation used the Aggression (“disruptive”, “starts fights”, “starts rumors”, “gets in trouble”, and “bully”) and Social Prominence composites (“leader”, “athletic”, “cool”, and “popular”) to assess the impact of aggression and popularity on informant accuracy. Reliability coefficients were $\alpha = .92$ for the Aggression composite and $\alpha = .82$ for the Social Prominence.

Composite scores were standardized within gender. A student was considered to be aggressive or popular if his/her standardized z-score was greater than or equal to +0.50. Students were conversely dichotomously labeled as “Aggressive” (1) versus “NonAggressive” (0) or “Popular” (1) versus “NonPopular” (0). Students were also placed into one of four categories based on the presence or absence of aggressive/popular traits: a) Popular-Aggressive, b) Popular-Nonaggressive, c) Nonpopular-Aggressive, d)Nonpopular-Nonaggressive.

Data Reduction Procedures

Social Cognitive Map Analyses. The SCM procedure identified a total of 75 boy groups with a mean size of 4.34 (range = 2 to 11). Ninety-seven girl groups were identified with a mean size of 5.15 group members (range = 2 to 9).

Peer-Group Types. In order to classify peer groups on popular and aggressive characteristics, the composite ICS-T ratings and peer nomination ratings (i.e., AGG, POP) were used to determine the proportions of aggressive and popular members in a peer group. Aggressive and popular peer groups were classified independently based on the proportion of groups members exhibiting each trait. Four group-types were identified for both popularity and aggression, which were similar to the groups reported by Farmer and colleagues (2002). The aggressive group types were as follows: (a) zero-aggressive group (no aggressive members), (b) non-aggressive group (1 or 2 aggressive members), (c) mixed-aggressive group (at least 2 aggressive and 2 non-aggressive members), and (d) high-aggressive group (no more than 1 or 2 non-aggressive members and more than half were aggressive). Popular peer group types were as follows: (a) zero-popular group (no popular members, (b) non-popular group (1 or 2 popular members), (c) mixed-popular group (at least 2 popular and 2 non-popular members), and (d) popular group (no more than 1 or 2 non-popular members and more than half are popular). In order to prevent small within cell sample sizes for group interactions, groups were collapsed or dichotomized as Non-Aggressive (Zero Agg. & Non-Agg.) versus Aggressive (Mixed Agg. & High Agg.) and Non-popular (Zero Pop. & Non-Pop.) versus High Popular (Mixed Pop. & High Pop).

Accuracy

The determination of informant accuracy requires comparison of individually reported social networks to the aggregate social network. For this investigation, a student's individual map was compared to the aggregate classroom structure using the SCM_AGREEMENT program (Leung, 2006). The SCM_AGREEMENT program calculated student-classroom

accuracy indexes as follows.[2] First, the groups identified by the SCM 4.0 procedure within each classroom were transformed into dyadic or pairwise relationships. The number of possible dyadic relationships in a classroom was calculated by Equation 2, where P is the number of possible combinations and N is the number of group members.

$$P = N * (N-1)/2 \quad (2)$$

An example would be a group found by the SCM that had 4 members (Tom, Jack, Sam, and Rick). This group has six possible dyadic combinations (Tom-Jack, Tom-Sam, Tom-Rick, Jack-Sam, Jack-Rick, and Sam-Rick). Thus, in order for a student to have 100% accuracy or agreement with this first group, he/she must name all six possible combinations (P = 6). If all combinations are not present, Equation 2 is used again to determine how many combinations were reported by the student. Let us say that a student reported that Tom, Jack, and Sam were in a group. Equation 2 tells us that the student reported 3 of the possible 6 dyads. A third step is the conversion from dyadic combinations back to individual members and is found by Equation 3 in which N_s is the unknown this time as the number of combinations in the student's report is substituted for P_s.

$$N_s * (N_s - 1) = 2P_s \quad (3)$$

The positive root for N_s in this quadratic equation represents the number of group members reported by the student that equals P_s dyadic combinations. The student's accuracy (A_s) for a group is the ratio between N_s and N (i.e., $A_s = N_t/N$). Thus, for our example the student

[2] A more detailed explanation of accuracy calculation is provided as APPENDIX III.

accurately identified 75% of the group ($A_s = 3/4 = .75$). An accuracy score is obtained for each group reported by the SCM, which gives an overall accuracy score for the group as seen in Equation 4, where N_{scm} is the total number of groups reported by the SCM procedure.

$$A_{overall} = \frac{\sum_{1}^{Nscm} As}{Nscm} \tag{4}$$

An important consideration for calculating accuracy based on dyadic relationships is the fact that central members will be reported more often than non-central members. In order to account for this discrepancy a weighting procedure can be used with the above mentioned equations. Consider the previous example of Tom, Jack, Sam, and Rick. Let us say that each of these students received the following number of nominations: (a) Tom = 10, (b) Jack = 8, (c) Sam = 5, and (d) Rick = 1. The total weighted binary relationship of each these members is 193 (Tom-Jack = 80, Tom-Sam = 50, Tom-Rick = 8, Jack-Sam = 40, Jack-Rick = 8, and Sam-Rick = 5). Now, using the same student that reported Tom, Jack, and Sam in the group, a total weighted combination of 170 is obtained. The weighted accuracy for a student is ($A_{ws} = N_{sw}/N_w$), where N_{sw} is the number of weighted combinations reported by the student and N_w is the number of possible weighted combinations reported by the SCM procedure. An overall weighted accuracy score can be obtained by multiplying a students weighted accuracy for each group by the total nominations for the group and then dividing by the total nominations, which is presented as Equation 5.

$$A_{overall} = \frac{\sum_{1}^{Nscm} Aws * G_{nom}}{\sum G_{nom}} \quad (5)$$

Here, A_{ws} is the average weighted accuracy and G_{nom} is the total number of nominations each group received.

The current investigation used the weighted method to determine accuracy as it has been shown that central members are more readily recognized within peer groups (Bernard et al., 1982; Kenny, 1991) therefore measures of accuracy must account for central membership. In addition to overall weighted accuracy scores, the SCM_AGREEMENT provides the number of groups reported by each informant, which was also analyzed as a dependent variable in this study.

The number of groups reported was examined in relation to informant accuracy to provide additional information regarding the types of recall errors made by students. For example students who report similar numbers of groups but are less accurate may be reporting peripheral members or putting members into groups that do not belong (commission). On the other hand students who report fewer groups and are less accurate may be leaving out group members (omission).

Data Analysis:

All statistical analyses were performed using SPSS 14.0 Graduate Pack software. Preliminary analysis examined overall sample descriptives including sample distribution for both dependent variables (# of groups; accuracy). Correlation coefficients were calculated

using Pearson and phi correlation coefficients to assess the relationships among independent and dependent variables.

To control for any effect associated with the ethnic diversity of the current sample, one-way Analysis of Variance (ANOVA) was performed on student ethnicity. Any significant effects were co-varied in subsequent analyses. Descriptive statistics were also generated for students' special education status at the time of data collection. Research questions and hypotheses are grouped below according to type of analysis.

Question 1: *Is informant accuracy for classroom social networks moderated by gender?* ***Hypothesis 1****: Girls will be more accurate perceivers of classroom social networks than boys.*

- **Data analysis 1**: An independent samples t-test was conducted on the total sample (n=511) to determine if girls have higher levels of informant accuracy than boys. This comparison was conducted separately from the multivariate analyses because a gender coding was available for all students, but not all students had ratings on aggression and popularity variables. An effect size was calculated using Cohen's d statistic.

Question 2: *Is individual aggression related to informant accuracy for classroom social networks?* ***Hypothesis 2a****: Aggressive boys will be less accurate in recalling classroom social networks than non-aggressive boys.* ***Hypothesis 2b:*** *Aggressive girls will be more accurate in recalling classroom social networks than non-aggressive girls.* **Question 3:** *Is individual popularity related to informant accuracy for classroom social networks?*

Hypothesis 3a: *Popular girls will have higher levels of informant accuracy for classroom social networks than unpopular girls.* ***Hypothesis 3b****: Popular boys will not vary significantly from unpopular boys in regards to informant accuracy.* **Question 4:** How *does being both popular and aggressive relate to informant accuracy?* ***Hypothesis 4a:*** *Popular-aggressive girls will have greater informant accuracy than aggressive-unpopular girls, popular-nonaggressive, and unpopular-nonaggressive girls.* ***Hypothesis 4b:*** *Aggressive-popular and aggressive-unpopular boys will show lower levels of informant accuracy compared to popular-nonaggressive and unpopular-nonaggressive boys.*

- **Data Analysis 2:** Using the General Linear Model (GLM), two (peer ratings; teacher ratings) 3-way factorial MANOVAs were conducted to determine the effect of gender, Individual Aggression, and Individual Popularity on the number of groups reported and informant accuracy of students. Multivariate homogeneity of variance was tested using Box's M statistic, and Wilk's Lamda was used to assess multivariate significance. In the absence of significant interaction effects, main effects were analyzed. Significant interactions involving gender were subsequently analyzed with follow-up univariate procedures (i.e., t-tests for independent samples) within gender. Significant interaction effects found between aggression and popularity were analyzed using an ANOVA(s) conducted on popular-aggressive status (i.e., popular-aggressive; popular-nonaggressive; nonpopular-aggressive; and nonpopular-nonaggressive). All secondary or post-hoc analysis used Bonferroni corrections at the .025 level to control for Type I error (.05/2 dependent variables). Effect sizes (Cohen's d) and power estimates were also obtained.

Question 5: *Is aggressive group membership associated with informant accuracy?* ***Hypothesis 5a:*** *Males in aggressive groups will have lower informant accuracy compared to males in nonaggressive groups.* ***Hypothesis 5b:*** *Females in aggressive groups will have higher informant accuracy than females in nonaggressive groups.* **Question 6**: *Is popular group membership associated with informant accuracy?* ***Hypothesis 6a:*** *Girls who are members of popular groups will have higher informant accuracy than girls in unpopular groups.* ***Hypothesis 6b****: Boys in popular groups and unpopular groups will have similar levels of informant accuracy.*

- **Data Analysis 3:** Using the General Linear Model (GLM), two (peer ratings; teacher ratings) 3-way factorial MANOVAs were conducted to determine the effect of gender, Group Aggression, and Group Popularity on the number of groups reported and informant accuracy of students. Multivariate homogeneity of variance was tested using Box's M statistic, and Wilk's Lamda was used to assess multivariate significance. In the absence of significant interaction effects, main effects were analyzed. Significant interactions involving gender were subsequently analyzed with follow-up univariate procedures (i.e., t-tests for independent samples) within gender. All secondary or post-hoc analysis used Bonferroni corrections at the .025 level. Effect sizes (Cohen's d) and power estimates were also obtained for significant effects.

CHAPTER IV

RESULTS

Preliminary Analysis

Overall informant accuracy scores for the entire sample (n = 511) suggested that children are able to accurately recall greater than 50% of available peer groups within their classroom social networks (M = .57, SD = .16) and report on average about 3.5 groups (M = 3.43, SD = 1.45). The number of groups reported by students and their informant accuracy were significantly, correlated ($r = .13$, $p < .01$). All measures of normality suggested both the number of groups reported and informant accuracy scores were normally distributed, therefore no linear transformations were necessary. Descriptive statistics for participant gender, ethnicity, and special education status are presented as Table 1.

Ethnicity. Analysis of variance (ANOVA) performed on informant ethnicity found no differences between students on number of groups reported, $F(3, 377) = 1.17$, $p = .32$, and informant accuracy $F(3, 377) = 1.90$, $p = .12$. An additional t-test was performed on a dichotomous coding of ethnicity as black (1) and white (0) also found no significant differences between on number of groups reported, $t(-1.80)$, $p = .07$, or informant accuracy $t(1.89)$, $p = .07$. Although ethnicity was not co-varied in subsequent analyses, teachers and peers were both more likely to rate African American students as aggressive ($\chi^2(1) = 22.47$, $p < .001$ for teachers; and $\chi^2(1) = 44.95$, $p < .001$ for students). Students were more likely to nominate African Americans as popular ($\chi^2 = 14.32$, $p < .001$).

Special Education Status. Independent sample t-tests performed on special education status found that students receiving special education services reported fewer groups, $t(4.63)$, $p < .001$ than students not receiving special education but were not less accurate, $t(1.81)$, $p = .09$ in the reporting of these groups. However, due to the under-reporting of special education status by participating schools, co-varying special education status reduced the sample size for analysis by twenty-five percent. Chi-square analysis performed to determine if certain classrooms contained higher than expected proportions of students receiving special education services was not significant $\chi^2(24) = 31.86$, $p = .13$. Similarly for the entire sample only 29 students were reported as receiving special education (6% of sample). The reduction in sample size (loss of power) and similar proportions of students receiving special education in classrooms that reported this status resulted in this variable not being co-varied. This method of co-variate selection has been supported by Tabachnick and Fidell (2001).

Peer vs. Teacher Ratings. Correlations coefficients were computed among the two dependent variables and eight independent variables using Pearson Product Moment (r) and phi (φ) correlation coefficients within gender (See Table 2). Pearson coefficients were confirmed using phi coefficients for correlation analysis between two dichotomous variables, which is available through the crosstabs procedure in SPSS 14.0. Peer nominations and teacher ratings of social behavioral characteristics were correlated at the $p = .01$ level for all four ratings scales (i.e., individual aggression, individual popularity, group aggression, group popularity). The highest inter-rater correlations were found for individual aggression and individual popularity for both males and female informants.

Gender

Question 1: *Is informant accuracy for classroom social networks moderated by gender?*

Hypothesis 1*: Girls will be more accurate perceivers of classroom social networks than boys.* An independent samples *t* test was conducted on number of groups reported and informant accuracy to evaluate Hypothesis 1 concerning gender differences. The test was significant, $t(509) = 7.30$, $p < .001$ for number of groups reported and informant accuracy, $t(509) = 3.59$, $p < .001$ suggesting that girls tend to report more groups and are more accurate at reporting these groups than boys. Females on average reported 3.83 groups whereas males reported 2.93. Mean informant accuracy scores were .59 for females and .54 for males. Effects sizes calculated using Cohen's d were 0.65 for number of groups reported and 0.31 for informant accuracy scores. Results supported Hypothesis 1 that girls would be more accurate perceivers of their classroom social networks than boys. All of the following multivariate analyses included gender as an independent variable to determine if the relationship between aggression/popularity and informant accuracy is also moderated by gender.

The moderating influence of gender on informant accuracy was supported by correlational analyses (Table 2), which found that being individually aggressive was positively correlated with informant accuracy in females ($r = .13$, $p < .05$ for teacher ratings; $r = .14$, $p < .05$ for peer rating) and negatively correlated with accuracy in males ($r = -.15$, $p < .05$ teacher ratings). The directionality of these correlation coefficients corroborates research espousing the sex-based differential effects of informant characteristics on social information processing (Crain et al., 2005).

Individual Characteristics

In order to determine the effect of individual aggression and popularity on the number of groups reported and informant accuracy two factorial (2 x 2 x 2) MANOVAs were performed on teacher and peer ratings of aggression and popularity. In both teacher and peer analysis gender was included to determine if there were gender interaction effects possibly linked to differences in how social-behavioral characteristics impact social information processing. Means and standard deviations are presented within gender for aggressive and popular students in Table 3.

The first MANOVA (see Table 4) conducted to determine how teacher ratings of aggression and popularity affect network recall and informant accuracy found significant multivariate differences on the dependent variables for gender, Wilks's $\lambda = 23.12$, $p < .001$; gender x aggression, Wilks's $\lambda = 5.22$, $p = .006$; and aggression x popularity, Wilks's $\lambda = 5.46$, $p = .005$. No differences were found for aggression, popularity, gender x individual popularity, or gender x aggression x popularity. All measures of normality were non-significant suggesting homogeneity of the variance-covariance matrices. Power estimates for multivariate effects were acceptable (.82 for gender x individual aggression; .85 for aggression x popularity).

A second MANOVA (see Table 5) conducted to determine how peer nomination ratings of aggression and popularity affect network recall and informant accuracy found significant multivariate differences on the dependent variables for gender, Wilks's $\lambda = 25.38$, $p < .001$; gender x aggression, Wilks's $\lambda = 4.75$, $p = .009$; and gender x aggression x popularity, Wilks's $\lambda = 3.11$, $p = .045$. No significant differences were found for aggression, popularity, gender x popularity, or aggression x popularity. All measures of normality were non-

significant suggesting homogeneity of the variance-covariance matrices. Power estimates for multivariate effects were acceptable (.89 for gender x aggression; .79 for gender x aggression x popularity).

Aggression. **Question 2**: *Is individual aggression related to informant accuracy for classroom social networks?* ***Hypothesis 2a****: Aggressive boys will be less accurate in recalling classroom social networks than non-aggressive boys.* ***Hypothesis 2b:*** *Aggressive girls will be more accurate in recalling classroom social networks than non-aggressive girls.*

Analysis of Variance (ANOVA) procedures were performed on each dependent variable as a follow up to the MANOVA. Using the Bonferroni method, each ANOVA was tested at the .025 level. The ANOVA for teacher ratings of aggression x gender was significant for informant accuracy scores, $F(1, 474) = 10.36$, p = .001, but not number of groups recalled $F(1, 474) = .43$, p = ns. The ANOVA for peer ratings of gender x aggression was significant for informant accuracy, $F(1, 502) = 9.31$, p = .002, but not for number of groups recalled $F(1, 502) = 0.55$, p = ns.

Post hoc analysis were conducted for teacher rated aggression within gender using independent sample t-tests at the .025 level found no significant differences for girls $t(-2.15)$, p = .032 or boys $t(2.20)$, p = .029 on informant accuracy. Aggressive boys reported on average 51% of their classroom social networks, which was lower than the 56 % for non-aggressive boys. Results did not support Hypothesis 2a that aggression would be associated with less accurate perception of social networks for boys. Aggressive girls recalled on average 63% of their classroom social networks compared to 58% for non-aggressive girls, but this difference was not significant. Results did not support Hypothesis 2b that being an aggressive girl would be associated with greater informant accuracy. Aggressive girls did

report classroom social groups more accurately than aggressive boys $t(4.23)$, $p < .001$ supporting the notion that aggression impacts social information processing differently across gender. It is important to note that a Bonferroni correction was used to control for Type I error for multiple comparisons, which is a very conservative approach for controlling Type I error.

Similarly, post hoc analysis for peer-rated aggression x gender conducted within gender using independent sample t-tests found significant differences for girls $t(-2.33)$, $p = .021$ but not boys $t(1.34)$, $p = .18$ on informant accuracy. Aggressive boys reported on average 51% of their classroom social networks, which was not significantly lower than the 55 % for non-aggressive boys. Results did not support Hypothesis 2a that aggression would lead to less accurate of perception of social networks for boys. Aggressive girls recalled on average 64% of their classroom social networks compared to 58% for non-aggressive girls. Results supported Hypothesis 2b that being an aggressive girl would be associated with more accurate recall of classroom social networks. Females had greater recall than males for both non-aggressive status $t(2.29)$, $p = .023$ and aggressive status $t(3.70)$, $p < .001$, supporting across gender differences in how aggression affects social information processing.

Popularity. **Question 3:** *Is individual popularity related to informant accuracy for classroom social networks?* ***Hypothesis 3a:*** *Popular girls will have higher levels of informant accuracy for classroom social networks than unpopular girls.* ***Hypothesis 3b****: Popular boys will not vary significantly from unpopular boys in regards to informant accuracy.*

No significant multivariate differences were found for individual popularity for teacher ratings Wilk's $\lambda = 1.04$, $p = ns$, or peer nomination ratings Wilk's $\lambda = 0.45$, $p = ns$. These

results did not support Hypothesis 3a that popular girls would have higher informant accuracy than non-popular girls. Results did support Hypothesis 3b that popular boys would not vary significantly from unpopular boys. Popular and non-popular students recalled on average 57% of their classroom social networks for both teacher and peer ratings. Popular students reported between 3.58 – 3.68 groups across ratings compared to non-popular students who recall between 3.30 – 3.37 groups.

Aggressive-Popular Status. **Question 4:** How *does being both popular and aggressive relate to informant accuracy?* ***Hypothesis 4a:*** *Popular-aggressive girls will have greater informant accuracy than aggressive-unpopular girls, popular-nonaggressive, and unpopular-nonaggressive girls.* ***Hypothesis 4b:*** *Aggressive-popular and aggressive-unpopular boys will show lower levels of informant accuracy compared to popular-nonaggressive and unpopular-nonaggressive boys.*

A significant multivariate interaction effect was found for teacher ratings of aggression x popularity, and was followed up with an ANOVA tested at the .025 level. Significant differences were found for informant accuracy $F(1, 474) = 7.09$, $p = .008$, but not for number of groups report $F(1, 474) = 2.78$, p = ns. Post hoc tests were conducted for pair wise comparisons of Aggressive-Popular status (i.e., aggressive-popular; aggressive-non-popular; nonaggressive-popular; nonaggressive-nonpopular) using a Bonferroni correction to control for Type I error. No significant differences were found for pair-wise comparisons of popular-aggressive status. As can be seen in Table 6 aggressive-popular students were the most accurate at recalling their classroom social networks at 62%. Although teacher ratings of Aggressive-Popular status were not analyzed within gender, Table 6 shows that aggressive-nonpopular boys were the least accurate at recalling their networks at 50%.

Aggressive-popular girls recalled on average 71% of their classroom networks compared to 56% for nonaggressive-popular girls.

A significant multivariate interaction effect was also found for peer nomination ratings of gender x aggression x popularity and was followed up with an ANOVA tested at the .025 level. Significant differences were found for informant accuracy $F(1, 502) = 5.30$, $p = .022$, but not for number of groups report $F(1, 502) = 0.46$, p = ns. Post hoc tests conducted for pairwise comparisons of Aggressive-Popular status were not significant using a Bonferroni correction for Type I error (.025/3 = .008). For males the lowest accuracy scores were from aggressive-popular students (47%), and the highest were from nonaggressive-popular students (58%). Aggressive-popular females recalled on average 68% of their classroom networks compared to 57% for nonaggressive-popular females. Across gender comparisons found that aggressive-popular females were significantly more accurate than aggressive-popular males at reporting classroom social groups $t(3.90)$, $p < .001$. Similarly, nonaggressive-nonpopular females were more accurate than nonaggressive-nonpopular males at classroom accuracy $t(2.71)$, $p = .007$. Interestingly, aggressive-nonpopular students did not differ across gender.

Group Characteristics

In order to determine the effect of group aggression/popularity on the number of groups reported by students and their informant accuracy two factorial (2 x 2 x 2) MANOVAs were performed on teacher and peer ratings. In both teacher and peer analysis gender was included to determine if there were gender interaction effects possibly linked to differences in how group social-behavioral characteristics impact social information processing. Means

and standard deviations are presented within gender for aggressive and popular groups in Table 7.

The third MANOVA (See Table 8) conducted to determine how teacher ratings of group aggression/popularity affect network recall and informant accuracy found significant multivariate differences on the dependent variables for gender Wilks's $\lambda = 17.32$, $p < .001$ and group popularity, Wilks's $\lambda = 8.91$, $p < .001$. No differences were found for group aggression, gender x group aggression, gender x group popularity, or gender x group aggression x group popularity. All measures of normality were non-significant suggesting homogeneity of the variance-covariance matrices. Power estimates were considered strong (.97) for the main effect of popularity.

A final MANOVA (See Table 9) conducted on peer nominated aggressive and popular groups found only significant multivariate differences related to gender, Wilk's $\lambda = 25.55$, $p < .001$. All measures of normality were non-significant suggesting homogeneity of the variance-covariance matrices.

Aggressive Groups. **Question 5:** *Is aggressive group membership associated with informant accuracy?* ***Hypothesis 5a:*** *Males in aggressive groups will have lower informant accuracy compared to males in nonaggressive groups.* ***Hypothesis 5b:*** *Females in aggressive groups will have higher informant accuracy than females in nonaggressive groups.* No significant differences were found for aggressive group status, which does not support Hypothesis 5a or 5b. Examination of group means for teacher ratings found that boys in aggressive groups recalled on average 50% of their social networks compared to 56% for non-aggressive boys. Females in aggressive groups recalled 62% of the network compared to 58% for females in non-aggressive groups. Group means for peer ratings indicated that

males in aggressive groups recalled 52% of their classroom networks compared to 54% for males in nonaggressive groups. Aggressive and nonaggressive girl groups recalled 59% of the network.

Popular Groups. **Question 6**: *Is popular group membership associated with informant accuracy?* ***Hypothesis 6a:*** *Girls who are members of popular groups will have higher informant accuracy than girls in unpopular groups.* ***Hypothesis 6b****: Boys in popular groups and unpopular groups will have similar levels of informant accuracy.*

Analysis of Variance (ANOVA) procedures were performed on each dependent variable as a follow-up to the significant MANOVA for teacher rated popular group status. Using the Bonferonni method, each ANOVA was tested at the .025 level. The ANOVA for teacher ratings of popularity was significant for number of groups reported, $F(1, 425) = 17.62$, $p < .001$, but not for informant accuracy $F(1, 425) = 0.02$, p = ns. Post hoc comparison at the .025 level indicated that popular groups reported a larger number of classroom peer groups than nonpopular groups ($p < .001$). The results did not provide support for Hypothesis 6a that being a popular girl would increase informant accuacy although being in a popular group did increase the number of groups reported. The results did support Hypothesis 6b that boys in popular and nonpopular groups would be similar in relation to informant accuracy. Popular group members recalled on average 3.8 groups compared to 3.2 for non-popular members. Estimates of effect size utilizing Cohen's d were considered moderate (0.44) for differences between popular and nonpopular groups on the number of classroom groups recalled.

Exploratory Analyses

Ethnicity. In order to determine if ethnicity had any impact on the number of groups reported by students or their overall informant accuracy, four additional MANCOVAs were

conducted with ethnicity as a covariate (African American vs. White). Hispanics and other ethnicity were removed from the analysis due to extremely small sample sizes. The results from these analyses with ethnicity covaried did not change the overall multivariate or univariate effects across all original multivariate analyses with no covariate.

Special Education Status. Although special education status was not covaried due to underreporting of special education services by participating schools, the means and standard deviations for different exceptional children's categories are presented in Table 10. Although samples sizes are too small to draw definitive conclusions, it is interesting to note differences in dependent variables across Exceptional Children's categories. In relation to the current study, children receiving services at Behaviorally-Emotionally Disabled (BED) (n = 3) were the least accurate at recalling classroom social networks (41%) despite reporting on average three groups. The next lowest were children receiving speech services (n = 6) who reported on average 2.3 groups at 42% accuracy. Children with learning disabilities (n = 10) were relatively accurate (54%) at recalling networks even though they reported significantly fewer groups (1.8). Children served under the Educably Mentally Disabled category (n = 3) were relatively accurate despite recalling less than one and half groups (M = 1.33).

CHAPTER V

DISCUSSION

The current investigation was the first to examine how accurate school-age children are at recalling their classroom social networks and if certain social-behavioral characteristics affect the processing of these groups. Adult studies of informant accuracy have found that adults recall on average 40% to 50% of their social networks (Bernard et al., 1994; Casciaro, 1998; Casciaro et al., 1999), which raised the question of whether or not children are capable of similar levels of recall. Children in the current study reported on average 3.4 groups and accurately recalled 57% of their classroom networks indicating a level of recall similar to adult networks. Comparable accuracy scores were expected given that the classroom social networks circumvented early methodological issues that plagued informant accuracy research (e.g., inconsistent, unstable networks). Conversely, by controlling for these mediating situational factors, the current study was able to conceptualize social network recall as a social information process. Based on this theoretical framework it was possible to examine whether or not gender, aggression, and popularity were related to informant accuracy at both the individual and group levels.

Although early research raised concerns about the relative inaccuracy of informants for social networks; newer models dealt with this criticism by looking at what members are recalled most often (Bernard et al., 1994). Bondonio (1998) and Krackhardt (1990) found

that informants most often recall the central members of social networks and are more likely to forget peripheral group members. These findings make sense considering the impact of memory on social processing. As such, this study used a weighted model, which gave students more "weight" for reporting central members and central groups. Weighted models were seen as a necessity by Kenny (1991) and control for the effect of memory decay when measuring an informant's recall for their social network. In addition, by looking at how many groups students were able to report in relation to their informant accuracy, assumptions could be made regarding the types of informant errors (i.e., commission and/or omission).

The necessity of the present study is highlighted by the emerging role of the peer group in adolescent social development. Late childhood and early adolescence are a turbulent time where children begin to command independence through association with their peers (Adler & Adler, 1995). Delays or difficulty making these social connections have implications for the choices and social trajectories accessible to children. The underlying assumption is that if a child has trouble recognizing peer group options in the network by default his/her membership in those groups is not obtainable. By learning what student characteristics impede or enhance accurate network recall, researchers can begin to improve social skill interventions for children who have difficulty processing and joining social groups.

Teacher vs. Peer Ratings

The relationship between aggression/popularity and informant accuracy was examined in this study using both teacher and peer ratings. Although significant correlations were found, these ratings appear to be sensitive to somewhat different components of aggression and popularity. More students were labeled aggressive by teachers with little difference in the proportion of males (n = 67) versus females (n = 68) rated as aggressive. Students labeled

more females as aggressive (n= 49) than males (n = 37). Archer (2004) in a meta-analytic review of aggression measurement techniques found that peer nomination procedures are more likely to pick up on relational types of aggression (i.e., alienation, gossiping, starting rumors) than teacher rating scales. The peer nomination procedure used in this study contained items (i.e., "starts rumors", "bullies") that have been used to measure relational aggression in other studies (Crick, 1996; Crick, 1997; Rose et al., 2004) and appear to be picking up on aspects of relational aggression. Informant accuracy was associated with both teacher and peer rated aggression for females, but not for males whose accuracy scores were correlated only with teacher rated aggression. This is possibly due to the relational qualities or items included on the peer nomination measure.

Another explanation may be due to the developmental qualities of aggression in late childhood where physical aggression begins to be less reinforced among student groups (Cairns et al., 1999). Although this study looked at an early adolescent group (5^{th} graders), it is possible that within these classrooms physical aggression was still used to obtain social prominence. If that was indeed the case then perhaps students were less likely to rate male students as aggressive based solely on physical attributes. Other characteristics such as being an aggressive-isolated or aggressive-withdrawn male student may have increased the likelihood of receiving peer nominations as aggressive. Rubin and Mills (1988) found that isolated students who displayed immature behaviors were more likely to be nominated as aggressive by peers in fifth grade. On a similar note, Erhardt and Hinshaw (1994) found that boys with Attention-Deficit/Hyperactivity Disorder (ADHD) type behaviors were more likely to be labeled aggressive by peers.

Ratings of individual popularity were not strongly correlated with numbers of groups reported or informant accuracy for teacher or peer ratings. The only significant correlation was found between peer nominated females and number of groups reported ($r = .12$, $p < .05$). Peer nominated popular students have been shown to be high on trend setting, relational manipulation, and social self-esteem (Bruyn & Boom, 2005). The items included on the ICS-T (i.e., "popular with boys", "popular with girls", and "lots of friends") appear to be tapping analogous aspects of popular behavior as sociometric popularity, which is more sensitive to prosocial behavior (Bruyn & Boom). Based on the initial correlational data, the relationship of popularity to network recall and informant accuracy remains unclear.

Gender

An important finding in the current study was that girls reported more classroom social groups and were more accurate at naming these groups than boys. Girls on average reported about one additional group than boys in the same classroom. Across the entire sample girls reported 59% of the classroom network accurately compared to 54% for boys. These findings support previous research that has shown girls to have more reasoning capacity in interpersonal situations (Porath, 2000). This finding is perhaps best conceptualized by Rosalind Wiseman's bestselling book, *Queen Bees and Wannabes* (2002), in which she describes the world of the adolescent female as one of never-ending social competitions. Unlike boys, girls are constantly competing for social position within their cliques and must be hypersensitive to changes in group structure, fashion, and reputation. This portrayal is reflected in research showing that adolescent females report higher dyadic friendship quality and greater motivation for maintaining friendships than boys (Laird et al., 1999; Lansford & Parker, 1999; Rose & Asher, 1999). Conversely, for males there appears to be less stress

involved in maintaining social group status as males can remain in a clique solely by being athletic and having similar interests as the other members (Rodkin et al., 2006). Therefore males do not need to be constantly aware of changing social dynamics that may affect their standing in a social group.

Differences in social perception across gender were conceptualized through social-developmental models of behavior (Bussey & Bandura, 1999; Gilligan & Attanuci, 1988). From an early age females are continuously reinforced for gender stereotypic behaviors such as being a caregiver but not for outwardly expressing emotions. The inability to externally resolve conflicts requires the development of "hidden techniques" of manipulation whereby girls relieve social stress to avoid internalizing disorders (Simmons, 2002). Adolescent females must be constantly aware of changing social dynamics and find ways to remain apart of the social hierarchy without drawing attention to themselves. Not surprisingly, these increased pressures for social adaptation make friendship loss detrimental to the adolescent female and increases the risk for anxiety and depressive disorders (Wiseman, 2002). By looking at what characteristics impact accurate network recall across and within gender, new school or system-wide interventions can be implemented to help alleviate social pressures for individuals who have difficulty seeing their social options.

Individual Aggression

Early research looking at how aggression impacts social information processing found that aggressive boys were more likely to make hostile attribution biases than nonaggressive boys (Dodge, 1980; Dodge & Frame, 1982). Dodge and Tomlin (1987) attributed these social processing deficits to the use of top-down processing in which males are unable to incorporate new social information into existing social schemas. The impact of aggression

on the social information processing of females has been less clear. Crain and colleagues (2005) determined that aggression is not significantly related to hostile attribution biases for girls. In fact aggressive girls were at times better at identifying social cues. This assumption was supported in the current study examining informant accuracy as a social information process. Specifically, initial analysis of associations between independent and dependent measures revealed a negative relationship between aggression and informant accuracy for males. However, the association between aggression and informant accuracy for females was positive suggesting that being aggressive may enhance social processing. Results supported work by Crain et al. (2005) suggesting differential effects of aggression across gender.

Males. Although the impact of aggression appears to vary across gender, the hypothesis that aggressive males would be less accurate than nonaggressive males at reporting social groups was not supported. This finding may not be surprising given that Dodge and Frame (1982) found the greatest number of hostile attribution biases were made by males when the social scenario was directed toward them. The reporting of social groups may not be viewed by aggressive males as threatening and therefore did not impact the accuracy of their reporting classroom groups. Similarly, physically aggressive behaviors can be reinforced in males during elementary school, which may suggest that the fifth grade boys examined in this study are not yet being excluded from social interactions for these behaviors. Consequently, the ability to recognize the groups in the classroom is not impeded because inclusion in these groups allows for easier reporting of networks.

However, the impact of being an aggressive male on informant accuracy should not completely be discarded. Aggressive boys recalled on average 51% of their classroom

networks compared to 56% for nonaggressive boys. Although these scores were not significantly different there appears to be a trend toward lower scores for aggressive boys. This was supported by the correlational analyses seen in Table 2. Several reasons may explain why substantial differences were not found, which are the threshold for aggression and the type of instrument used to measure aggression. First of all, the current study labeled students as aggressive if their z-score on teacher ratings (ICS-T) or peer nominations was greater than 0.5 standard deviations above the mean. Teacher ratings identified 135 (28%) students as aggressive compared to 86 (17%) students for peer nominations. It is possible that the lower cut-off allows for mildly aggressive students to receive classification as aggressive. The 0.5 standard deviation threshold has been used in other studies (Rodkin et al., 2000; Rodkin et al., 2006), but may not measure aggression at a level relevant to informant accuracy. Research into the social information processing model has shown that the largest effect sizes are found for severely aggressive students (Orobio de Castro et al., 2002). The ICS-T has not been shown to be efficacious at discriminating mild, moderate, or severe levels of aggression, especially at a level indicative of severe psychopathology (e.g., conduct disorder, oppositional defiant disorder). It is interesting to note the average informant accuracy score for the students receiving Special Education services as Behavioral-Emotional Disabled (BED) were 40% in spite of the fact they reported similar numbers of groups (M = 3.0) as the rest of the sample. Though no definitive conclusions can be drawn from such a small sample size (n = 3), the trend toward greater social processing deficits with severe pathology is suggested.

Females. Several longitudinal investigations have found that by late childhood females are more relationally aggressive than males (Cairns et al., 1999; Crick & Grotpeter, 1995;

Zimmer-Gimbeck et al., 2005). Given that effective relationally aggressive strategies require some degree of social knowledge, the present study looked how being an aggressive girl impacted social information processing. More specifically it was hypothesized that being an aggressive girl would actually increase network recall and informant accuracy compared to nonaggressive girls. Research by Crain and colleagues (2005) provided initial support for this hypothesis as these researchers found that being aggressive did not increase the number of hostile attribution bias made by girls. However, in this study the hypothesis was only supported by peer ratings of aggression. No significant differences were found between aggressive and nonaggressive girls based on teacher ratings. This finding was not astonishing given that the ICS-T measure is sensitive to overt (physical or verbal) but not covert (relational) forms of aggression.

The peer nomination procedure contained items ("starts rumors", "bullies") that have been used in other research to measure relational aggression (Crick, 1996; Crick, 1997; Rose et al., 2004). It is quite possible that the inclusion of these items led to more relationally aggressive girls being identified by their peers and conversely to higher informant accuracy scores. Friendships of relationally aggressive females have been shown to contain more intimacy, jealousy, and exclusivity than friendships of nonaggressive girls (Grotpeter & Crick, 1996).

Conversely, a study of gender normative versus gender non-normative forms of aggression found that females who use physically aggressive techniques are at the greatest risk for social maladaptivion (Crick, 1997). Since both measures of aggression used in this study (i.e., ICST; peer nominations) contained more items relating to physical aggression, it is quite possible that a greater proportion of females displayed gender non-normative forms

of aggression. The lack of purely relationally aggressive females represented in this sample may indicate why stronger effects sizes were not found for the peer nomination measure, although there does appear to be a trend toward aggressive girls having more accurate recall.

Regardless, the within gender effects postulated by this study were not strongly supported; however, the differential outcomes of aggression on social information processing were quite interesting. Aggressive females were significantly more accurate than aggressive males across both rating measures (63% versus 51% for ICST; and 64% vs. 51% for peer nominations). Similarly associations between aggression and informant accuracy were positively correlated for females and negatively correlated for males. Thus, it could be concluded that the aggressive techniques used by females to manipulate their social surroundings require a somewhat advanced social knowledge. However, without more stringent measures of relational aggression this relationship remains uncertain.

Individual Popularity

Recent informant accuracy research has shown that persons with high network centrality within a social group are better at recalling social networks (Bondonio, 1998; Casciaro, 1998). Casciaro and colleagues (1999) also suggested that individuals with higher informant accuracy scores are rated high on prosocial characteristics. Popular students tend to be central members of networks (Farmer & Rodkin, 1996), possess prosocial characteristics (Pakaslahti, et al., 2002), and have greater recall for social events (Normandeau & Kordash, 1999). Measures of social competence also have positive correlations with popularity ratings in middle school children (Lease et al., 2002). This study sought to examine the impact of popularity on network recall and informant accuracy by obtaining both peer and teacher ratings of student popularity.

Females. It was hypothesized that being a popular girl would increase the overall informant accuracy for females; however, this assumption was not supported. Popular and nonpopular females accurately recalled around 59% of their classroom networks. No differences were found across teacher or peer ratings. Previous studies of popular females suggested that being "popular" was related to relational aggression and dominance for females (Lafontana & Cillessen, 2002). Conversely, popular females have been found to be more accurate at naming individuals who like them within a classroom than nonpopular girls (Chambliss et al., 2001). Regardless, within gender differences on network recall and informant accuracy were not significant in this study.

Although prior studies have linked popularity in females to increased social competence (Lease et al., 2002), it is quite possible that being female predisposes young girls to be hypersensitive to social networks. Mirny (2001) discovered that middle school females were overly concerned about being accepted into a peer group. This apprehension applied to all females despite social standing. Across the board females are more worried about maintaining friendships and utilize "communal" strategies to accomplish the over-arching goal of peer acceptance (Grotpeter & Crick, 1999; Salmivalli et al., 2005). Thus, it appears that although popular students may have enhanced skill in social manipulation, the importance of peer group acceptance requires all females to be knowledgeable of their social surroundings. Unfortunately, the difference in social status may well be associated with socioeconomic status as Xie and colleagues (2006) found that self-presentation ("what you wear") was highly correlated with popularity in the fourth through seventh grades. Therefore, being rated popular by peers may be more related to shopping power as opposed to social-perceptual skill.

Males. As was expected, no differences were found between popular and non-popular status for males in relation to informant accuracy. Several researchers have suggested that males become popular not by enhancing their socio-cognitive abilities, but by being athletic and having similar interests to surrounding peer groups (Farmer et al., 2003; Mirny, 2001; Rodkin et al., 2000). Given this assumption, male students may rely less on knowledge of "who hangs out together", but instead look for peers who are athletic or have similar interests. Although this finding was not surprising given research on popular males, longitudinal investigation into middle school is necessary to determine if there is a developmental effect on popularity for male students. It is possible that as peer groups become more diversified in middle school, boys will have to pay attention to more than peer group interests. In the same way middle school networks will be more diversified they will also be more numerous, which may demand more socio-cognitive attention than for elementary school cliques.

Aggressive-Popular Status

Building on earlier research, which brought to light the fact that students can simultaneously be labeled as both aggressive and popular (Farmer et al., 2002; Lease et al., 2002; Rodkin et al., 2006), this study also examined how being both aggressive and popular impacted informant accuracy compared to students who were aggressive-nonpopular, popular-nonaggressive, and nonpopular-nonaggressive. It was hypothesized that being labeled aggressive-popular would increase the accuracy of classroom network recall for females compared to other females groups. For males both aggressive-popular and aggressive-nonpopular students were postulated to have lower scores than the other male groups. Results did not support the hypothesis that being both aggressive and popular would

decrease informant accuracy for males. Differences in popular-aggressive status for females also did not reach statistical significance although aggressive-popular females were significantly more accurate than aggressive-popular males.

Although not significant, being a popular-aggressive female appeared to have a positive association with informant accuracy as these students accurately reported 71% of the network according to teacher ratings and 68% according to peer nominations. Aggressive-popular male students reported 52% of the network according to teacher nominations and 47% based on peer nominations. The directional influence of aggression on informant accuracy supported work by Crain et al. (2005) who found that aggression affects social information processing differently across gender. Aggressive females do make attributional biases, but typically in situations where the provocation is relational in nature (e.g., a student did not invite them to a party) (Crick, Grotpeter, & Bigbee, 2002). The task used in the current study appears not make any relational provocations as aggressive-popular females report the classroom network more accurately than any other group across gender.

Another reason for looking at popular-aggressive status in females is to possibly parse out the effects of gender-normative versus gender-nonnormative forms of aggression. Crick (1997) found that females who presented with gender-nonnormative forms of aggression (e.g., physical) had the worst social outcomes. Females who are labeled as aggressive-popular may be using strategies that are relational in nature as opposed to females labeled as aggressive-nonpopular who may use more overt forms of aggression. Although post hoc comparisons did not reveal any significant differences, aggressive-nonpopular females were less accurate than aggressive-popular females (71% vs. 60% teacher; 68% vs. 62% peer). No definitive conclusions can be made about how different forms of aggression relate to

informant accuracy for females as both measure used in this study (i.e., ICST; peer nomination) contained high number of items pertaining to overt aggression. Future studies may incorporate measures that look at relational and physical aggression in isolation to determine the relationship between accurate network recall and gender-normative versus gender-nonnormative forms of aggression.

Group Aggression

In addition to examining the influence of individual characteristics on informant accuracy, this study looked at the effect of group characteristics. Such an approach makes sense when conceptualized through ecological models that suggest cognition and behavior are influenced by broader social contexts (Bronfenbrenner, 1979). Building on this premise, research has indicated that aggressive students are not always members of aggressive groups (Farmer et al., 2002). Therefore, it was hypothesized that being in an aggressive group would decrease informant accuracy for males and increase accuracy for females. However, these hypotheses were not supported in this study as no significant differences were found within or across gender. Male students in aggressive groups were the least accurate across both peer and teacher ratings accurately recalling 52% and 50%, respectively. Females in aggressive groups were the most accurate according to teacher ratings (62%), but not for peer ratings.

The results combined with correlational data do suggest a trend toward lower informant accuracy for aggressive male groups and higher informant accuracy for aggressive female groups. As previously mentioned, the instrumentation used in this study may only mildly detect relational forms of aggression, which makes it difficult to determine how this type of aggression relates to accurate network recall. Similarly, for boys the threshold of one-half

standard deviation may be too liberal to assess the true impact of aggression on social processing.

What is known it that aggressive responses can be mediated by peer group norms (DeRosier et al., 1994; Espelage, Holt, & Henkel, 2003), which may also affect social information processing. Future research is needed to determine if being an aggressive student in an aggressive or nonaggressive group improves or worsens network recall. Based on the current study, clarification is needed to determine if being labeled individually aggressive and hanging out in an aggressive group would lead to decreased social perception. Conversely, a second question would be if being an individually aggressive male in a nonaggressive male group would improve social cognition.

For females, follow-up hypotheses based on this study are difficult to generate because females appear to be hypersensitive to social networks regardless of individual or group characteristics. Although there appears to be some benefit to being in a relationally aggressive group in terms of social network accuracy, this type of group may have a developmental course. Subsequent investigations might examine the impact of using relationally aggressive techniques after middle school.

Group Popularity

Achieving membership in a popular group is a social goal for many children and adolescents. Popular students have been shown to have social-perceptual advantages over nonpopular children, especially when popularity is obtained through prosocial methods (Pakaslahti et al., 2002). These advantages appear to vary by gender meaning that popular female groups are typically well-liked and highly socially driven, whereas popular male groups have similar interests or sports affiliations (Farmer et al., 2003; Mirny, 2001; Rodkin

et al., 2000). Equally as important, research has shown even prosocial peer groups can have maladaptive socialization influences on members (e.g., dropping out of school, drug use) (Allen et al., 2003; Farmer et al., 2002). Building on these previous investigations, the relationship between popular group status (i.e., popular; nonpopular) and informant accuracy was examined. This study hypothesized that being a member of a popular group would increase the accuracy of social network recall for girls but not for boys.

Popular cliques in the current study recalled significantly more classroom peer groups (3.9 groups) than nonpopular cliques (3.2 groups) based on teacher ratings of popularity. This finding did not vary by gender although the largest average number of groups reported was by popular females (4.0 groups) and the lowest by nonpopular males (2.8 groups). Differences in the number of groups recalled were not found for peer nominated popularity. One explanation is that teacher ratings of popularity may be more sensitive to the prosocial aspects of popularity. Correlational data presented in Table 2 suggest teachers do not typically rate students as both aggressive and popular. Students, on the other hand, were highly likely to rate male students as both aggressive and popular. Once again the question becomes one of rater bias in that teachers appear to rate prosocial-popular children more often as popular. Student rated popularity has been shown to encompass many traits, which include social dominance, athletic ability, and trend setting (LaFontana & Cillessen, 2002; Rodkin et al., 2000) Therefore, this assumption would not be without merit based on previous investigations of rating systems used for children (Archer, 2004; Pellegrini & Bartini, 2000; Rodkin et al., 2000).

Females. Interestingly, the differences in number of groups reported did not translate to lower informant accuracy scores for nonpopular students. Likewise, the hypothesis that

being in a popular female group would increase an individual's overall accuracy for the classroom network was not supported. The effect of group popularity on informant accuracy appears to be similar to the effect of individual popularity on informant accuracy. This is especially true for females who seem to have heightened awareness of their social network in spite of social standing. One way to possibly conceptualize these findings for females it that popular females report more groups because of the necessity to monitor lower groups trying to infiltrate their clique. Nonpopular females report fewer groups solely because they are most interested in the more popular cliques. However, both groups tend to recall the most popular members of the network, which leads to similar accuracy scores.

Males. For boys, the constant monitoring of social networks is not essential to maintaining social contacts, which supported the hypothesis 6b. Popular boy cliques reported around 3 groups compared to around 3.8 groups for popular female groups. Being in a popular boy group in elementary school may require only similar interests to other members, which means members are likely to change when their similarity to the group changes. Group membership for boys might not be as strongly affected by new fashion trends, gossip, or socioeconomic status as girls. For popular boys the effect of being at the top could be opposite that of popular girls in that sensitivity to the social network decreases. Krackhardt (1990) found that adults who were more central in a network were actually less accurate than the "middle men" because their high status prevented them from obtaining or wanting to obtain information about more peripheral social groups.

To conclude, the results of this study suggest that group popularity has little impact on informant accuracy. A significant effect was found for the number of groups reported by students but not their informant accuracy. Popular group membership's association with

social accuracy did not vary by gender as was expected, yet this lack of variation is quite possibly a consequence of different underlying social mechanisms.

Exploratory analyses

Ethnicity. Data on ethnicity was obtained for 87% of the current sample, which indicated a large minority representation for African American youth (40%). Although no initial differences among ethnicity were found in regards to groups reported or informant accuracy, teachers and peers were more likely to rate African American youth as aggressive. Follow-up multivariate procedures revealed similar results to the initial analyses when covarying ethnicity. It is important to note that the ethnicity data obtained from this Eastern North Carolina sample underestimates the proportion of Hispanic and Other Ethnicity students enrolled in school systems this size. As a result, this study was not able to make definitive conclusions in regards to ethnicity's impact on informant accuracy.

Special Education Status. Data were also obtained on special education status for 75% of the current sample with 29 students (8%) receiving special education services. During the 2003-2004 school-year roughly 13% of students were receiving special education services in North Carolina (NCDPI, 2006). Hence, it appears the proportion of students receiving special education services in these two school districts was underestimated by the available data in this study. For this reason special education status was not included as a covariate, nonetheless the descriptive analysis presented as Table 10 suggests some interesting trends.

To begin with the lowest informant accuracy scores were discovered in students who were labeled behaviorally and emotionally disabled (BED) (41%) followed by students receiving speech-language services (42%). This finding supports the premise of the current study and work by previous researchers showing that severely aggressive students have

social processing deficits (Orobio de Castro et al., 2002). Accuracy scores were lower for BED students despite reporting on average 3 groups, which might have indicated a tendency to make commission errors or identify lower status members. The low informant accuracy scores by students receiving speech-language services are also not surprising given the language requirements inherent in the study design.

Another interesting finding is that students with learning disabilities (LD) were relatively accurate (54%) despite recalling fewer than 2 groups. This was perhaps due to the demands of memory in recalling social groups. Students with LD may be able to see the most prominent social group members in the more nuclear groups, but the memory demands for peripheral groups may exhaust their socio-cognitive capacity. This finding was also true for children labeled educably-mentally disabled (EMD) as this group was also relatively accurate (54%) in spite of reporting fewer groups. It is important to note that samples sizes for the above mentioned statistics were very small and preclude any definitive discussion regarding informant accuracy outcomes for children receiving special education services. The relationship between special education status and accurate social network recall will require future study with samples where special education data is more readily available.

Limitations

Although this study of children's informant accuracy circumvented many of the methodological flaws found in previous investigations, limitations did exist and will be discussed so that future research may address these concerns. These limitations include data acquisition through group administration, low participation classrooms, and social-behavioral rating measures.

Group administration. The measurement of children's informant accuracy took place within the classroom via a group administration procedure. Students were asked to write the names of peers who "hang around together", which required a moderate amount of orthographic skill. A possible concern about the measurement of social networks in group format (i.e., classroom) is that children have a visual prompt for determining groups. More specifically, if children are already sitting proximate to their social group, then the recall of these groups is somewhat assisted. Secondly, group administration often limits the ability of an examiner to assist a student who has difficulty with spelling first and last names. Often times the result was that a child refused to participate in the study or his/her handwriting was illegible, which prevented data entry.

Participation Rates. An additional concern arises from aggregating children's networks from classrooms that have lower participation rates (~ 50%). The average participation rate for this sample was 69% with participation rates ranging from 52% to 100%. Investigations using socio-cognitive mapping (SCM) procedures with 50% participation rates have demonstrated considerable overlap with observations of peer interactions (Cairns et al., 1995; Cairns et al., 1985; Farmer & Hollowell, 1994; Gest et al., 2003; Leung, 1996). Thus it appears that the 50% participation cut-off is adequate for using an aggregate network as an overall criterion for individual accuracy. However, adult studies have typically gained participation from the entire population (100%) within a social network (Bondonio, 1998; Casciaro, 1998; Casciaro et al., 1999; Krackhardt, 1990). This level of participation did not increase the overall accuracy for the group (40%-50%), but these groups were not stable with consistent exposure to the network. Consequently, investigations using consistent, stable

networks and gaining higher levels of participation (~90%) might strengthen the aggregate network to which individual maps are compared.

Aggression measurement. One further limitation is how aggression is measured in the current study using teacher ratings (ICST) and peer nominations. Both procedures use a half-standard deviation cut-off to determine aggressive status, which led to a high percentage of students being identified as aggressive, primarily by teachers (28%). Although raising the cut-off level to one or two standard deviations would greatly reduce the number of students identified, it probably would not increase the likelihood of identifying severe pathologically aggressive children. Future studies may want to incorporate measures geared toward assessing extreme (or psychopathological) aggression as Orobio de Castro and colleagues (2002) have shown that social processing deficits are greatest in severely aggressive children.

In the same way this study was only mildly sensitive to relational aggression, which is particularly important when examining aggressive status in females. The peer nomination procedure utilized in the investigation contained the items "starts rumors" and "bullies", yet only these items are typically included on measures of relational aggression (Crick, 1996; Crick, 1997; Rose et al., 2004). For this reason prospective studies may want to include complete measures of relational aggression to determine if the techniques inherent in this aggressive method enhance informant accuracy.

Future Research

Given the above mentioned limitations, future research should attempt to address these concerns when studying children's informant accuracy. The subsequent discussion focuses on potential solutions for addressing the limitations of the current study in hopes to encourage future studies of children's informant accuracy. Furthermore, suggestions for

prospective research based on the exploratory analyses completed in this study are also discussed.

Data Collection. First and foremost, the administration of the SCM form might be best utilized in an individual interview format. If possible, researchers would interview each child in a classroom individually in order to alleviate the problem of children obtaining social cues from proximate peer groups (e.g., children sitting with their groups during administration). This technique will maximize the variance attributed to children's free socio-cognitive recall and social-dyadic memory.

Additionally, individual administration could also deal with issues regarding low spelling ability by providing rosters if needed. Children would be asked to circle students who "hang around together" as opposed to writing down first and last names. The use of rosters would increase the likelihood of gathering viable data and may also increase the probability of getting severely impaired children in the sample. This method has been used by Bagwell and colleagues (2000) to identify social networks in preadolescent children.

Aggregate models. The use of aggregated social networks to determine informant accuracy has a long history in the adult literature (Krackhardt, 1987). As this is the first study to look at informant accuracy in children, the question of how to aggregate children's social networks for individual report comparison will ultimately arise. Although the 50% participation cut-off appears to provide a reliable overall estimate of the existing social groups within a classroom, this estimation will be greatly skewed as children begin to switch classes. The problem is that middle school students typically change classes up to 9 times per day, which makes their exposure to one network limited. Consequently, using the prompt "who hangs around together" within a classroom would not be sufficient because

middle school cliques are not classroom-based. It would be difficult to compare an individual student's cognitive map to the aggregate map for a middle school because the aggregate would likely consist of many groups (~40) and groups sizes would be larger (10-20 members). So what can be done to allow for further exploration of informant accuracy in middle school?

One solution may be to take teacher reports of social groups and aggregate across an entire grade in middle school. Aggregate maps reported by teachers may provide a more reasonable social network (e.g., fewer members per group) than student maps. On a cautionary note, Gest (2006) discovered that teachers identify male peer groups more accurately than female groups. An additional solution may come from a linear transformation of informant accuracy scores adjusting for larger criterion measures. In other words, comparing individual student maps to an aggregate middle school map is likely to produce smaller accuracy scores due to the difficulty in naming many large groups. Even though a linear transformation will preclude accuracy measurement, it will provide a statistic of association between individual and aggregate maps in middle school.

Aggression measurement. Two decades worth of research on social information processing has found social processing to be impacted by aggression (Crick et al., 2002; Dodge, 1980; Dodge & Frame, 1982). This impact has been shown across gender with girls being more sensitive to relational provocations and boys to instrumental (or physical) (Crain et al., 2005; Crick et al., 2002). The current study examined the impact of aggression on informant accuracy using teacher and peer rated aggression. As mentioned earlier two limitations of using these measures are the insensitivity to relational forms of aggression and inability to identify severe aggression.

Future research may want to incorporate more comprehensive measures of relational aggression that include more than one or two items aimed at these traits (See Crick et al., 2002 for example). Such inclusion might increase the possibility of finding that relationally aggressive girls see their classroom social networks more accurately than nonaggressive girls. In addition, research could address the developmental trajectory of how relational aggression influences informant accuracy. Crick (1996) found that relational aggression was predictive of future social maladjustment, which begs the question of whether the advantages of being relationally aggressive decrease after middle school. Further investigations using cross sectional longitudinal designs would assist in determining the developmental outcomes of relational aggression.

A major issue for future research is determining what measures are appropriate for identifying school-age aggression. Orobio de Castro and colleagues (2002) in a meta-analytic review of the hostile attribution bias literature found that social processing deficits were greatest in severely aggressive children. Therefore, investigators might include rating measures capable of distinguishing serious aggressive psychopathology or DSM-IV TR (American Psychiatric Association, 2000) characteristics. Examples of such measures would be the *Behavior Assessment System for Children – Second Edition* (2004) or the *Achenbach System of Empirically Based Assessment* (2001). These instruments could be completed by both parents and teachers to provide a way of comparing students to a larger normative population. On a cautionary note, several items on these scales address suicidal ideation and would necessitate follow-up if endorsed by a student. Nonetheless, the inclusion of such measures should greatly decrease the number of students classified as aggressive, which would increase the probability of determining how aggression affects informant accuracy.

Ethnicity. The use of diverse samples to study informant accuracy will be important for future studies. The sample used in this study had a large minority representation for African American students (40%), and both teachers and peers were more likely to rate African American students as aggressive. Given that prior research has shown African American students are more likely to select friends based on ethnic identity (Hamm, 2000), future studies might examine informant accuracy in terms of classroom diversity. Specifically, accurate social network recall could be examined for classrooms with large proportions of minority students (> 50%) versus classrooms with small minority populations (< 25%). This methodology would help to determine if the ethnic make-up of a classroom affects how children see their social surroundings.

Special Education. Children who receive special education services spend a varying amount of time out of the regular education classroom. As one of the underlying assumptions of studying informant accuracy in children is that they receive equal exposure to classroom networks, more research is needed to ascertain how special education status impacts social network recall. Future studies might consider examining the amount of time students are pulled out for special education services in relation to informant accuracy. It would be suspected that students who spend a large percentage of the school day in a special education setting would have lower network recall and informant accuracy. Research of this nature would help determine the impact of pull-out instruction on social development and the timing threshold by which students can be expected to process their social surroundings.

Intervention Research. A major aim of this study was to examine social network accuracy in children in hopes of uncovering how certain social-behavioral characteristics impact this process. By gaining a better understanding of children's informant accuracy,

social skill intervention programs may be adapted to include training in identifying social groups and social group characteristics. However, the results of this study are unclear in respect to how aggression impacts informant accuracy. Future investigations of the relationship between aggression and informant accuracy must be conducted before intervention programs begin to incorporate informant accuracy skill sets into social skill programs.

Of equal importance would be the examination of informant accuracy in school systems implementing social skill or anti-bullying paradigms. This type of study could be randomized with some classrooms receiving intervention and others not receiving intervention. By investigating the impact of social intervention programs on informant accuracy, prospective researchers may begin to develop componential treatment models for improving informant accuracy.

Conclusion

The current study was the first to examine children's accuracy in recalling their classroom social networks and if their recall was affected by gender, aggression or popularity. Teacher and peer ratings of popularity and aggression were collected from a cohort of 5th grade students, and each student received both individual and group ratings on these characteristics. Female students recalled significantly more classroom groups and were more accurate at recalling these groups than males. Multivariate analyses revealed that peer-rated individual aggression was associated with increased informant accuracy for aggressive girls compared to nonaggressive girls possibly due to the relational nature of peer-rated aggression. No differences were found for male students although trends were suggested by

correlational data. Teacher ratings of popular group membership indicated that students who are a part of popular groups tend to recall more groups although this did not increase the overall accuracy for the classroom network.

Exploratory analyses were also completed on informant ethnicity and special education status. The inclusion of ethnicity as a covariate did not change the overall results even though teachers and students were more likely to nominate African American students as aggressive. Similarly, only descriptive statistics were generated for special education status due to the under-reporting of this variable by school systems. Students with severe behavior disorders (BED) had the lowest accuracy scores for the classroom networks indicating that psychopathological aggression may have a strong impact on informant accuracy. Students receiving special education services under the categories of Learning Disabled (LD) and Educably Mentally Disabled recalled the fewest number of classroom groups.

Based on these findings, the limitations of the current study and future research directions were discussed.

Table 1: Descriptive Statistics

			Groups		Accuracy	
		n	M	SD	M	SD
Overall		511	3.43	(1.45)	.57	(.16)
Gender	Males	230	2.93**	(1.39)	.54**	(.16)
	Females	281	3.83	(1.37)	.59	(.16)
Ethnicity	White	260	3.55	(1.45)	.56	(.15)
	Black	179	3.27	(1.45)	.59	(.17)
	Hispanic	5	4.00	(0.71)	.61	(.19)
	Other	9	3.44	(1.51)	.51	(.19)
Special Education Status	In Special Ed.	353	2.24**	(1.12)	.52	(.16)
	Not in Special Ed.	29	3.51	(1.44)	.58	(.15)

Note: ** $p < .01$

Table 2: Correlations between measures and outcomes

Measure	1.	2.	3.	4.	5	6.	7.	8.	9.	10.
1.	--	.17**	-.03	.09	-.03	.12*	.03	.15*	.04	-.05
2.	.00	--	.13*	-.02	.14*	.00	.12	-.06	.01	.03
3.	-.10	-.15*	--	-.11	.45**	-.05	.55**	-.08	.20**	.03
4.	.13	-.03	-.08	--	-.01	.39**	.01	.60**	.13**	.21**
5.	-.13	-.09	.42**	.07	--	.08	.29	.05	.42	.10
6.	-.03	.01	.06	.44**	.26**	--	.03	.20	.15	.38
7.	.04	-.16*	.48**	.10	.28**	.08	--	.03	.25**	.17*
8.	.25**	-.03	.18*	.41**	.09	.17*	.34**	--	.16*	.22**
9.	-.05	-.06	.22**	.07	.41**	.16**	.31**	.04	--	.24**
10.	.07	.00	.11	.25**	.14*	.39**	.26**	.31**	.32**	--

Note: * $p < .05$; ** $p < .01$
Top right female; Bottom left male

1. Number of Groups
2. Accuracy
3. Individual Aggression-Teacher
4. Individual Popularity-Teacher
5. Individual Aggression-Peer
6. Individual Popularity-Peer
7. Group Aggression-Teacher
8. Group Popularity-Teacher
9. Group Aggression-Peer
10. Group Popularity-Peer

Table 3: Means and Standard Deviations – Individual Characteristics

		Teacher Report					Peer Nomination				
			Groups		Accuracy			Groups		Accuracy	
		n	M	SD	M	SD	n	M	SD	M	SD
Male	Non Aggressive	148	3.05	(1.39)	.56	(.16)	193	3.01	(1.41)	.55[a]	(.16)
	Aggressive	67	2.75	(1.37)	.51[b]	(.17)	37	2.54	(1.19)	.51[b]	(.16)
Female	Non Aggressive	199	3.84	(1.36)	.58	(.15)	231	3.85	(1.39)	.58[a]	(.15)
	Aggressive	68	3.74	(1.36)	.63[b]	(.17)	49	3.73	(1.29)	.64[b]*	(.17)
Total	Non Aggressive	347	3.50	(1.43)	.57	(.16)	424	3.47	(1.46)	.57	(.16)
	Aggressive	135	3.24	(1.45)	.57	(.18)	86	3.22	(1.38)	.58	(.17)
Male	Non Popular	149	2.83	(1.34)	.55	(.17)	173	2.96	(1.41)	.54	(.16)
	Popular	66	3.23	(1.46)	.54	(.16)	78	2.86	(1.32)	.54	(.17)
Female	Non Popular	170	3.71	(1.32)	.60	(.16)	202	3.72	(1.35)	.59	(.16)
	Popular	97	3.99	(1.41)	.59	(.15)	78	4.10	(1.41)	.59	(.16)
Total	Non Popular	319	3.30	(1.40)	.57	(.16)	375	3.37	(1.43)	.57	(.16)
	Popular	163	3.68	(1.47)	.57	(.16)	135	3.58	(1.50)	.57	(.16)

Note: within gender = * $p < .05$; across gender = [a] $p < .05$, [b] $p < .01$

Table 4: Multivariate and Univariate Analyses – Individual Characteristics (Teacher Ratings)

		Multivariate	Univariate	
Source	df	F	Groups	Accuracy
Gender (G)	2	23.12***	30.42***	20.75***
Aggression (A)	2	2.23	3.26	.82
Popularity (P)	2	1.04	1.48	.81
G x A	2	5.22**	.43	10.36***
G x P	2	.69	.18	1.09
A x P	2	5.46**	2.78	7.09**
G x A x P	2	.73	.004	1.43
MSE			1.86	.025

Note: ** $p < .01$; ***$p < .001$

Table 5: Multivariate and Univariate Analyses – Individual Characteristics (Peer Ratings)

		Multivariate	Univariate	
Source	df	F	Groups	Accuracy
Gender	2	25.38***	38.90***	16.29***
Aggression	2	1.99	3.52	0.25
Popularity	2	.45	0.89	0.00
G x A	2	4.75**	0.55	9.31**
G x P	2	.59	0.21	0.65
A x P	2	.12	0.05	0.21
G x A x P	2	3.11*	0.55	5.30*
MSE			1.89	0.03

Note: * $p < .05$; ** $p < .01$; *** $p < .001$

Table 6: Means and Standard Deviations – Aggressive-Popular Status

		Teacher Ratings			Peer Nominations		
			Accuracy			Accuracy	
		n	M	SD	n	M	SD
Male	AGG-POP	16	.52	(.15)	18	.47**	(.15)
	AGG-NPOP	51	.50	(.18)	19	.54	(.16)
	NAGG-POP	50	.54	(.17)	39	.58	(.16)
	NAGG-NPOP	98	.57	(.16)	154	.54*	(.16)
Female	AGG-POP	19	.71	(.16)	16	.68**	(.15)
	AGG-NPOP	49	.60	(.16)	33	.62	(.17)
	NAGG-POP	78	.56	(.14)	62	.57	(.15)
	NAGG-NPOP	120	.60	(.16)	169	.59*	(.15)
Total (M-F)	AGG-POP	35	.62	(.18)	34	.57	(.18)
	AGG-NPOP	100	.55	(.18)	52	.59	(.17)
	NAGG-POP	128	.55	(.15)	101	.57	(.16)
	NAGG-NPOP	218	.58	(.16)	323	.56	(.16)

Note: across gender * $p < .01$; ** $p < .001$

Table 7: Means and Standard Deviations – Group Characteristics

		Teacher Report					Peer Nomination				
			Groups		Accuracy			Groups		Accuracy	
		n	M	SD	M	SD	n	M	SD	M	SD
Male	Non Aggressive	118	2.95	(1.34)	.56	(.16)	121	2.93	(1.29)	.54	(.15)
	Aggressive	64	3.03	(1.52)	.50	(.18)	80	2.79	(1.15)	.52	(.18)
Female	Non Aggressive	205	3.78	(1.34)	.58	(.15)	184	3.80	(1.34)	.59	(.15)
	Aggressive	46	3.91	(1.24)	.62	(.18)	71	3.93	(1.43)	.59	(.17)
Total	Non Aggressive	323	3.47	(1.42)	.57	(.15)	305	3.45	(1.39)	.57	(.15)
	Aggressive	110	3.40	(1.47)	.55	(.19)	151	3.32	(1.58)	.56	(.18)
Male	Non Popular	129	2.76	(1.28)	.54	(.16)	97	2.77	(1.40)	.53	(.15)
	Popular	53	3.51	(1.55)	.53	(.18)	104	2.96	(1.37)	.53	(.17)
Female	Non Popular	144	3.63	(1.33)	.60	(.16)	134	3.90	(1.36)	.59	(.15)
	Popular	107	4.04	(1.35)	.58	(.15)	121	3.77	(1.38)	.60	(.16)
Total	Non Popular	273	3.22***	(1.38)	.57	(.16)	231	3.42	(1.48)	.57	(.15)
	Popular	160	3.86***	(1.44)	.56	(.16)	225	3.40	(1.43)	.57	(.17)

Note: *** $p < .001$

Table 8: Multivariate and Univariate Analyses – Group Characteristics (Teacher Ratings)

		Multivariate	Univariate	
Source	df	F	Groups	Accuracy
Gender (G)	2	17.32***	22.68***	14.90***
AggGroup (A)	2	0.01	0.01	0.00
PopGroup (P)	2	8.91***	17.62***	0.02
G x A	2	2.78	1.07	4.86
G x P	2	0.34	0.59	0.15
A x P	2	1.40	0.53	2.45
G x A x P	2	0.44	0.41	0.40
MSE			1.83	0.03

Note: *** $p < .001$

Table 9: Multivariate and Univariate Analyses – Group Characteristics (Peer Ratings)

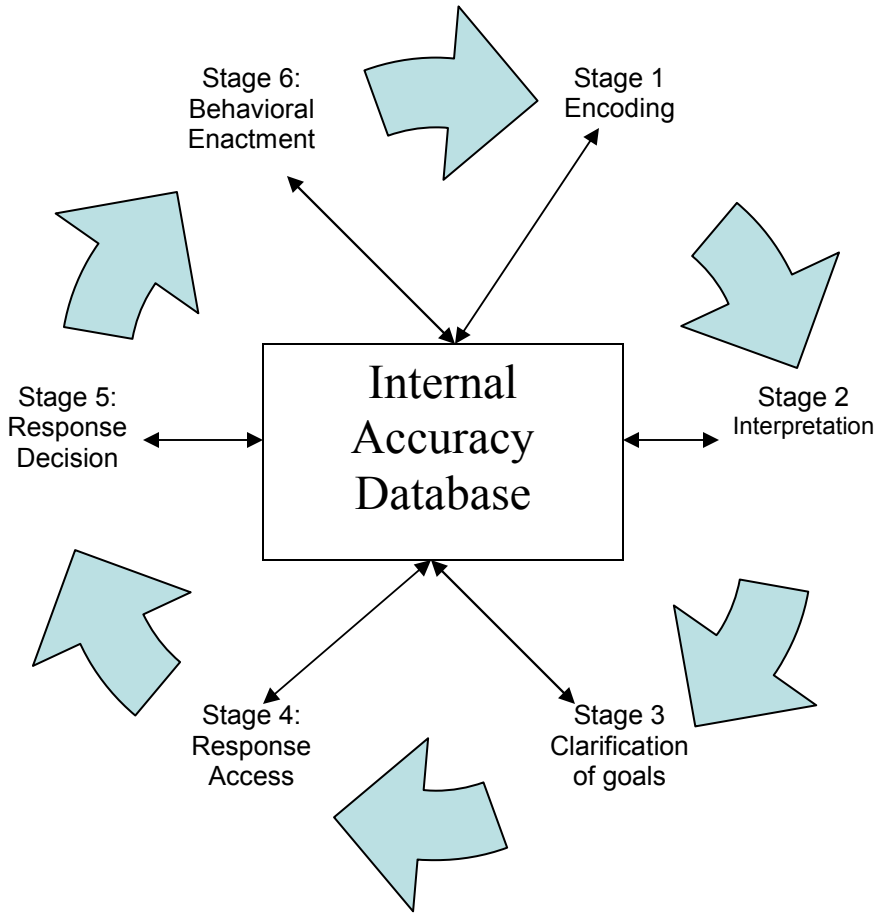
		Multivariate	Univariate	
Source	df	F	Groups	Accuracy
Gender	2	25.55***	42.52***	12.19***
AggGroup	2	0.46	0.50	0.50
PopGroup	2	0.96	1.74	0.28
G x A	2	0.77	1.26	0.38
G x P	2	0.35	0.69	0.01
A x P	2	2.52	5.04	0.00
G x A x P	2	0.64	1.27	0.00
MSE			1.87	0.03

Note: *** $p < .001$

Table 10: Means and Standard Deviations – Special Education Status

		Groups		Accuracy	
Group	n	M	SD	M	SD
LD	10	1.80	(0.92)	.54	(.16)
BED	3	3.00	(1.00)	.41	(.23)
EMD	3	1.33	(0.58)	.54	(.11)
Speech	6	2.33	(1.21)	.42	(.14)
OHI	3	2.33	(1.53)	.61	(.12)
504	3	3.67	(1.46)	.62	(.13)

Figure 1: Informant accuracy seen through the social information processing model



APPENDIX I

Friends and Groups

Are there any kids in your class who hang around together a lot? **Yes / No**

Please write their names on the lines below. Include each person's last name. Name all the groups that you can think of.

Group 1: _____

_____

_____

Group 2: _____

_____

_____

Group 3: _____

_____

_____

Group 4: _____

_____

_____

Group 5: _____

_____

_____

Group 6: _____

_____

_____

If you need more space, turn the paper over. Remember, you don't have to fill in all the lines.

APPENDIX II

Peer Nomination Form

For the following, name the three kids in your class who best fit the description.

1) Cooperative**. "**Here is someone who is really good to have as part of your group, because this person is agreeable and cooperative – pitches in, shares, and gives everyone a turn."

_____ _____ _____

2) **Disruptive**. "This person has a way of upsetting everything when he or she gets into a group – doesn't share and tries to get everyone to do things their way."

_____ _____ _____

3) **Acts Shy**. "This person acts very shy with other kids. It's hard to get to know this person."

_____ _____ _____

4) **Starts Fights**. "This person starts fights. This person says mean things to other kids or pushes them, or hits them."

_____ _____ _____

5) **Seeks Help**. "This person is always looking for help, asks for help even before trying very hard."

_____ _____ _____

6) **Leader**. "This person gets chosen by others as the leader. Other people like to have this person in charge."

_____ _____ _____

7) **Athletic**. "This person is very good at many outdoor games and sports."

_____ _____ _____

8) **Gets in trouble**. "This person doesn't follow the rules, doesn't pay attention, and talks back to the teacher."

_____ _____ _____

9) **Good student**. "This person makes good grades, usually knows the right answer, and works hard in class."

_____ _____ _____

Do not name more than three persons for each question.

Remember, you don't have to fill in all the lines.

APPENDIX II contd.

10) Cool**. "**This person is really cool. Just about everybody in school knows this person**."**

_____ _____ _____

11) **Sad**. "This person often seems sad."

_____ _____ _____

12) **Starts rumors**. "This person gossips and says things about others. This person is good at causing people to get mad at each other."

_____ _____ _____

13) **Popular**. "Some kids are very popular with their peers. That is, many classmates like to play with them or do things with them."

_____ _____ _____

14) **Picked on**. "This person is picked on by others."

_____ _____ _____

15) **Friendly**. "This person is usually friendly to others."

_____ _____ _____

16) **Bully**. "This person bullies others. This person is always hurting or picking on others."

_____ _____ _____

17) **Gets their way**. "Other kids do what this person wants. This person always gets their way."

_____ _____ _____

APPENDIX III

Accuracy Calculation

INFO FROM AGGREGATED SCM

GROUP 1: TOM (6) JACK (6) SAM (3) BOB (2)

TOTALGROUPNOM = **17**
POSSIBLE DYADS = 4(4-1)/2 = **6**
POSSIBLE WEIGHTED DYADS = TOM-JACK = **36**; TOM-SAM = **18**; TOM-BOB = **12**; JACK-SAM=**18**; JACK-BOB=**12**; SAM-BOB=**6**

TOTAL WEIGHTED = **102**

GROUP 2: KRISTI (6) BRITTANY (6) MEGAN (1) LAUREN (1)

TOTALGROUPNOM = **14**
POSSIBLE DYADS = 4(4-1)/2 = **6**
POSSIBLE WEIGHTED DYADS = KRISTI-BRITTANY=**36**; KRISTI-MEGAN=**6**; KRISTI-LAUREN=**6**; BRITTANY-MEGAN=**6**; BRITTANY-LAUREN=**6**; MEGAN-LAUREN=**1**

TOTAL WEIGHTED = **61**

GROUP 3: JON (6) ADAM (6) MARK (5) BRYAN (4)

TOTALGROUPNOM = **21**
POSSIBLE DYADS = 4(4-1)/2 = **6**
POSSIBLE WEIGHTED DYADS = JON-ADAM=**36**; JON-MARK=**30**; JON-BRYAN=**24**; ADAM-MARK=**30**; ADAM-BRYAN=**24**; MARK-BRYAN=**20**

TOTAL WEIGHTED **164**

PHIL'S INDIVIDUAL STUDENT REPORT

GROUP 1: TOM JACK BOB
GROUP 2: MEGAN LAUREN
GROUP 3: JON ADAM MARK

STEP 1: NUMBER OF WEIGHTED DYADS PHIL REPORTED
GROUP 1: TOM-JACK=**36**; TOM-BOB=**12**; JACK-BOB=**12**; TOTAL WEIGHTED=**60**
GROUP 2: MEGAN-LAURAN=**1**; TOTAL WEIGHTED=**1**
GROUP 3: JON-ADAM=**36**; JON-MARK=**30**;ADAM-MARK=**30**; TOTAL WEIGHTED=**96**

STEP 2: PERCENTAGED OF POSSIBLE WEIGHTED DYADS OBTAINED
GROUP 1: **60/102 = .588**; GROUP 2: **1/61 = .016**; GROUP 3: **96/164 = .585**

STEP 3: CONVERSION BACK TO UNWEIGHTED DYADS
.588 x 6 POSSIBLE DYADS = **3.52**
.016 x 6 POSSIBLE DYADS = **.096**
.585 x 6 POSSIBLE DYADS = **3.51**

STEP 4: CONVERSION TO NUMBER OF INDIVIDUALS REPORTED USING QUADRATIC FORMULA
GROUP 1: QUADRATIC POSITIVE ROOT = **3.2**
GROUP 2: QUADRATIC POSITIVE ROOT = **1.16**
GROUP 3: QUADRATIC POSTIVE ROOT = **3.19**

STEP 5: CALCULATE ACCURACY FOR EACH GROUP
3.20 REPORTED MEMBERS/ **4** ACTUAL = **.80**
1.16 REPORTED MEMBERS/ **4** ACTUAL = **.29**
3.19 REPORTED MEMBERS/ **4** ACTUAL = **.80**

STEP 6: CALCULATE WEIGHTED ACCURACY FOR CLASSROOM BY MULTIPLYING INDIVIDUAL GROUP ACCURACY BY INDIVIDUAL GROUP NOMINATIONS AND THEN DIVIDE BY TOTAL NOMINATIONS FOR CLASSROOM
.80 X 17 TOTAL NOMS FOR GROUP 1 = **13.6**
.29 X 14 TOTAL NOMS FOR GROUP 2 = **4.06**
.80 X 21 TOTAL NOMS FOR GROUP 3 = **16.8**

13.6 + 4.06 + 16.8 = 21.72

21.72/ 52 NOMS ACROSS ALL GROUPS (17+14+21) = **.42**

OR 42% ACCURACY

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